TRANSVERSALITY OF THE GRAVITON SELF-ENERGY

by

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To my

mother, father,

relatives and friends.

- past, present and future -

"As a teacher you hope for your students

to be able to do things you could not,

to learn things you never knew".

Professor Hebbel Hoff

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TRANSVERSALITY OF THE GRAVITON SELF-ENERGY

Supervisor: Professor Abdus Salam

ABSTRACT

It is indicated in this work the relevance of the transversality of the graviton self-energy in quantum gravity. From the general results it is evident that a connexion does exist between the symmetry of the metric indices and the transversality of the graviton self-energy.

It is difficult to ignore the importance of the computer programs for symbolic evaluation of algebraic expressions, in quantum gravity. In this way, it is also incorporated in this work the details of the algebraic

manipulation, which permit the reader to walk the steps that lead to the above conclusions.

INTRODUCTION

INTRODUCTION

In 1973, two independent articles presented the first determinations of the one-loop graviton contribution to the graviton self-energy, by using the path integral formalism to quantize the gravitational Einstein Lagrangian /1,2/.

The basic characteristics of these reports are: the graviton field is defined as a small perturbation using a tensor density of weight +1 , a Lorentz covariant gauge breaking term is used, the gauge parameter α is fixed in such a way to give the graviton propagator in its simplest form, finally, all the algebraic manipulation was performed by hand. Their conclusions make it clear that the second order graviton contribution to the graviton self-energy, obtained, is not transverse. However, each group explain its results in its own way: According to Capper et al. the Slavnov-Ward identities relate the two-point graviton Green's function to the graviton fictitious particles vertex/3/ spoiling the transversality. On the other hand, Brown explains the lack of transversality appealing to some kind of tadpole graphs that were not included in his computation/2/. As it can be seen there does not exist any logical link between the two hypothesis suggested.

Essentially, those calculations demonstrate that gravitation, regarded as a self-interacting massless spin-2 field theory/4-17/ gives rise to a calculable perturbation expansion.

Apparently, the choice of a specific gauge parameter, with the purpose of simplifying the calculation, is not compatible with the transversality of the graviton self-energy. But it might be thought that if a general gauge parameter were used, then it ought to be possible to find a value for this parameter in which the two-point Green's function could be made transverse. This motivated a new calculation of the graviton contribution to the graviton self-energy/18/. As the complexity increased considerably all the algebra was worked out in the computer employing SCHOONSCHIP, a program written by Veltman to deal with the symbolic evaluation of algebraic expressions/19/; in all successive calculations extensive use of this computer program will be made. It is found to be impossible to adjust the general gauge parameter such that the graviton contribution to the graviton self-energy could be transverse.

Believing seriously that the presence of the fictitious particles in the quantum field theory of gravity prevent the transversality of the graviton self-energy, a new attempt

was made using a two parameter Lorentz covariant gauge breaking expression/20/. It was expected that a judicious choice of the gauge parameters could finally solve the problem of the transversality of the graviton self-energy. Playing with two parameters it is easy to fix the transversality of the graviton self-energy to order k^2, but, for the same values of the gauge parameters, this success cannot, certainly, be extended to the total graviton propagator/21/.

So, at this point, it is necessary to accept that the list of Lorentz covariant gauge breaking terms has been exhausted leading to the conclusion that a Lorentz covariant gauge breaking term does not allow a transverse expression for the graviton self-energy/21/.

Another effort was made, by Capper et al., employing a non-covariant gauge breaking term, the axial gauge/22-30/, which reaffirms their general idea that, in quantum gravity, the lowest order, irreducible two-point graviton Green's function could not be transverse/21,31/.

The implication of those results in the elimination of the infinities, in quantum gravity, is crucial. It excludes the general covariant objects as counterterms for pure quantum gravity in a flat-spacetime expansion approach/21,32,33/, although they can be realized in the framework of the

background-field approach/34,35/.

It is the aim of this work to introduce the suggestion that, in what regards the transversality of the graviton contribution to the graviton self-energy and consequently the nature of the counterterms for pure quantum gravity , flat space-time expansion, the conclusions outlined in Refs.3,18,20,21,31,32, may not be correct/36-39/. Ac tually, those negative results are based on the complexity of the algebraic manipulation in quantum gravity, a misunderstanding of the Slavnov-Ward identities and the inadequate treatment of the integrals $\delta_{\alpha_1\alpha_2}\delta_{\beta_1\beta_3}p_{\alpha_3}p_{\beta_2}\int d^{2\omega}q\,(q-p)^{-2}$, or similar, many times confused with the massless scalar tadpoles which have the same integrand/40,41/, but are associated to topologically different graphs/42/. Definitely, there is neither, any physical argument or heuristic demonstration preventing the realization of generally covariant counterterms in quantum gravity, flat-spacetime expansion.

The Einstein Lagrangian, as it is well known, is generally covariant, or in the language of the particle physicist, is gauge invariant; general covariance being the analogue of gauge invariance. All these facts suggest the possibility of general covariant counterterms.

It follows that the study of the transversality of the

graviton Green's function cannot rely on the adjustment of gauge parameters but should be expressed unequivocally through a complete review of the subject in order to continue with a constructively unifying treatment of gravity as a theory of elementary particles.

CHAPTER I

THE STUDY OF THE TRANSVERSALITY OF THE TOTAL GRAVITON PROPAGATOR IN THE LANDAU GAUGE

1.0 Introduction

During the last twenty years the covariant approach to quantum gravity - flat spacetime expansion - has been applied several times in an attempt to understand the structure of the counter terms required for the graviton loops/1,2,18,20,21,30,39,43/. Essentially, these calculations demonstrate the possibilities for regularizing the lowest order contributions for the two-point graviton Green's function - a single graviton and fictitious loops - by employing the method of dimensional regularization/64-68/. But also a conclusion was forwarded according to which the counter terms required to cancel the one-loop infinities in pure quantum gravity cannot be made from the generally covariant objects $\sqrt{-g}\,R^2$, $\sqrt{-g}\,R_{\mu\nu}R^{\mu\nu}$ and $\sqrt{-g}\,R_{\mu\nu\alpha\beta}R^{\mu\nu\alpha\beta}$, working with the flat spacetime expansion method, in the presence of Lorentz covariant gauge breaking expressions; where general covariance is the gravitational analog of gauge invariance. The reason for these results being the dependence of the one-loop radia tive corrections to the graviton Green's function on the gauge parameter α, and the impossibility of choosing α such that transversal Green's function occurs/1,2,18,20,21/.

Unfortunatel y the conclusions quoted above rel y on a

misunderstanding of the Slavnov-Ward identities and is in striking contradiction with the results obtained for pure gravity in the background field formalism/34,35/.

In the absence of a convincing physical argument to explain such disagreement it is worth investigating the subject further. In principle, the general covariance of the Einstein gravitational Lagrangian suggests gauge invariant counter terms and it is shown below that a consistent treatment of the problem confirms this expectation.

1.1 Notation

The starting point of this article is a general description of an off shell calculation of the divergent one-loop graviton contribution to the graviton self-energy, in the context of the covariant quantization method, by using Lorentz covariant gauge breaking terms, and working with two distinct parametrizations for the graviton field, referred to as {1} and {2}. These results will serve to check the conclusions extracted from the gravitational Slavnov-Ward identities. A brief explanation of the notation used follows.

$$\mathcal{L} = \frac{1}{2\kappa^2}\left(\tilde{g}^{\rho\sigma}\tilde{g}_{\lambda\mu}\tilde{g}_{\kappa\nu} - \frac{1}{n-2}\tilde{g}^{\rho\sigma}\tilde{g}_{\mu\kappa}\tilde{g}_{\lambda\nu}\right.$$

$$\left. - 2\,\delta^{\sigma}_{\kappa}\delta^{\rho}_{\lambda}\tilde{g}_{\mu\nu}\right)\tilde{g}^{\mu\kappa}_{,\rho}\,\tilde{g}^{\lambda\nu}_{,\sigma} \qquad \text{I.1.1}$$

{1}

is Goldberg's version of the Einstein Lagrangian extended to n dimensions/1,61/, where $\tilde{g}^{\mu\nu}$ and $\tilde{g}_{\mu\nu}$ are defined by: $\tilde{g}^{\mu\nu} = (-g)^{1/2} g^{\mu\nu}$, $\tilde{g}_{\mu\nu} = (-g)^{1/2} g_{\mu\nu}$. Here, $g_{\mu\nu}$ is the metric tensor, $g = \det g_{\mu\nu}$ and $g^{\mu\nu} g_{\nu\lambda} = \delta^{\mu}_{\lambda}$. In the system of units $\hbar = c = 1$, the relation between the gravitational coupling constant κ and the Newton constant G is $\kappa^2 = 16\pi G$.

$$\tilde{g}^{\mu\nu} = \delta^{\mu\nu} + \kappa\phi^{\mu\nu} \qquad \text{I.1.2}$$

{1}

is the definition of the gravitational field, here called $\phi^{\mu\nu}$, and

$$\mathcal{L}_B = -\frac{1}{2\alpha}\left(\partial_\mu \phi_{\mu\nu}\right)^2 \qquad \text{I.1.3}$$

{1}

is the gauge breaking term.

Alternatively it is possible in a different

parametrization to set

$$\{2\}\quad \mathcal{L} = \frac{2}{\kappa^2}\sqrt{-g}\,R \qquad \text{I.1.4}$$

to define the graviton field $h_{\mu\nu}$ by

$$\{2\}\quad g_{\mu\nu} = \delta_{\mu\nu} + \kappa h_{\mu\nu} \qquad \text{I.1.5}$$

and to choose a deDonder-type gauge breaking term, i.e.,

$$\{2\}\quad \mathcal{L}_B = -\frac{1}{2\alpha}\left(\partial_\mu h_{\mu\nu} - \frac{1}{2}\partial_\nu h_{\mu\mu}\right)^2 \qquad \text{I.1.6}$$

The classical gravitational Lagrangian written as in Eq(I.1.1), differs from the more familiar Einstein-Hilbert form Eq(I.1.4) by a surface term, and the only purpose of computing the graviton contribution to the graviton self-energy using both expressions is to control the accuracy of the results.

1.2 The One-loop Contribution And The Slavnov-Ward Identities

The determination of the graviton propagator, $\Delta_{\lambda\beta,\lambda'\beta'}(p)$, in a momentum space of n dimensions, $n=2w$, is considerably simplified making use of the relation/35/:

$$\Delta_{\lambda\beta,\lambda'\beta'}(p)\,\Delta^{-1}{}_{\lambda'\beta',\rho\sigma}(p) = -\mathbb{1}_{\lambda\beta,\rho\sigma} \qquad \text{I.2.1}$$

The unit matrix is given by:

$$\mathbb{1}_{\lambda\beta,\rho\sigma} = \frac{1}{2}\left(\delta_{\lambda\rho}\delta_{\beta\sigma} + \delta_{\lambda\sigma}\delta_{\beta\rho}\right) \qquad \text{I.2.2}$$

The factor $\Delta^{-1}{}_{\lambda'\beta',\rho\sigma}(p)$, in the Eq(I.2.1), represents the part of Einstein's Lagrangian quadratic in the graviton field, plus a gauge breaking term, $\mathcal{L}_B$, after the appropriate indices symmetrization(Appendixes I and II). Following this procedure the bare graviton propagators are obtained in both cases; for general α:

$$\{1\}\ \Delta_{\lambda\beta,\lambda'\beta'}(p) = \frac{1}{2p^2}\left[\delta_{\lambda\lambda'}\delta_{\beta\beta'} + \delta_{\lambda\beta'}\delta_{\lambda'\beta}\right.$$

$$\left. - 2(1+\alpha)\,\delta_{\lambda\beta}\delta_{\lambda'\beta'}\right] +$$

$$+ \frac{(1+2\alpha)}{(p^2)^2}\left[\delta_{\lambda\beta}p_{\lambda'}p_{\beta'} + \delta_{\lambda'\beta'}p_{\lambda}p_{\beta}\right]$$

$$+ \frac{(1+2\alpha)}{2(p^2)^2}\left[\delta_{\lambda'\lambda}p_{\beta}p_{\beta'} + \delta_{\beta\beta'}p_{\lambda}p_{\lambda'}\right.$$

$$\left. + \delta_{\lambda\beta'}p_{\lambda'}p_{\beta} + \delta_{\lambda'\beta}p_{\lambda}p_{\beta'}\right] \qquad \text{I.2.3}$$

$$\{2\}\quad \Delta_{\lambda\beta,\lambda'\beta'}(p) = \frac{1}{2p^2}\left[\delta_{\lambda\lambda'}\delta_{\beta\beta'} + \delta_{\lambda\beta'}\delta_{\lambda'\beta}\right.$$

$$\left. - \frac{1}{\omega-1}\delta_{\lambda\beta}\delta_{\lambda'\beta'}\right]$$

$$- \frac{(1+2\alpha)}{2(p^2)^2}\left[\delta_{\lambda\lambda'}p_{\beta}p_{\beta'} + \delta_{\beta\beta'}p_{\lambda}p_{\lambda'}\right.$$

$$\left. + \delta_{\lambda\beta'}p_{\lambda'}p_{\beta} + \delta_{\lambda'\beta}p_{\lambda}p_{\beta'}\right] \qquad \text{I.2.4}$$

factors of i and 2π are neglected in this work.

For $\alpha = -1/2$ the simplest form of the bare graviton propagator is recovered:

$$\{1\}\ \Delta_{\lambda\beta,\lambda'\beta'}(p) = \frac{1}{2p^2}\left(\delta_{\lambda\lambda'}\delta_{\beta\beta'} + \delta_{\lambda\beta'}\delta_{\lambda'\beta} - \delta_{\lambda\beta}\delta_{\lambda'\beta'}\right) \qquad \text{I.2.5}$$

$$\{2\}\ \Delta_{\lambda\beta,\lambda'\beta'}(p) = \frac{1}{2p^2}\left(\delta_{\lambda\lambda'}\delta_{\beta\beta'} + \delta_{\lambda\beta'}\delta_{\lambda'\beta} - \frac{1}{w-1}\,\delta_{\lambda\beta}\,\delta_{\lambda'\beta'}\right) \qquad \text{I.2.6}$$

A simple pole $\underline{1/[n-2]}$ is always present in the Feynman rules for the gravitational field, indicating that the Einstein-Hilbert Lagrangian is meaningless in 2-dimensions, $\underline{w=1}$ reducing to a total divergence/1,35/. The appearance of the pole in the free graviton propagator or in the graviton vertices depends on the choice of $\underline{\quad\sigma^{\mu\nu}\quad}$ or $\underline{\quad\tilde{g}^{\mu\nu}\quad}$, respectively, for the graviton field definition.

The derivation of the three-graviton vertex function and the fictitious particles Feynman rules follows immediately(Appendixes III and IV). Then one is faced with the task of multiplying appropriately propagators and vertices, with subsequent evaluation of the corresponding integrals in order to obtain the divergent one-loop graviton contribution to the graviton self-energy(Appendix V).

Once the one-particle irreducible amputated gravitational Green's function is obtained, referred to as $\Pi_{\lambda\beta,\lambda'\beta'}(p)$, the connected one can be immediately built:

$$\Pi^{c}_{\mu\nu,\rho\sigma}(p) = \Delta_{\mu\nu,\lambda\beta}(p)\,\Pi_{\lambda\beta,\lambda'\beta'}(p)\,\Delta_{\lambda'\beta',\rho\sigma}(p) \qquad \text{I.2.7}$$

The c stands for connected.

Proceeding further the generalized Slavnov-Ward identities are investigated for the quantized gravitational field by using functional techniques; from 't Hooft's technique /1,2,62/ the results are:

$$\{1\}\ \frac{1}{\alpha}\langle 0|T(\partial_\mu \phi_{\mu\nu}(x)\,\partial_\rho \phi_{\rho\sigma}(y))|0\rangle = -\delta_{\nu\sigma}\,\delta(x-y), \qquad \text{I.2.8}$$

$$\alpha \neq 0$$

$$\{2\}\ \frac{1}{\alpha}\Big[\langle 0|T(\partial_\mu h_{\mu\nu}(x)\,\partial_\rho h_{\rho\sigma}(y))|0\rangle - \langle 0|T(\partial_\nu h_{\mu\mu}(x)\,\partial_\rho h_{\rho\sigma}(y))|0\rangle$$

$$+\frac{1}{4}\langle 0|T(\partial_\nu h_{\mu\mu}(x)\,\partial_\sigma h_{\rho\rho}(y))|0\rangle\Big] = -\delta_{\nu\sigma}\,\delta(x-y), \quad \alpha\neq 0 \qquad \text{I.2.9}$$

in momentum space, to order κ^2, these relations read:

(1) $p_\mu p_\beta \Pi^c_{\mu\nu,\beta\sigma}(p) = 0$

I.2.10

(2) $p_\mu p_\beta \Pi^c_{\mu\nu,\beta\sigma}(p) - p_\nu p_\beta \Pi^c_{\mu\mu,\beta\sigma}(p)$

$$+ \frac{1}{4} p_\nu p_\sigma \Pi^c_{\mu\mu,\beta\beta}(p) = 0$$

I.2.11

These identities are independent of the way in which the Lorentz covariant gauge breaking terms are chosen. If for example, Eq(I.2.7) were replaced by an expression like $(-1/2\alpha)(\partial_\mu \phi_{\mu\nu} - J_\nu)^2$, for an arbitrary J_ν, Eq(I.2.8) and Eq(I.2.10) would still hold. This arbitrariness, in some sense, obscures the behaviour of the purely longitudinal part of the graviton propagator, however, if someone is particularly interested in understanding the problem of transversality in quantum gravity by following the analogy with the Q.E.D. theory, in which case the longitudinal part of the photon propagator doesn't suffer radia tive corrections, instead of the method suggested by 't Hooft, it is advisable to use the prescription outlined by Slavnov to derive Ward identities for the gauge theories/3,63/. Doing so, one has:

$$\{1\}\ \frac{1}{\alpha}\langle 0|T(\phi_{\rho\sigma}(x)\,\partial_\mu\phi_{\mu\lambda}(y))|0\rangle = \langle 0|T(A_{\rho\sigma\lambda}(x,y))|0\rangle ,$$

I.2.12

$$\alpha \neq 0$$

$$\{2\}\ \frac{1}{\alpha}\left[\langle 0|T(h_{\rho\sigma}(x)\,\partial_\mu h_{\mu\lambda}(y)|0\rangle - \frac{1}{2}\langle 0|T(h_{\rho\sigma}(x)\,\partial_\lambda h_{\mu\mu}(y))|0\rangle\right]$$

$$= \langle 0|T(B_{\rho\sigma\lambda}(x,y))|0\rangle \ , \quad \alpha \neq 0$$

I.2.13

It is clear looking at the right hand side of Eq(I.2.12) and Eq(I.2.13), that the longitudinal and transversal parts of the graviton propagator are equally interacting and suffer radia tive corrections. And now, exploiting the freedom of the gauge independence of the S-matrix it is possible to fix the gauge parameter α, in such a way that the longitudinal contribution in the loop will drop. So, multiplying the above expressions, on both sides, by α and taking the limit as $\alpha \longrightarrow 0$, one obtains:

$$\{1\}\ \langle 0|T(\phi_{\rho\sigma}(x)\,\partial_\mu\phi_{\mu\lambda}(y))|0\rangle = 0$$

I.2.14

$$\{2\}\ \langle 0|T(h_{\rho\sigma}(x)\,\partial_\mu h_{\mu\lambda}(y))|0\rangle - \frac{1}{2}\langle 0|T(h_{\rho\sigma}(x)\,\partial_\lambda h_{\mu\mu}(y))|0\rangle = 0$$

I.2.15

which in momentum space takes the form:

$$\{1\}\ p_\mu \overline{\Pi}^{c}_{\mu\lambda,\rho\sigma}(p) = 0$$

I.2.16

$$\{2\}\ p_\mu \overline{\Pi}^{c}_{\mu\lambda,\rho\sigma}(p) - \frac{1}{2}\, p_\lambda \overline{\Pi}^{c}_{\mu\mu,\rho\sigma}(p) = 0$$

I.2.17

The Slavnov-Ward identities, presented in this way, for both parametrizations, establish that the <u>total graviton propagator is transverse</u> and the Landau gauge is essential/52/ in order to eliminate the undesirable longitudinal contribution to the graviton self-energy.

All the above relations were derived analytically and later verified up to second order in the coupling constant by employing SCHOONSCHIP/19/. In fact, extensive use of this computer program for symbolic evaluation of algebraic expressions was required at each step of the calculation, from the derivation of the graviton Feynman rules until the

explicit confirmation of the gauge invariance through the Slavnov-Ward identities(Appendixes I, II, III, IV, V).

CHAPTER II

TRANSVERSALITY, GAUSS-BONNET IDENTITY AND SELF-INTERACTING GRAVITY IN THE ABSENCE OF MATTER

2.0 Introduction

The central core of this thesis deals with computer algebra/19,44,45/, the motivation coming from the covariant diagrammatic approach to quantum gravity. The Feynman rules for the quantized gravitational field should be taken as the starting point, and unnecessary to say, as the building blocks of this work.

The initial impulse toward a covariant quantization of the gravitational field was made by Gupta, in 1952/46/. He, successfully, applied the analogy of the Fermi method to quantize the electromagnetic field, in order to overcome the singularity of the free part of the gravitational Lagrangian. The procedure invented by Fermi consists in adding to the Maxwell Lagrangian, $-\frac{1}{4} F_{\mu\nu} F^{\mu\nu}$, the term $-\frac{1}{2}(\partial_\mu A^\mu)^2$ /47/. When applied to the gravitational case the result is a non-singular kinetic matrix, which could be inverted to give the Lorentz covariant graviton propagator. The Gupta quantization method can be used to compute amplitudes at the tree level/48/.

The next contribution came from Feynman, in 1963/6,49/. He discovered that the application of the Fermi quantization scheme to non-abelian theories like Yang-Mills and gravitation, generates the propagation of non-gauge modes, leading to the violation of unitarity in the S-matrix. The

unitarity can be recovered by subtracting these unwanted gauge-effects. The trick consists in introducing the so called fictitious particles, which, propagating around closed loops never appear in the external legs. Then, to every closed loop diagram, it must be subtracted the corresponding fictitious particle loop. These fictitious particles, many times also called ghost particles, are scalars in the Yang-Mills case and vectors in the case of gravitation.

In his own way, Feynman mapped out the path to avoid the difficulties which he had pointed out, dealing with one loop diagrams. The solution for arbitrary diagrams was found, independently, by DeWitt and Faddeev and Popov, in 1967/50-53/. The use of function integral techniques provides an elegant mathematical framework to describe their works, and to treat the covariant perturbation theory of gauges fields/52-54,69-75/.

2.1 Einstein Gravitational Action

In the theory of General Relativity, the classical gravitation, in empty spacetime, is described by the action/55-58/:

$$S = \frac{2}{\kappa^2}\int d^4x \sqrt{-g}\, R \qquad \text{II.1.1}$$

The Ricci scalar curvature, R, is constructed out of the metric tensor $g_{\mu\nu}$ and its derivatives by means of the substitutions:

$$R = g^{\mu\nu} R_{\mu\nu} \qquad \text{II.1.2}$$

$$R_{\mu\nu} = \frac{\partial \Gamma^{\rho}_{\mu\rho}}{\partial x^{\nu}} - \frac{\partial \Gamma^{\rho}_{\mu\nu}}{\partial x^{\rho}} + \Gamma^{\sigma}_{\mu\rho}\Gamma^{\rho}_{\nu\sigma} - \Gamma^{\sigma}_{\mu\nu}\Gamma^{\rho}_{\sigma\rho} \qquad \text{II.1.3}$$

$$\Gamma^{\rho}_{\mu\nu} = \frac{1}{2} g^{\rho\sigma}\left(\frac{\partial g_{\mu\nu}}{\partial x^{\nu}} + \frac{\partial g_{\sigma\nu}}{\partial x^{\mu}} - \frac{\partial g_{\mu\nu}}{\partial x^{\sigma}} \right) \qquad \text{II.1.4}$$

Where $g = \det g_{\mu\nu}$ and $g^{\mu\nu}$ is defined by $g^{\mu\nu} g_{\nu\lambda} = \delta^{\mu}_{\lambda}$. In the system of units $\hbar = c = 1$, $\kappa^2 = 16\pi G$. Here G is the Newton's constant.

It is evident from the above expressions that the Ricci scalar curvature, includes second derivative and first derivative terms of the metric tensor, $g_{\mu\nu}$, which occur linearly and quadratically respectively. This consideration turns out to be fundamental for the analysis of the divergences of the Feynman diagrams in quantum gravity.

The classical action for Einstein's gravitation, Eq.(I.1.1) is invariant under the general tensorial transformation law,

$$g'_{\mu\nu}(x) = \frac{\partial x^{\rho}}{\partial x'^{\mu}} \frac{\partial x^{\sigma}}{\partial x'^{\nu}} g_{\rho\sigma}(x) \qquad \text{II.1.5}$$

which determines a variation $\underline{\delta g_{\mu\nu}(x)}$ at the spacetime $\underline{x^{\mu}}$.

Under the infinitesimal coordinate transformation

$$x'^{\mu} = x^{\mu} + \xi^{\mu} \qquad \text{II.1.6}$$

it is a relatively easy task to write down the Eq.(II.1.5) explicitly. It reads:

$$\delta g'_{\mu\nu}(x) = g_{\mu\nu}(x) - \frac{\partial \xi^{\sigma}}{\partial x^{\nu}}(x)\, g_{\mu\sigma}(x) - \frac{\partial \xi^{\sigma}(x)}{\partial x^{\mu}}\, g_{\rho\nu}(x)$$

$$- \xi^{\alpha}(x) \frac{\partial g_{\mu\nu}(x)}{\partial x^{\alpha}} \qquad \text{II.1.7}$$

As the general coordinate transformation, in General Relativity, corresponds to the gauge invariance in Particle Physics/78,79/, the Eq.(II.1.7) will be referred as the

gravitational gauge transformation, and the $\xi^{\mu}(x)$, as the four infinitesimal gravitational gauge parameters.

The flat spacetime expansion approach to quantum gravity can be switched on by linearizing the metric tensor $g_{\mu\nu}$ about a Minkowskian background. To this end, the graviton field, $h_{\mu\nu}$, is defined as follows:

$$g_{\mu\nu} = \eta_{\mu\nu} + \kappa h_{\mu\nu} \qquad \text{II.1.8}$$

The indices are now raised and lowered with $\eta_{\mu\nu}$, the Minkowski metric.

After this decomposition the gravitational action can be written as an infinite power series of $h_{\mu\nu}$

$$S = S_0 + \kappa S_1 + \kappa^2 S_2 + \ldots \qquad \text{II.1.9}$$

The subscripts 0,1,... denotes the bilinear, trilinear,... terms in the graviton field respectively.

This modified gravitational action is treated as representing a self-interacting theory of the spin-2 field $h_{\mu\nu}$, in the Minkowski spacetime, such that geometrical considerations will be of secondary importance/33/.

Similarly, the gauge transformation, defined by Eq(II.1.7), can now be rewritten using the definition of the gravitational field contained in Eq(II.1.8):

$$h'_{\mu\nu}(x) = h_{\mu\nu}(x) - k^{-1}\left(\frac{\partial \xi_\mu(x)}{\partial x^\nu} + \frac{\partial \xi_\nu(x)}{\partial x^\mu}\right)$$

$$-\left(\xi^\alpha(x)\frac{\partial h_{\mu\nu}(x)}{\partial x^\alpha} + \frac{\partial \xi^\alpha(x)}{\partial x^\nu}h_{\mu\alpha}(x) + \frac{\partial \xi^\beta(x)}{\partial x^\mu}h_{\beta\nu}(x)\right) \qquad \text{II.1.10}$$

2.2 The Gauge Fixing Term

In the General Relativity Theory the freedom of coordinate transformations, which, as can be seen in Eq(II.1.7), includes four arbitrary functions, doesn't permit a unique determination of the metric tensor $g_{\mu\nu}$, from the Einstein field equations. There must be imposed on the metric tensor four additional constraints usually known as the coordinate conditions. These conditions specify the coordinate system in which $g_{\mu\nu}$ should be solved/58/.

An analogous problem arises in electrodynamics, where the invariance of the Maxwell equations under a gauge transformation, $A_\mu \longrightarrow A_\mu + \partial_\mu \Lambda$, with Λ being an arbitrary scalar function, makes it impossible to obtain a

unique solution for the radiation field, without fixing the gauge .

A practical example of coordinate condition is the expression

$$\partial_\nu \tilde{g}^{\mu\nu} = \partial_\nu (\sqrt{-g}\, g^{\mu\nu}) = 0$$

II.2.1

It is not generally covariant, and can be used to break the general covariance of the Einstein action. As a matter of fact, the above expression is the well known deDonder coordinate condition, which determines a harmonic coordinate system.

For the quantization of the gravitational field, the first attempt to invert the quadratic form, S_o, Eq(II.1.9), in order to derive the graviton propagator; shows that it is degenerate , as an immediate consequence of the invariance of the Einstein action with respect to the gravitational gauge transformation. Being purely transverse it is singular and clearly non-invertible.

The example of QED - Fermi Method - suggests the introduction of longitudinal components, which must be non-gauge invariant in order to break the gauge invariance of the classical action:

$$\mathcal{L}_B = -\frac{1}{2\alpha} C_\nu^2 \qquad \text{II.2.2}$$

C_ν is a function of the gauge field $h_{\mu\nu}$ and its first derivative ; while α, is the general gauge parameter.

This important technical device which is fundamental to obtain a covariant propagator is the gauge breaking term.

As far as the physical content of the theory is concerned, the gauge invariance of the S-matrix elements guarantees that there will be many different , but physically equivalent gauge conditions.

For convenience, a Lorentz covariant gauge breaking expression is used in the present work:

$$\mathcal{L}_B = -\frac{1}{2\alpha}\left(\partial_\mu h_{\mu\nu} - \frac{1}{2}\partial_\nu h_{\mu\mu}\right)^2 \qquad \text{II.2.3}$$

where,

$$C_\nu = \partial_\mu h_{\mu\nu} - \frac{1}{2}\partial_\nu h_{\mu\mu} \qquad \text{II.2.4}$$

2.3 The Ghost Term

The introduction of the gauge fixing terms, invariably, leads to a longitudinal part in the gauge field propagator, whose behaviour is different according with the nature of the gauge group. Namely, if the gauge group is abelian the longitudinal part of the propagator, automatically, does not suffer radiative corrections. However, in the case of non-abelian gauge groups, the naive calculation of closed-loops diagrams receives a longitudinal contribution, leading to the violation of the Slavnov-Ward identities and non-unitarity of the scattering matrix/6,49-53/.

Carrying two symmetric Lorentz indices, the graviton field, $h_{\mu\nu}$, has ten degrees of freedom. However, the non-uniqueness of the gauge invariance indicates that not all degrees of freedom are independent. Of course, only two are independent and must be quantized.

In this way, the elimination of the longitudinal contribution in the closed-loop diagrams is equivalent to the elimination of the eight unphysical degrees of freedom.

In some sense, the gauge condition carries with it a complex vector field that must be taken into account in order to recover unitarity at the quantum level.

The solution of this problem initially offered by Feynman, was later generalized by DeWitt and Faddeev and Popov. In

what concerns the present calculation all that is necessary is the inclusion of an extra term, $\int dx^4 \mathcal{L}_G$, carrying two complex anti-commuting vector fields, χ_α and χ^*_β, usually called "fictitious particles" or "Faddeev-Popov ghost". The ghost Lagrangian, $\mathcal{L}_G$, is defined in the following way:

$$\mathcal{L}_G = \chi^*_\nu \left(\frac{\delta C_\nu}{\delta \Lambda_\mu} \right)_{\Lambda=0} \chi_\mu \qquad \text{II.3.1}$$

In this equation Λ_α are the four infinitesimal gravitational gauge parameters.

Working out the above expression one finds:

$$\begin{aligned} \mathcal{L}_G = {} & \chi^*_\nu \Box \chi_\nu \\ & + \kappa \chi^*_\nu (\partial_\mu h_{\beta\nu} \partial_\mu + h_{\beta\nu} \partial_\mu \partial_\mu + \partial_\mu h_{\mu\beta} \partial_\nu \\ & + \partial_\beta h_{\mu\nu} \partial_\mu + \partial_\mu \partial_\beta h_{\mu\nu} - \partial_\nu h_{\mu\beta} \partial_\mu \\ & - \tfrac{1}{2} \partial_\beta h_{\mu\mu} \partial_\nu - \tfrac{1}{2} \partial_\nu \partial_\beta h_{\mu\mu}) \chi_\beta \end{aligned} \qquad \text{II.3.2}$$

2.4 The Feynman Rules

As remarked in the earlier sections, in the covariant quantization of the gravitational field, the classical generally covariant action is replaced by a non-generally covariant one. This quantum action yields Feynman rules describing a unitary and causal theory.

$$\frac{2}{\kappa^2}\int d^{2\omega}x\sqrt{-g}R \longrightarrow \int d^{2\omega}x\left(\frac{2}{\kappa^2}\sqrt{-g}R + \mathcal{L}_B + \mathcal{L}_G\right)$$

II.4.1

Armed with this quantum action the first step toward the determination of the graviton self-energy consists in the correct derivation of the Feynman rules. In the case of gravity, it is very important to pay attention to a particular kind of symmetry of the theory: The graviton field is described by a symmetric second rank tensor. This symmetry must be made manifest in the graviton Feynman rules. For the connected Green's function it is enough to have only the graviton propagator symmetric in the Lorentz indices. However, for the amputated, one particle irreducible Green's function, either, the graviton propagator and vertices have to exhibit the indices symmetry.

The description of the gravitational gauge field in that way comes out to be the source of one of the major problems when performing explicit computation, a problem that

becomes evident from the very begining of the derivation of the graviton Feynman rules. The amount of terms to be taken into consideration is so large that it becomes almost prohibitive their manipulation by hand, and certainly a misuse of the human energy considering that it is just a mechanical work; something, that can be done by a computer, if programed to do so , with an infinitely high speed and accuracy, compared with the human standards.

In fact, the graviton Feynman rules have been derived by computer(Appendixes I to IV). The SCHOONSCHIP program for symbolic evaluation of algebraic expression - SCHOONSCHIP Version January 1, 1977 - has been adopted to perform the whole algebra of the present work, in a CDC CYBER 170/720 Computer.

The determination of the graviton propagators has already been outlined in the Chapter 1(see also Appendixes I and II).

The expressions for the bare graviton vertices can be obtained in a straightforward manner by repeated functional differentiation of the term S_1, in the linearized Einstein's action, Eq(II.1.9).

In coordinate space the nth. order bare vertex function is given by:

$$ {}^{n}\Gamma_{\alpha_1\beta_1\ldots\alpha_n\beta_n}(x_1\ldots x_n) = 2\,k^{n-2}\,\frac{\delta^n}{\delta h_{\alpha_1\beta_1}(x_1)\ldots\delta h_{\alpha_n\beta_n}(x_n)}\int d^{2w}x\;\mathcal{L}_n(h) \qquad \text{II.4.2} $$

Where use is made of the relations:

$$ \frac{\delta h_{\alpha\beta}(x_1)}{\delta h_{\alpha'\beta'}(x_2)} = \delta_{\alpha(\alpha'}\delta_{\beta')\beta}\,\delta(x_1-x_2) \qquad \text{II.4.3} $$

and

$$ F_{(\alpha}H_{\beta)} = \frac{1}{2}\left(F_\alpha H_\beta + F_\beta H_\alpha\right) \qquad \text{II.4.4} $$

Consequently the three-graviton vertex function in momentum space is immediate. In this case it is employed the momentum index combinations $p_1\alpha_1\beta_1$, $p_2\alpha_2\beta_2$, $p_3\alpha_3\beta_3$. The vertex must not only be symmetric in each index pair, but must also remain unchanged under arbitrary permutations of the momentum-index triplets.

It was found that 78(Goldberg's parametrization) and 495(Einstein's parametrization) separate terms are required in the complete expressions of the three graviton vertex function to incorporate all the symmetries of the graviton field(Appendixes III and IV).

In addition to the free graviton propagator and the

graviton vertex functions , the Feynman propagator for the fictitious particles and the graviton-fictitious-particles vertex are needed for the calculation of the radiative corrections . In momentum space they read, respectively:

$$G_{\alpha\beta}(p) = -\frac{i}{(2\pi)^{2\omega}} \frac{\delta_{\alpha\beta}}{(p^2+i\varepsilon)} \qquad \text{II.4.5}$$

$$\cdot V_{\alpha_1\beta_1,\alpha_2,\alpha_3}(p_1,p_2,p_3) = i\kappa(2\pi)^{2\omega}\left(p_1\cdot p_3\,\delta_{\rho(\mu}\delta_{\lambda)\sigma} + \right.$$

$$+ p_3\cdot p_3\,\delta_{\rho(\mu}\delta_{\lambda)\sigma} + p_{3\lambda}\,p_{1(\rho}\delta_{\sigma)\mu} + p_{1\mu}\,p_{3(\rho}\delta_{\sigma)\lambda} + p_{1\mu}\,p_{1(\rho}\delta_{\sigma)\lambda} -$$

$$\left. - p_{1\lambda}\,p_{3(\rho}\delta_{\sigma)\mu} - p_{1\mu}\,p_{3\lambda}\delta_{\rho\sigma} - p_{1\lambda}\,p_{1\mu}\delta_{\rho\sigma}\right) \qquad \text{II.4.6}$$

In the above graviton-ghost-ghost vertex, the momentum-index combinations are $p_1\alpha_1\beta_1$, $p_2\alpha_2$ and $p_3\alpha_3$. The symmetrization of the graviton index pair, $\alpha_1\beta_1$, has been included.

Now the Feynman rules are complete, and it is possible to proceed consistently to the construction of the one-loop graviton contribution to the graviton self-energy.

2.5 The Transversality Of The Graviton Self-Energy

The second order contribution to the two-point, one particle irreducible, amputated, graviton Green's function, coming from a single graviton plus fictitious loops, is a four index object which by symmetry and Lorentz covariance has the tensorial form(Appendix VI)

$$\overline{\Pi}_{\alpha\beta,\alpha'\beta'}(p) = \{ p_\alpha p_\beta p_{\alpha'} p_{\beta'} \overline{T}_{11}(p) + \delta_{\alpha\beta}\delta_{\alpha'\beta'}(p^2)^2 \overline{T}_{21}(p)$$

$$+ (\delta_{\alpha\alpha'}\delta_{\beta\beta'} + \delta_{\alpha\beta'}\delta_{\alpha'\beta})(p^2)^2 \overline{T}_{31}(p)$$

$$+ (\delta_{\alpha\beta} p_{\alpha'} p_{\beta'} + \delta_{\alpha'\beta'} p_\alpha p_\beta) p^2 \overline{T}_{41}(p)$$

$$+ (\delta_{\alpha\alpha'} p_\beta p_{\beta'} + \delta_{\beta\beta'} p_\alpha p_{\alpha'} + \delta_{\alpha\beta'} p_{\alpha'} p_\beta$$

$$+ \delta_{\alpha'\beta} p_\alpha p_{\beta'}) p^2 \overline{T}_{51}(p) \} \kappa^2 \qquad \text{II.5.1}$$

To proceed further the gravitational Slavnov-Ward identities were obtained following the prescription outlined by Slavnov. Subjected to the choice of the Lorentz covariant gauge breaking term.

$$\mathcal{L}_B = -\frac{1}{2\alpha}\left(\partial_\mu h_{\mu\nu} - \frac{1}{2}\partial_\nu h_{\mu\mu}\right)$$

II.5.2

they read,

$$\frac{1}{\alpha}\left(\partial_\mu \frac{\delta Z}{\delta J_{\mu\lambda}(x)} - \frac{1}{2}\delta_{\mu\rho}\partial_\lambda \frac{\delta Z}{\delta J_{\mu\rho}(x)}\right) =$$

$$\int j_{\mu\nu}(y) D_0(x-y)\left(\delta_{\mu\lambda}\partial_\nu + \delta_{\nu\lambda}\partial_\mu\right) dy\, Z \qquad \text{II.5.3}$$

This represents a compact expression of the identities, written in terms of the variational derivatives of the generating functional $Z(h_{\mu\nu}, j_{\rho\sigma})$, where $D_0(x)$ is the massless scalar propagator.

By taking the functional derivative with respect to the source term. $j_{\rho\sigma}$, in the limit as $j_{\alpha\beta} \to 0$, gives the identity for the two point Green's function. Its final result will take on a simpler form in momentum space:

$$\frac{1}{\alpha}\left[p_\mu \Pi^c_{\mu\nu,\rho\sigma}(p) - \frac{1}{2} p_\nu \Pi^c_{\mu\mu,\rho\sigma}(p)\right] =$$

$$-\frac{1}{p^2}\left(p_\rho \delta_{\sigma\nu} + p_\sigma \delta_{\rho\nu}\right) \qquad \text{II.5.4}$$

In the above expression the superscript c stands for connected, and $\overline{\Pi}^{c}_{\mu\nu,\rho\sigma}(p)$ is obtained from Eq(II.5.1) by attaching the graviton propagator $\Delta_{\alpha\beta,\alpha'\beta'}(p)$ to its external legs:

$$\overline{\Pi}^{c}_{\mu\nu,\rho\sigma}(p) = \Delta_{\mu\nu,\alpha\beta}(p)\,\overline{\Pi}_{\alpha\beta,\alpha'\beta'}(p)\,\Delta_{\alpha'\beta',\rho\sigma}(p) \qquad \text{II.5.5}$$

The general content of these gravitational Slavnov-Ward identities is that <u>the longitudinal part of the graviton propagator does not suffer radiative corrections</u>. Indeed, the right hand side of the Eq(II.5.4) comes from the bare graviton propagator:

$$\Delta_{\lambda\beta,\lambda'\beta'}(p) = \frac{1}{2p^2}\left(\delta_{\lambda\lambda'}\delta_{\beta\beta'} + \delta_{\lambda\beta'}\delta_{\lambda'\beta} - \delta_{\lambda\beta}\delta_{\lambda'\beta'}\right)$$

$$- \frac{(1+2\alpha)}{2(p^2)^2}\left(p_\lambda p_{\lambda'}\delta_{\beta\beta'} + p_\beta p_{\beta'}\delta_{\lambda\lambda'}\right.$$

$$\left. + p_\lambda p_{\beta'}\delta_{\lambda'\beta} + p_{\lambda'}p_\beta\delta_{\lambda\beta'}\right) \qquad \text{II.5.7}$$

As a natural consequence the one-loop contribution to the one-particle irreducible amputated, two-point, graviton Green's function Eq(II.5.1), <u>is purely transverse</u>.

Contrary to the general belief/40-41/, even in the context of the dimensional regularization scheme, the appropriate inclusion of the integral $A_{\alpha_1\beta_1,\alpha_2\beta_2\alpha_3\beta_3}(p)\int d^{2w}q\,(q-p)^{-2}$ is essential, in order to have Green's functions consistent with the gravitational Slavnov-Ward identities/36,42/.

2.6 Meaning of Finiteness in Pure Quantum Gravity

Once the above steps have been accomplished it is possible to say that, definitely, the divergent one-loop graviton contribution to the graviton self-energy is part of a generally covariant object whose most general form is:

$$\int d^4x\sqrt{-g}\left(a R^2 + b R_{\mu\nu}R^{\mu\nu} + c R_{\mu\nu\alpha\beta}R^{\mu\nu\alpha\beta}\right) \qquad \text{II.6.1}$$

The determination of the coefficients a, b and c requires the outcome of the one-loop calculation. Then, Eq(II.6.1) was linearized, by using the definition of the graviton field adopted along this work,

$$g_{\mu\nu} = \delta_{\mu\nu} + \kappa\, h_{\mu\nu} \qquad \text{II.6.2}$$

and Fourier transformed. When the result obtained is compared with $\overline{\Pi}^{div}_{\lambda\beta,\lambda'\beta'}(p)$, which, was computed by using

the covariant quantization approach, for the gauge parameter $\alpha = -1/2$; it is verified that the infinite part of the two-point, one-particle irreducible amputated graviton Green's function is contained in the generally covariant object, essentially built up from the bilinear products of the Riemann tensors.

The Gauss-Bonnet identity in four dimensions/76,77/ states that for any field $g_{\mu\nu}$

$$\int d^4x \sqrt{-g} \left(R^2 - 4 R_{\mu\nu} R^{\mu\nu} + R_{\mu\nu\alpha\beta} R^{\mu\nu\alpha\beta} \right) \equiv 0 \qquad \text{II.6.3}$$

But, on the mass-shell the external $g_{\mu\nu}$ satisfies the classical Einstein field equations, in the vacuum,

$$R_{\mu\nu} = 0 \qquad \text{II.6. 4}$$

This means that $R_{\mu\nu} R^{\mu\nu}$ and R^2 vanish.

On the other hand, the Eq(II.6.6) implies that also $\int d^4x \sqrt{-g} R_{\mu\nu\alpha\beta} R^{\mu\nu\alpha\beta}$ vanishes.

At this point a natural conclusion arises: The divergent one-loop graviton contribution to the two-point graviton Green's function is identically zero.

$$\overline{\Pi}^{div}_{\alpha\beta,\alpha'\beta'}(p) \equiv 0 \qquad \text{II.6. 5}$$

CONCLUSIONS

CONCLUSIONS

Initially, the study of the gravitational Slavnov-Ward identities shows that the total graviton propagator is transversal in the Landau gauge $-\alpha=0$. An, off shell, explicit computation of the one-loop graviton contribution to the graviton self-energy confirms this result for order K^2.

The concrete calculation of the lowest order graviton contribution to the graviton self-energy makes it clear that the computation of any higher order process to the gravitational S-matrix is a very difficult enterprise. The limitation of the algebraic computing programs is dramatic, establishing a serious constraint on how far it is possible to go with the Feynman diagrammatic techniques in quantum gravity/85/.

Here, it is present a typical situation where the use of the brute force is senseless and probably only the remarkable power of general covariance can be invoked, in order to overcome this apparently unsurmountable obstacle.

More then ten years ago, the principle of general coordinate transformation, in connexion with the background

field formalism, had been employed by 't Hooft and Veltman, to claim that in pure quantum gravity, at the one-loop level, "no physically relevant divergences remain; they can all be absorbed in a field renormalization"/35/.

Although treating the problem in a different approach, it is the author[6] claim that the principle of general covariance not only assures the finiteness of pure quantum gravity at one-loop level, but opens new horizons for the understanding of the meaning of finiteness in pure quantum gravity. However, the way in which it happens gives rise to a new challenge to the physicist mind.

Generally speaking, the symmetry of the graviton gauge field plus Lorentz covariance fix the general structure of the two-point graviton Green's function. The explicit calculation , performed in the context of the covariant quantization approach, flat spacetime expansion, up to second order in the gravitational coupling constant, demonstrates that this Green's function is generally covariant(Appendix VI). Finally, the Gauss-Bonnet identity, in four dimensions, guarantees that the divergent one-loop graviton contribution to the graviton self-energy cancels on mass-shell.

In view of the lack of experimental information to guide our minds in the formulation of a physical quantum gravity theory, the determination of the structure of the "counterterms"(if this concept will be of any use at all in

what concerns gravity) even in pure quantum gravity, is still an object that deserves intensive studies and, certainly, will occupy the physicists for many years to come/82 84/.

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APPENDIX I

THE GRAVITON PROPAGATOR FOR A GENERAL GAUGE PARAMETER

Goldberg's Parametrization

```
SCHOONSCHIP , VERSION OF  APRIL  1, 1977

   TIME          .13  SECONDS


                    C WORKS OUT PH1**2 PART OF R AND G**.5*R
                    COMMON LAG
                    S  D1,D2,D1Q,D1PQ,D2Q,D2PQ,W,Z,K,Z2,
                       I1T11,I1T12,I1T22,
                       I2T11,I2T12,I2T21,I2T22,
                       I3T11,I3T12,I3T22,
                       I4T11,I4T12,I4T21,I4T22,
                       I5T11,I5T12,I5T21,I5T22,
                       I6T11,I6T12,I6T21,I6T22,
                       I7T11,I7T12,I7T21,I7T22,
                       I8T11,I8T12,I8T21,I8T22,
                       I9T11,I9T12,I9T22,
                       I1011,I1012,I1021,I1022,
                       I1111,I1112,I1121,I1122,
                       I1211,I1212,I1221,I1222,
                       I1311,I1312,I1321,I1322,
                       I1411,I1412,I1421,I1422,
                       I1511,I1512,I1521,I1522
                    I  MU=Z,NU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=
                     L7=Z,L8=Z,L9=Z,PO=Z,SI=Z,AA=Z,BB=Z,CC=Z,AA1=Z,AA2=Z,AA3
                     A1=Z,A2=Z,A3=Z,B1=Z,B2=Z,B3=Z,J,BB1=Z,BB2=Z,BB3=Z,LA=Z,
                     S1=Z,S2=Z,S3=Z,S4=Z
                    F  GU,PO,P1
                    *FIX

SYMBOLS         I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS       D, EPF=I, G=I, GI, GF=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.

EXPR.           LAG.
```

```
BEGIN          .40  SECONDS

                    N R
                    Z LAG=1./2.*K**-2*((D(RO,SI)+1./2.*K*(PO(RO,SI)+PO(SI,RO)))*
                         1./4.*(GU(LA,MU)*GU(MU,LA))*(GU(KA,NU)+GU(NU,KA))
                        -1./Z2*(D(RO,SI)+1./2.*K*(PO(RO,SI)+PO(SI,RO)))*
                         1./4.*(GU(NU,KA)+GU(KA,MU))*(GU(LA,NU)+GU(NU,LA))
                        -2*D(SI,KA)*D(RO,LA)*1./2.*(GU(MU,NU)+GU(NU,MU)))*
                         1./4.*K**2*(P1(MU,KA,RO)+P1(KA,MU,RO))
                                   *(P1(LA,NU,SI)+P1(NU,LA,SI))
              L 4       ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                         +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                                     +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                         -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                                     +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                                     +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                                     +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                                     +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                                     +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                                     +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                                     +PO(L3,A)*PO(L4,L3)*PO(B,L4)))
                                   *(D(AA,BB)-1./2.*K*(PO(AA,BB)+PO(BB,AA))
                         +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                                     +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                         -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                                     +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                                     +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                                     +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                                     +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                                     +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                                     +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                                     +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
              L 7       ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                         +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                                     +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                         -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                                     +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                                     +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                                     +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                                     +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                                     +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                                     +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                                     +PO(L3,A)*PO(L4,L3)*PO(B,L4))
              L 9       ID,K=0
                        NPRINT LAG
                        *BEGIN

SYMBOLS         I=I, D1, D2, D10, D1PQ, D20, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.


EXPR.           LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	69.17			
TERMS IN OUTPUT	12			
GENERATED TERMS	40	INPUT SPACE	667	2000
EQUAL TERMS	28	OUTPUT SPACE	85	4740
CANCELLATIONS	0	NR. OF EXPR.	51	260
RECORDS WRITTEN	0	ID. REGISTER	14	500
MULTIPLICATIONS	132809	FUNCT. REG.	39	750

```
BEGIN       69.61  SECONDS

            NAMES LAG
            COMMON V1,V2,INVP,INVPP
            S Z,KK,T1,T2,T3,T4,T5,T6,T7,T8,T9,T10
            V Q1,Q2,P
            *FIX

SYMBOLS     I=I, D1, D2, D10, D1PQ, D20, D2PQ, W, Z, K, Z2, I1T11,
            I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
            I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
            I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
            I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
            I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
            I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
            I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
            KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
            DT, DS=U, DX, DK, DP, DF=U, GU, PD, P1.

EXPR.       LAG, V1, V2, INVP, INVPP.
```

```
                M R
                C WORKS OUT THE GRAVITON PROPAGATOR
                Z LAG=LAG
          L 2   ID,K**(J+)=KK**(-J)
          L 3   ID,KK=0
                *NEXT

SYMBOLS         I=I, D1, D2, D10, D1PQ, D20, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, URG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GU, PQ, P1.

EXPR.           LAG, V1, V2, INVP, INVPP.

RUNNING TIME (SEC)      .13.                          USED    MAXIMUM
TERMS IN OUTPUT          12
GENERATED TERMS          12        INPUT SPACE        231       2000
EQUAL TERMS               0        OUTPUT SPACE        85       4740
CANCELLATIONS             0        NR. OF EXPR.        24        260
RECORDS WRITTEN           2        ID. REGISTER         6        500
MULTIPLICATIONS          61        FUNCT. REG.         10        750


 LAG =

   + P1(MU,MU,SI)*P1(NU,NU,SI)

   * ( - 1./8.*Z2**(-1) )


   + P1(MU,MU,SI)*P1(LA,LA,SI)

   * ( - 1./8.*Z2**(-1) )


   - 1./4.*P1(NU,SI,LA)*P1(NU,LA,SI)


   - 1./4.*P1(NU,SI,LA)*P1(LA,NU,SI)


   + 1./8.*P1(NU,LA,SI)*P1(NU,LA,SI)
```

```
    + 1./8.*P1(MU,LA,SI)*P1(LA,MU,SI)

    + P1(KA,KA,SI)*P1(MU,MU,SI)
    * ( - 1./8.*Z2**(-1) )

    + P1(KA,KA,SI)*P1(LA,LA,SI)
    * ( - 1./8.*Z2**(-1) )

    - 1./4.*P1(SI,MU,LA)*P1(MU,LA,SI)

    - 1./4.*P1(SI,MU,LA)*P1(LA,MU,SI)

    + 1./8.*P1(LA,MU,SI)*P1(MU,LA,SI)

    + 1./8.*P1(LA,MU,SI)*P1(LA,MU,SI)  +0.

                C GAUGE BREAKING TERM
                Z LAG=LAG-1./4.*D1**-1*(P1(MU,NU,MU)*P1(RO,NU,RO)
                          +P1(MU,NU,MU)*P1(NU,RO,RO)
                          +P1(NU,MU,MU)*P1(RO,NU,RO)
                          +P1(NU,MU,MU)*P1(NU,RO,RO))
                NPRINT LAG
                *NEXT

SYMBOLS         I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.

EXPR.           LAG, V1, V2, INVP, INVPP.
```

```
RUNNING TIME (SEC)          .41                              USED    MAXIMUM
TERMS IN OUTPUT              16
GENERATED TERMS              16          INPUT SPACE          241       2000
EQUAL TERMS                   0          OUTPUT SPACE         113       4740
CANCELLATIONS                 0          NR. OF EXPR.          21        260
RECORDS WRITTEN               5          ID. REGISTER           1        500
MULTIPLICATIONS              46          FUNCT. REG.           16        750


SYMBOLS       I=I, D1, D2, D10, D1P0, D20, D2P0, W, Z, K, Z2, I1T11,
              I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
              I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
              I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
              I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
              I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
              I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
              I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
              KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, P.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.         LAG, V1, V2, INVP, INVPP.
                   N R
                   Z V1=LAG
         L 2       ID,ADISO,P0(L1+,L2+)*P2(L3+,L4+,L5+,L6+)=
                    D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*Q2(L5)*Q2(L6)
         L 3       ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)=
                    D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)
                   *NEXT

SYMBOLS       I=I, D1, D2, D10, D1P0, D20, D2P0, W, Z, K, Z2, I1T11,
              I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
              I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
              I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
              I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
              I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
              I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
              I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
              KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, P.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.         LAG, V1, V2, INVP, INVPP.

RUNNING TIME (SEC)          .77                              USED    MAXIMUM
TERMS IN OUTPUT              11
GENERATED TERMS              16          INPUT SPACE          278       2000
EQUAL TERMS                   5          OUTPUT SPACE          67       4740
```

CANCELLATIONS	0	NR. OF EXPR.	22	260
RECORDS WRITTEN	8	ID. REGISTER	23	500
MULTIPLICATIONS	81	FUNCT. REG.	19	750

SYMBOLS I=I, D1, D2, D10, D1PQ, D20, D2PQ, W, Z, K, Z2, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RD=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR. LAG, V1, V2, INVP, INVPP.

```
 V1 =

   + Q1(A1)*Q2(A2)*D(B1,B2)

   * ( - 1./4.*D1**(-1) )


   + Q1(A1)*D(A2,B1)*Q2(B2)

   * ( - 1./4.*D1**(-1) )


   - 1./4.*Q2(A1)*Q1(A2)*D(B1,B2)


   - 1./4.*Q2(A1)*D(A2,B1)*Q1(B2)


   + D(A1,A2)*Q1(B1)*Q2(B2)

   * ( - 1./4.*D1**(-1) )


   - 1./4.*D(A1,A2)*Q2(B1)*Q1(B2)


   + D(A1,A2)*D(B1,B2)

   * ( 1./4.*Q1DQ2 )
```

```
    + D(A1,B1)*D(A2,B2)
    * ( - 1./2.*Z2**(-1)*Q1DQ2 )


    - 1./4.*D(A1,B2)*Q1(A2)*Q2(B1)


    + D(A1,B2)*Q2(A2)*Q1(B1)
    * ( - 1./4.*D1**(-1) )


    + D(A1,B2)*D(A2,B1)
    * ( 1./4.*Q1DQ2 )  +0.
```

```
                N R
                Z V2=LAG
          L 2   ID,ADISO,P0(L1+,L2+)*P2(L3+,L4+,L5+,L6+)=
                 D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*Q1(L5)*Q1(L6)
          L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)=
                 D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)
                *NEXT
```

```
SYMBOLS         I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, INVP, INVPP.

RUNNING TIME (SEC)      1.12                          USED    MAXIMUM
TERMS IN OUTPUT           11
GENERATED TERMS           16        INPUT SPACE        278       2000
EQUAL TERMS                5        OUTPUT SPACE        67       4740
CANCELLATIONS              0        NR. OF EXPR.        23        250
RECORDS WRITTEN           10        ID. REGISTER        23        500
MULTIPLICATIONS           81        FUNCT. REG.         19        750
```

```
SYMBOLS         I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
```

```
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, INVP, INVPP.

 V2 =

   + Q1(A1)*Q2(A2)*D(B1,B2)

   * ( - 1./4.*D1**(-1) )


   + Q1(A1)*D(A2,B1)*Q2(B2)

   * ( - 1./4.*D1**(-1) )


   - 1./4.*Q2(A1)*Q1(A2)*D(B1,B2)


   - 1./4.*Q2(A1)*D(A2,B1)*Q1(B2)


   + D(A1,A2)*Q1(B1)*Q2(B2)

   * ( - 1./4.*D1**(-1) )


   - 1./4.*D(A1,A2)*Q2(B1)*Q1(B2)


   + D(A1,A2)*D(B1,B2)

   * ( 1./4.*Q1DQ2 )


   + D(A1,B1)*D(A2,B2)

   * ( - 1./2.*Z2**(-1)*Q1DQ2 )


   - 1./4.*D(A1,B2)*Q1(A2)*Q2(B1)
```

```
   + D(A1,B2)*Q2(A2)*Q1(B1)
   * ( - 1./4.*D1**(-1) )

   + D(A1,B2)*D(A2,B1)
   * ( 1./4.*Q1DQ2 )  +0.

                  N R
                  Z INVP=V1+V2
                  DELETE LAG,V1,V2
                  *NEXT

SYMBOLS      I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
             I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
             I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
             I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
             I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
             I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
             I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
             I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
             KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES      MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
             CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
             B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS      Q1, Q2, P.

FUNCTIONS    D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
             DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.        LAG, V1, V2, INVP, INVPP.

RUNNING TIME (SEC)      1.41                          USED    MAXIMUM
TERMS IN OUTPUT           11
GENERATED TERMS           22      INPUT SPACE        215       2000
EQUAL TERMS               11      OUTPUT SPACE        67       4740
CANCELLATIONS              0      NR. OF EXPR.        22        260
RECORDS WRITTEN           12      ID. REGISTER         1        500
MULTIPLICATIONS           68      FUNCT. REG.         17        750

SYMBOLS      I=1, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
             I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
             I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
             I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
             I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
             I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
             I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
             I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
             KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES      MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
             CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
             B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS      Q1, Q2, P.
```

```
FUNCTIONS       D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, INVP, INVPP.

 INVP =

   + Q1(A1)*Q2(A2)*D(B1,B2)
   * ( - 1./2.*D1**(-1) )

   + Q1(A1)*D(A2,B1)*Q2(B2)
   * ( - 1./2.*D1**(-1) )

   - 1./2.*Q2(A1)*Q1(A2)*D(B1,B2)

   - 1./2.*Q2(A1)*D(A2,B1)*Q1(B2)

   + D(A1,A2)*Q1(B1)*Q2(B2)
   * ( - 1./2.*D1**(-1) )

   - 1./2.*D(A1,A2)*Q2(B1)*Q1(B2)

   + D(A1,A2)*D(B1,B2)
   * ( 1./2.*Q1DQ2 )

   + D(A1,B1)*D(A2,B2)
   * ( - Z2**(-1)*Q1DQ2 )

   - 1./2.*D(A1,B2)*Q1(A2)*Q2(B1)

   + D(A1,B2)*Q2(A2)*Q1(B2)
   * ( - 1./2.*D1**(-1) )

   + D(A1,B2)*D(A2,B1)
   * ( 1./2.*Q1DQ2 )  +0.
```

```
                U R
                Z INVP=INVP
          L 2   ID,Q1(MU+)=P(MU)
          L 3   ID,2,OUTPR,Q1(MU+)=P(MU)
          L 5   ID,Q2(MU+)=-P(MU)
          L 6   ID,2,OUTPR,Q2(MU+)=-P(MU)
                *BEGIN

SYMBOLS         I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RU=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           =0, =0, =0, INVP, INVPP.
```

RUNNING TIME (SEC)	1.77		USED	MAXIMUM
TERMS IN OUTPUT	11			
GENERATED TERMS	11	INPUT SPACE	254	2000
EQUAL TERMS	0	OUTPUT SPACE	55	4740
CANCELLATIONS	0	NR. OF EXPR.	24	260
RECORDS WRITTEN	15	ID. REGISTER	13	500
MULTIPLICATIONS	78	FUNCT. REG.	17	750

```
SYMBOLS         I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RU=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           =0, =0, =0, INVP, INVPP.

 INVP =
```

```
     + P(A1)*P(A2)*D(B1,B2)
     * ( 1./2. + 1./2.*D1**(-1) )

     + P(A1)*D(A2,B1)*P(B2)
     * ( 1./2. + 1./2.*D1**(-1) )

     + D(A1,A2)*P(B1)*P(B2)
     * ( 1./2. + 1./2.*D1**(-1) )

     + D(A1,A2)*D(B1,B2)
     * ( - 1./2.*PDP )

     + D(A1,B1)*D(A2,B2)
     * ( Z2**(-1)*PDP )

     + D(A1,B2)*P(A2)*P(B1)
     * ( 1./2. + 1./2.*D1**(-1) )

     + D(A1,B2)*D(A2,B1)
     * ( - 1./2.*PDP )  +0.
```

BEGIN 71.67 SECONDS

```
NAMES INVP
X PP(A1,B1,AA1,BB1)=
    P(AA1)*P(A1)*P(B1)*P(BB1)*T1
    + P(AA1)*P(A1)*D(B1,BB1)*T5
    + P(AA1)*D(A1,B1)*P(BB1)*T4
    + P(AA1)*D(A1,BB1)*P(B1)*T5
    + D(AA1,A1)*P(B1)*P(BB1)*T5
    + D(AA1,A1)*D(B1,BB1)*T3
    + D(AA1,B1)*P(A1)*P(BB1)*T5
    + D(AA1,B1)*D(A1,BB1)*T3
    + D(AA1,BB1)*P(A1)*P(B1)*T4
    + D(AA1,BB1)*D(A1,B1)*T2
X U(A1,B1,A2,B2)=INVP
*FIX
```

SYMBOLS I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PD=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. =0, =0, =0, INVP, INVPP, PP=1, U=2.

```
                  B B
                  Z UNIT=INVP*PP(A2,B2,AA1,BB1)
          L 2     ID)Z=2*W
                  DELETE INVP
                  *BEGIN

SYMBOLS           1=I, D1, D2, D10, D2P0, D20, D2P0, W, Z, K, Z2, I1T11,
                  I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                  I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                  I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                  I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                  I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                  I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                  I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                  KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES           MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                  L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                  CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                  B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS           Q1, Q2, P.
```

```
FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.

EXPR.          =0, =0, =0, INVP, INVPP, PP=1, U=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	1.17			
TERMS IN OUTPUT	32			
GENERATED TERMS	110	INPUT SPACE	291	2000
EQUAL TERMS	72	OUTPUT SPACE	157	4740
CANCELLATIONS	6	NR. OF EXPR.	26	260
RECORDS WRITTEN	20	ID. REGISTER	3	500
MULTIPLICATIONS	555	FUNCT. REG.	24	750

```
SYMBOLS        I=I, D1, D2, D10, D1PQ, D2Q, D2PQ, W, Z, K, Z2, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.

EXPR.          =0, =0, =0, INVP, INVPP, PP=1, U=2.

 UNIT =

   + P(AA1)*P(A1)*P(B1)*P(BB1)

   * ( 2.*D1**(-1)*T1*PDP + 2.*D1**(-1)*T4 + 4.*D1**(-1)*T5 + T1*PDP + 2.*T4 + 4.*T5 )


(2) + P(AA1)*P(A1)*D(B1,BB1)

   * ( D1**(-1)*T3 + D1**(-1)*T5*PDP + T3 )

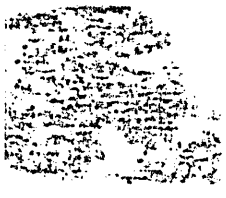

   + P(AA1)*D(A1,B1)*P(BB1)

(5) * ( 2.*W*Z2**(-1)*T4*PDP + Z2**(-1)*T1*PDP**2 + 4.*Z2**(-1)*T5*PDP - T4*PDP )


(2) + P(AA1)*D(A1,BB1)*P(B1)

   * ( D1**(-1)*T3 + D1**(-1)*T5*PDP + T3 )


(5) + D(AA1,A1)*P(B1)*P(BB1)
```

```
      * ( D1**(-1)*T3 + D1**(-1)*T5*PDP + T3 )

      + D(AA1,A1)*D(B1,BB1)
(1)
      * ( - T3*PDP )

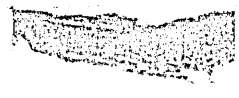
      + D(AA1,B1)*P(A1)*P(BB1)
(2)
      * ( D1**(-1)*T3 + D1**(-1)*T5*PDP + T3 )

      + D(AA1,B1)*D(A1,BB1)
(1)
      * ( - T3*PDP )

      + D(AA1,BB1)*P(A1)*P(B1)
(3)
      * ( 2.*D1**(-1)*T2 + 2.*D1**(-1)*T4*PDP + 2.*T2 + T4*PDP )

      + D(AA1,BB1)*D(A1,B1)
(4)
      * ( 2.*W*Z2**(-1)*T2*PDP + 2.*Z2**(-1)*T3*PDP + Z2**(-1)*T4*PDP**2 - T2*PDP )  +0.
```



```
BEGIN       73.23  SECONDS

                   URITE COMMON
                   *END

SYMBOLS        I=I, D1, D2, D10, D1PQ, D20, D2PQ, W, Z, K, Z2, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

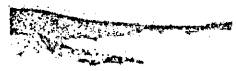
VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.

EXPR.          =0, =0, =0, =0, INVPP, PP=1, U=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	.13			
TERMS IN OUTPUT	0			
GENERATED TERMS	0	INPUT SPACE	239	2000
EQUAL TERMS	0	OUTPUT SPACE	0	4740
CANCELLATIONS	0	NR. OF EXPR.	20	260
RECORDS WRITTEN	28	ID. REGISTER	1	500
MULTIPLICATIONS	0	FUNCT. REG.	0	750

```
END OF RUN.    TIME       73.38  SECONDS
```

APPENDIX II

THE GRAVITON PROPAGATOR FOR A GENERAL GAUGE PARAMETER

Einstein's Parametrization

SCHOONSCHIP , VERSION OF APRIL 1, 1977

TIME .13 SECONDS

```
      C WORKS OUT PHI**2 PART OF P AND G**.5*R
      COMMON R,RR,LAG
      S Z,K
      I MU=Z,NU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=Z,L6=Z,
       L7=Z,L8=Z,L9=Z,RU=Z,SI=Z,AA=Z,BB=Z,CC=Z,AA1=Z,AA2=Z,AA3=Z,
       A1=Z,A2=Z,A3=Z,B1=Z,B2=Z,B3=Z,J,BB1=Z,BB2=Z,BB3=Z
      F GM1,GM,GU1,GU,P0,P1,P2
      *FIX
```

SYMBOLS I=I, Z, K.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. R, RR, LAG.

```
                H R
                Z RR(MU,MU)=(GM1(RU,MU,RU,MU)-GM1(RU,MU,MU,RU)+GM(RU,SI,MU)
                 *GM(SI,MU,RU)-GM(SI,MU,MU)*GM(RU,SI,RU))*K**-2
          L 2   ID,GM1(A+,B+,L+,KA+)=1./4.*K*GU1(A,C,KA)*(P1(B,C,L)+P1(C,B,L)
                                                          +P1(C,L,B)+P1(L,C,B)
                                                          -P1(B,L,C)-P1(L,B,C))
                 +1./4.*K*GU(A,C)*(P2(B,C,L,KA)+P2(C,B,L,KA)
                                   +P2(C,L,B,KA)+P2(L,C,B,KA)
                                   -P2(B,L,C,KA)-P2(L,B,C,KA))
          L 4   ID,GM(A+,B+,C+)*GM(AA+,BB+,CC+)=1./16.*K**2
                 *GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                           +P1(L1,C,B)+P1(C,L1,B)
                           -P1(B,C,L1)-P1(C,B,L1))
                 *GU(AA,L2)*(P1(BB,L2,CC)+P1(L2,BB,CC)
                            +P1(L2,CC,BB)+P1(CC,L2,BB)
                            -P1(BB,CC,L2)-P1(CC,BB,L2))
          L 6   ID,GM(A+,B+,C+)=1./4.*K*GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                                                 +P1(L1,C,B)+P1(C,L1,B)
                                                 -P1(B,C,L1)-P1(C,B,L1))
          L 8   ID,GU1(A+,B+,C+)=-1./2.*K*(P1(A,B,C)+P1(B,A,C))
                 +1./4.*K**2*(P1(A,L3,C)*P0(L3,B)+P1(A,L3,C)*P0(B,L3)
                             +P1(L3,A,C)*P0(L3,B)+P1(L3,A,C)*P0(B,L3)
                             +P0(A,L3)*P1(L3,B,C)+P0(A,L3)*P1(B,L3,C)
                             +P0(L3,A)*P1(L3,B,C)+P0(L3,A)*P1(B,L3,C))
                 -1./8.*K**3*(P1(A,L3,C)*P0(L3,L4)*P0(L4,B)
                             +P1(A,L3,C)*P0(L3,L4)*P0(B,L4)
                             +P1(A,L3,C)*P0(L4,L3)*P0(L4,B)
                             +P1(A,L3,C)*P0(L4,L3)*P0(B,L4)
                             +P1(L3,A,C)*P0(L3,L4)*P0(L4,B)
                             +P1(L3,A,C)*P0(L3,L4)*P0(B,L4)
                             +P1(L3,A,C)*P0(L4,L3)*P0(L4,B)
                             +P1(L3,A,C)*P0(L4,L3)*P0(B,L4)
                             +P0(A,L3)*P1(L3,L4,C)*P0(L4,B)
                             +P0(A,L3)*P1(L3,L4,C)*P0(B,L4)
                             +P0(A,L3)*P1(L4,L3,C)*P0(L4,B)
                             +P0(A,L3)*P1(L4,L3,C)*P0(B,L4)
                             +P0(L3,A)*P1(L3,L4,C)*P0(L4,B)
                             +P0(L3,A)*P1(L3,L4,C)*P0(B,L4)
                             +P0(L3,A)*P1(L4,L3,C)*P0(L4,B)
                             +P0(L3,A)*P1(L4,L3,C)*P0(B,L4)
                             +P0(A,L3)*P0(L3,L4)*P1(L4,B,C)
                             +P0(A,L3)*P0(L3,L4)*P1(B,L4,C)
                             +P0(A,L3)*P0(L4,L3)*P1(L4,B,C)
                             +P0(A,L3)*P0(L4,L3)*P1(B,L4,C)
                             +P0(L3,A)*P0(L3,L4)*P1(L4,B,C)
                             +P0(L3,A)*P0(L3,L4)*P1(B,L4,C)
                             +P0(L3,A)*P0(L4,L3)*P1(L4,B,C)
                             +P0(L3,A)*P0(L4,L3)*P1(B,L4,C))
          L10   ID,K=0
          L11   ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(P0(A,B)+P0(B,A))
                 +1./4.*K**2*(P0(A,L3)*P0(L3,B)+P0(A,L3)*P0(B,L3)
                             +P0(L3,A)*P0(L3,B)+P0(L3,A)*P0(B,L3))
                 -1./8.*K**3*(P0(A,L3)*P0(L3,L4)*P0(L4,B)
                             +P0(A,L3)*P0(L3,L4)*P0(B,L4)
                             +P0(A,L3)*P0(L4,L3)*P0(L4,B)
                             +P0(A,L3)*P0(L4,L3)*P0(B,L4)
                             +P0(L3,A)*P0(L3,L4)*P0(L4,B)
                             +P0(L3,A)*P0(L3,L4)*P0(B,L4)
                             +P0(L3,A)*P0(L4,L3)*P0(L4,B)
                             +P0(L3,A)*P0(L4,L3)*P0(B,L4)))
                            *(D(AA,BB)-1./2.*K*(P0(AA,BB)+P0(BB,AA))
```

```
                +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                            +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                            +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                            +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                            +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                            +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                            +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                            +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                            +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
        L14     ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                            +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                            +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                            +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                            +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                            +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                            +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                            +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                            +PO(L3,A)*PO(L4,L3)*PO(B,L4))
        L16     ID,K=0
                NPRINT RR
                *NEXT

SYMBOLS         I=I, Z, K.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.           R, RR, LAG.
```

RUNNING TIME (SEC)	40.40		USED	MAXIMUM
TERMS IN OUTPUT	132			
GENERATED TERMS	132	INPUT SPACE	903	2000
EQUAL TERMS	0	OUTPUT SPACE	913	4740
CANCELLATIONS	0	NR. OF EXPR.	52	260
RECORDS WRITTEN	0	ID. REGISTER	33	500
MULTIPLICATIONS	101361	FUNCT. REG.	35	750

```
                II R
                Z R=RR(MU,NU)*(D(MU,NU)-1./2.*K*(PO(MU,NU)+PO(NU,MU))
                 +1./4.*K**2*(PO(MU,L7)*PO(L7,NU)+PO(MU,L7)*PO(NU,L7)
                            +PO(L7,MU)*PO(L7,NU)+PO(L7,MU)*PO(NU,L7))
                 -1./8.*K**3*(PO(MU,L7)*PO(L7,L8)*PO(L8,NU)
                            +PO(MU,L7)*PO(L7,L8)*PO(NU,L8)
                            +PO(MU,L7)*PO(L8,L7)*PO(L8,NU)
                            +PO(MU,L7)*PO(L8,L7)*PO(NU,L8)
                            +PO(L7,MU)*PO(L7,L8)*PO(L8,NU)
                            +PO(L7,MU)*PO(L7,L8)*PO(NU,L8)
                            +PO(L7,MU)*PO(L8,L7)*PO(L8,NU)
                            +PO(L7,MU)*PO(L8,L7)*PO(NU,L8)))
        L 4     ID,K=0
                NPRINT R
                *NEXT

SYMBOLS         I=I, Z, K.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
```

```
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
```

RUNNING TIME (SEC)	44.76		USED	MAXIMUM
TERMS IN OUTPUT	123			
GENERATED TERMS	156	INPUT SPACE	336	2000
EQUAL TERMS	33	OUTPUT SPACE	853	4740
CANCELLATIONS	0	NR. OF EXPR.	27	260
RECORDS WRITTEN	4	ID. REGISTER	3	500
MULTIPLICATIONS	7633	FUNCT. REG.	23	750

```
SYMBOLS         I=I, Z, K.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
                     N R
                     Z LAG=2.*R*(1.+.5*K*P0(L8,L8)+K**2*(P0(L8,L8)*P0(L9,L9)/8.
                      -1./16.*(P0(L8,L9)*P0(L8,L9)+P0(L8,L9)*P0(L9,L8)
                       +P0(L9,L8)*P0(L8,L9)+P0(L9,L8)*P0(L9,L8))))
          L 5        ID,K=0
                     NPRINT LAG
                     *NEXT

SYMBOLS         I=I, Z, K.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
```

RUNNING TIME (SEC)	46.85		USED	MAXIMUM
TERMS IN OUTPUT	132			
GENERATED TERMS	132	INPUT SPACE	308	2000
EQUAL TERMS	0	OUTPUT SPACE	916	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	8	ID. REGISTER	3	500
MULTIPLICATIONS	3682	FUNCT. REG.	22	750

```
SYMBOLS         I=I, Z, K.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.
```




```
FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR.
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
                     DELETE R,RR
                     *BEGIN

SYMBOLS         I=I, Z, K.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           D, RR, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	46.97			
TERMS IN OUTPUT	0			
GENERATED TERMS	0	INPUT SPACE	175	2000
EQUAL TERMS	0	OUTPUT SPACE	0	4740
CANCELLATIONS	0	NR. OF EXPR.	19	260
RECORDS WRITTEN	12	ID. REGISTER	1	500
MULTIPLICATIONS	0	FUNCT. REG.	0	750



```
BEGIN       47.32  SECONDS

            NAMES LAG
            COMMON V1,V2,INPP,LAG1
            S Z,KK,T1,T2,T3,T4,T5,T6,T7,T8,T9,T10,SA,SB,SC
            V Q1,Q2,P
            *FIX

SYMBOLS     I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
            SA, SB, SC.

INDICES     NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UB6, DD=U, D8,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, INPP, LAG1.
```

```
SYMBOLS        I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
               SA, SB, SC.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, INPP, LAG1.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	.45			
TERMS IN OUTPUT	2			
GENERATED TERMS	9	INPUT SPACE	235	2000
EQUAL TERMS	7	OUTPUT SPACE	13	4740
CANCELLATIONS	0	NR. OF EXPR.	24	260
RECORDS WRITTEN	19	ID. REGISTER	3	500
MULTIPLICATIONS	46	FUNCT. REG.	13	750

```
SYMBOLS        I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
               SA, SB, SC.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, INPP, LAG1.
```

```
N R
C WORKS OUT THE GRAVITON PROPAGATOR
Z LAG=LAG
```

```
          L 2       ID,K**(J+)=KK**(-J)
          L 3       ID,KK=0
                    NPRINT LAG
                    *NEXT

SYMBOLS             I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                    SA, SB, SC.

INDICES             MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                    L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                    CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                    B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS             Q1, Q2, P.

FUNCTIONS           D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
                    DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.               =0, =0, LAG, V1, V2, INPP, LAG1.
```

RUNNING TIME (SEC)	.95		USED	MAXIMUM
TERMS IN OUTPUT	123			
GENERATED TERMS	123	INPUT SPACE	238	2000
EQUAL TERMS	0	OUTPUT SPACE	862	4740
CANCELLATIONS	0	NR. OF EXPR.	25	260
RECORDS WRITTEN	26	ID. REGISTER	6	500
MULTIPLICATIONS	424	FUNCT. REG.	20	750

```
SYMBOLS             I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                    SA, SB, SC.

INDICES             MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                    L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                    CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                    B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS             Q1, Q2, P.

FUNCTIONS           D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
                    DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.               =0, =0, LAG, V1, V2, INPP, LAG1.
                         N R
                         C GAUGE BREAKING TERM
                         Z LAG=LAG-1./2.*(1./2.*(P1(MU,NU,MU)+P1(NU,MU,MU))
                                   *1./2.*(P1(RU,NU,P0)+P1(MU,P0,P0))
                                   -1./4.*(P1(MU,NU,MU)+P1(NU,MU,MU))*P1(P0,P0,MU)
                                   -1./4.*(P1(RU,NU,P0)+P1(MU,P0,P0))*P1(MU,MU,NU)
                                   +1./4.*P1(MU,MU,MU)*P1(P0,P0,MU))
                         NPRINT LAG
                         *NEXT

SYMBOLS             I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                    SA, SB, SC.

INDICES             MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                    L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                    CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                    B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS             Q1, Q2, P.

FUNCTIONS           D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
```

```
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.           =O, =O, LAG, V1, V2, INPP, LAG1.

RUNNING TIME (SEC)        1.52                              USED    MAXIMUM
TERMS IN OUTPUT            132
GENERATED TERMS            132        INPUT SPACE          278       2000
EQUAL TERMS                  0        OUTPUT SPACE         925       4740
CANCELLATIONS                0        NR. OF EXPR.          30        260
RECORDS WRITTEN             33        ID. REGISTER           1        500
MULTIPLICATIONS            403        FUNCT. REG.           19        750


SYMBOLS         I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                SA, SB, SC.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.           =O, =O, LAG, V1, V2, INPP, LAG1.
                     N R
                     Z V1=LAG
              L 2    ID,ADISU,PO(L1+,L2+)*P2(L3+,L4+,L5+,L6+)=
                      D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*Q2(L5)*Q2(L6)
              L 3    ID,ADISU,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)=
                      D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)
                     NPRINT V1
                     *NEXT

SYMBOLS         I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                SA, SB, SC.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.           =O, =O, LAG, V1, V2, INPP, LAG1.

RUNNING TIME (SEC)        2.24                              USED    MAXIMUM
TERMS IN OUTPUT             22
GENERATED TERMS            132        INPUT SPACE          280       2000
EQUAL TERMS                102        OUTPUT SPACE         172       4740
CANCELLATIONS                8        NR. OF EXPR.          26        260
RECORDS WRITTEN             40        ID. REGISTER          23        500
MULTIPLICATIONS            661        FUNCT. REG.           19        750


SYMBOLS         I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                SA, SB, SC.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
```

```
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, INPP, LAG1.
                     N R
                     Z V2=LAG
          L 2        ID,ADISO,P0(L1+,L2+)*P2(L3+,L4+,L5+,L6+)=
                      D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*Q1(L5)*Q1(L6)
          L 3        ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)=
                      D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)
                     NPRINT V2
                     *NEXT

SYMBOLS         I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                SA, SB, SC.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, INPP, LAG1.

RUNNING TIME (SEC)      2.88                          USED    MAXIMUM
TERMS IN OUTPUT           22
GENERATED TERMS          132        INPUT SPACE       289       2000
EQUAL TERMS              102        OUTPUT SPACE      172       4740
CANCELLATIONS              8        NR. OF EXPR.       27        250
RECORDS WRITTEN           42        ID. REGISTER       23        500
MULTIPLICATIONS          661        FUNCT. REG.        19        750


SYMBOLS         I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                SA, SB, SC.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, INPP, LAG1.
                     N R
                     Z INPP=V1+V2
                     DELETE,LAG,LAG1,V1,V2
                     *NEXT

SYMBOLS         I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                SA, SB, SC.
```

```
INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UAG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, INPP, LAG1.

RUNNING TIME (SEC)      3.09                          USED    MAXIMUM
TERMS IN OUTPUT           33
GENERATED TERMS           44        INPUT SPACE        214       2000
EQUAL TERMS               11        OUTPUT SPACE       181       4740
CANCELLATIONS              0        NR. OF EXPR.        26        260
RECORDS WRITTEN           44        I9. REGISTER         1        500
MULTIPLICATIONS          134        FUNCT. REG.         15        750


SYMBOLS        I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
               SA, SB, SC.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UAG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, INPP, LAG1.

 INPP =

   + Q1(A1)*Q1(A2)*D(B1,B2)

   + 3./4.*Q1(A1)*Q2(A2)*D(B1,B2)

   + Q1(A1)*D(A2,B1)*Q1(B2)

   + 3./4.*Q1(A1)*D(A2,B1)*Q2(B2)

   - Q1(A1)*D(A2,B2)*Q1(B1)

   - 3./4.*Q1(A1)*D(A2,B2)*Q2(B1)

   + 1./2.*Q2(A1)*Q1(A2)*D(B1,B2)
```

```
     + Q2(A1)*Q2(A2)*D(B1,B2)

     + 1./2.*Q2(A1)*D(A2,B1)*Q1(B2)

     + Q2(A1)*D(A2,B1)*Q2(B2)

     - 3./4.*Q2(A1)*D(A2,B2)*Q1(B1)

     - 2.*Q2(A1)*D(A2,B2)*Q2(B1)

     + D(A1,A2)*Q1(B1)*Q1(B2)

     + 3./4.*D(A1,A2)*Q1(B1)*Q2(B2)

     + 1./2.*D(A1,A2)*Q2(B1)*Q1(B2)

     + D(A1,A2)*Q2(B1)*Q2(B2)

     + D(A1,A2)*D(B1,B2)
     * ( - Q1DQ1 - 3./2.*Q1DQ2 - Q2DQ2 )

     - 2.*D(A1,B1)*Q1(A2)*Q1(B2)

     - 3./4.*D(A1,B1)*Q1(A2)*Q2(B2)

     - 3./4.*D(A1,B1)*Q2(A2)*Q1(B2)

     - D(A1,B1)*Q2(A2)*Q2(B2)

     + D(A1,B1)*D(A2,B2)
     * ( Q1DQ1 + 3./4.*Q1DQ2 + Q2DQ2 )
```

```
    + D(A1,B2)*Q1(A2)*Q1(B1)

    + 1./2.*D(A1,B2)*Q1(A2)*Q2(B1)

    + 3./4.*D(A1,B2)*Q2(A2)*Q1(B1)

    + D(A1,B2)*Q2(A2)*Q2(B1)

    + D(A1,B2)*D(A2,B1)

    * ( - Q1DQ1 - 3./2.*Q1DQ2 - Q2DQ2 )  +0.

                  H R
                  Z INPP=INPP
          L 2     ID,Q1(MU+)=P(MU)
          L 3     ID,2,OUTPR,Q1(MU+)=P(MU)
          L 5     ID,Q2(MU+)=-P(MU)
          L 6     ID,2,OUTPR,Q2(MU+)=-P(MU)
                  *NEXT

SYMBOLS       I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
              SA, SB, SC.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS       Q1, Q2, P.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D3,
              DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.         =0, =0, =0, =0, =0, INPP, =0.

RUNNING TIME (SEC)      3.54                          USED    MAXIMUM
TERMS IN OUTPUT            9
GENERATED TERMS           33      INPUT SPACE          251       2000
EQUAL TERMS               24      OUTPUT SPACE          55       4740
CANCELLATIONS              0      NR. OF EXPR.          26        260
RECORDS WRITTEN           47      ID. REGISTER          13        500
MULTIPLICATIONS          232      FUNCT. REG.           15        750

SYMBOLS       I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
              SA, SB, SC.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z.
```

```
VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GD1, GU, P0, P1, P2.

EXPR.           =0, =0, =0, =0, =0, INPP, =0.

 INPP =

   + 3./4.*P(A1)*P(A2)*D(B1,B2)

   + 3./4.*P(A1)*D(A2,B1)*P(B2)

   - 3./2.*P(A1)*D(A2,B2)*P(B1)

   + 3./4.*D(A1,A2)*P(B1)*P(B2)

   + D(A1,A2)*D(B1,B2)
   * ( - 1./2.*PDP )

   - 3./2.*D(A1,B1)*P(A2)*P(B2)

   + D(A1,B1)*D(A2,B2)
   * ( 5./4.*PDP )

   + 3./4.*D(A1,B2)*P(A2)*P(B1)

   + D(A1,B2)*D(A2,B1)
   * ( - 1./2.*PDP )  +0.


SYMBOLS         I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
                SA, SB, SC.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PD=Z, SI=Z, AA=Z, BP=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.
```

```
BEGIN                SECONDS

                     NAMES INPP,
                     X PP(A1,B1,AA1,BB1)=
                         + P(AA1)*P(A1)*P(B1)*P(BB1)*T1
                         + P(AA1)*P(A1)*D(B1,BB1)*T5
                         + P(AA1)*D(A1,B1)*P(BB1)*T4
                         + P(AA1)*D(A1,BB1)*P(B1)*T6
                         + D(AA1,A1)*P(B1)*P(BB1)*T7
                         + D(AA1,A1)*D(B1,BB1)*T3
                         + D(AA1,B1)*P(A1)*P(BB1)*T8
                         + D(AA1,B1)*D(A1,BB1)*T9
                         + D(AA1,BB1)*P(A1)*P(B1)*T10
                         + D(AA1,BB1)*D(A1,B1)*T2
                     X UN(A,B,BB,SI)= INPP

                     *FIX

SYMBOLS              I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
                     T8, T9, T10, SA, SB, SC.

INDICES              MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                     L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, DD=Z, SI=Z, AA=Z, BB=Z,
                     CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                     B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS              Q1, Q2, P.

FUNCTIONS            D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBC, DD=U, DB,
                     DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, D0, D1, B2.

EXPR.                =0, =0, =0, =0, =0, =0, =0, INPP, INPF, =0, =0, PP=1, UN=1.
```




```
EXPR.          =0, =0, =0, =0, =0, INPP, =0, PP=1, UN=1.
```

```
                    N R
                    Z UNIT=INPP*PP(A2,B2,AA1,BB1)
                    DELETE INPP
                    *BEGIN

SYMBOLS        I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
               SA, SB, SC.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PU=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, =0, =0, =0, INPP, =0, PP=1, UN=1.

RUNNING TIME (SEC)      1.97                          USED    MAXIMUM
TERMS IN OUTPUT           42
GENERATED TERMS           90        INPUT SPACE        297       2000
EQUAL TERMS               42        OUTPUT SPACE       177       4740
CANCELLATIONS              6        NR. OF EXPR.        24        260
RECORDS WRITTEN           50        ID. REGISTER         1        500
MULTIPLICATIONS          451        FUNCT. REG.         22        750

SYMBOLS        I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
```

```
                SA, SB, SC.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PD=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, =0, =0, =0, INPP, =0, PP=1, UN=1.

 UNIT =

(5)  + P(AA1)*P(A1)*P(B1)*P(BB1)
     * ( - 3./2.*Z*T4 + 1./2.*T1*PDP + 3.*T4 )

(2)  + P(AA1)*P(A1)*D(B1,BB1)
     * ( 3./4.*T3 + 1./4.*T5*PDP + 1./4.*T6*PDP + 3./4.*T9 )

(6)  + P(AA1)*D(A1,B1)*P(BB1)
     * ( 5./4.*Z*T4*PDP - 1./4.*T1*PDP**2 - 3./2.*T3 - 5./2.*T4*PDP - 1./4.*T5*PDP - 1./4.*T6*PDP - 1./4.*T7*PDP
       - 1./4.*T8*PDP - 3./2.*T9 )

(2)  + P(AA1)*D(A1,BB1)*P(B1)
     * ( 3./4.*T3 + 1./4.*T5*PDP + 1./4.*T6*PDP + 3./4.*T9 )

(2)  + D(AA1,A1)*P(B1)*P(BB1)
     * ( 3./4.*T3 + 1./4.*T7*PDP + 1./4.*T8*PDP + 3./4.*T9 )

(1)  + D(AA1,A1)*D(B1,BB1)
     * ( - 1./2.*T3*PDP - 1./2.*T9*PDP )

     + D(AA1,B1)*P(A1)*P(BB1)
(2)  * ( 3./4.*T3 + 1./4.*T7*PDP + 1./4.*T8*PDP + 3./4.*T9 )

(1)  + D(AA1,B1)*D(A1,BB1)
     * ( - 1./2.*T3*PDP - 1./2.*T9*PDP )
```

UNIVERSITÀ DI TRIESTE
CENTRO DI CALCOLO DELL' UNI

```
     + D(AA1,BB1)*P(A1)*P(B1)
(3)  * ( - 3./2.*Z*T2 + 3.*T2 - 3./2.*T3 - 3./2.*T9 + 1./2.*T10*PDP )

     + D(AA1,BB1)*D(A1,B1)
(4)  * ( 5./4.*Z*T2*PDP - 5./2.*T2*PDP + 5./4.*T3*PDP + 5./4.*T9*PDP - 1./4.*T10*PDP**2 )  +0.
```

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CENTRO DI CALCOLO DELL' UNI

```
BEGIN       53.59  SECONDS

                   WRITE COMMON
                   *END

SYMBOLS        I=I, Z, K, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10,
               SA, SB, SC.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, =0, =0, =0, =0, =0, PP=1, UM=1.

RUNNING TIME (SEC)        .10                          USED    MAXIMUM
TERMS IN OUTPUT             0
GENERATED TERMS             0        INPUT SPACE        252       2000
EQUAL TERMS                 0        OUTPUT SPACE         0       4740
CANCELLATIONS               0        NP. OF EXPR.        19        200
RECORDS WRITTEN            54        ID. REGISTER         1        500
MULTIPLICATIONS             0        FUNCT. REG.          0        750


END OF RUN.    TIME       53.70  SECONDS
```

APPENDIX III

THE 3-GRAVITON VERTEX FUNCTION

Goldberg's Parametrization

```
SCHOONSCHIP , VERSION OF  APRIL  1, 1977

   TIME          .34  SECONDS


                    C WORKS OUT PH1**3 PART OF R AND G**.5*R
                    COMMON LAG
                    S ALFA,D1,D2,D1Q,D1PQ,D2Q,D2PQ,W,W1,Z,K,N2,
                      I1T11,I1T12, I1T22,
                      I2T11,I2T12,I2T21,I2T22,
                      I3T11,I3T12,I3T22,
                      I4T11,I4T12,I4T21,I4T22,
                      I5T11,I5T12,I5T21,I5T22,
                      I6T11,I6T12,I6T21,I6T22,
                      I7T11,I7T12,I7T21,I7T22,
                      I8T11,I8T12,I8T21,I8T22,
                      I9T11,I9T12,I9T22,
                      I1011,I1012,I1021,I1022,
                      I1111,I1112,I1121,I1122,
                      I1211,I1212,I1221,I1222,
                      I1311,I1312,I1321,I1322,
                      I1411,I1412,I1421,I1422,
                      I1511,I1512,I1521,I1522
                    I MU=Z,NU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=Z,L6=Z,
                     L7=Z,L8=Z,L9=Z,R8=Z,SI=Z,AA=Z,B3=Z,CC=Z,AA1=Z,AA2=Z,AA3=Z,
                     A1=Z,A2=Z,A3=Z,B1=Z,B2=Z,B3=Z,J,BB1=Z,BB2=Z,BB3=Z,LA=Z,
                     S1=Z,S2=Z,S3=Z,S4=Z
                    F GU,P0,P1
                    *FIX

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R8=Z, SI=Z, AA=Z, B3=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.           LAG.
```

```
BEGIN          .63  SECONDS

                    N R
                    Z LAG=1./2.*K**-3*((D(RO,SI)+1./2.*K*(PO(RO,SI)+PO(SI,RO)))*
                          1./4.*(GU(LA,MU)+GU(MU,LA))*(GU(KA,NU)+GU(NU,KA))
                         -N2*(D(RO,SI)+1./2.*K*(PO(RO,SI)+PO(SI,RO)))*
                          1./4.*(GU(MU,KA)+GU(KA,MU))*(GU(LA,NU)+GU(NU,LA))
                         -2*D(SI,KA)*D(RO,LA)*1./2.*(GU(MU,NU)+GU(NU,MU)))*
                          1./4.*K**2*(P1(MU,KA,RO)+P1(KA,MU,RO))
                                    *(P1(LA,NU,SI)+P1(NU,LA,SI))
          L 4       ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                     +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                                 +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                     -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                                 +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                                 +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                                 +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                                 +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                                 +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                                 +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                                 +PO(L3,A)*PO(L4,L3)*PO(B,L4)))
                                *(D(AA,BB)-1./2.*K*(PO(AA,BB)+PO(BB,AA))
                     +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                                 +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                     -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                                 +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                                 +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                                 +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                                 +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                                 +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                                 +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                                 +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
          L 7       ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                     +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                                 +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                     -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                                 +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                                 +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                                 +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                                 +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                                 +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                                 +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                                 +PO(L3,A)*PO(L4,L3)*PO(B,L4))
          L 9       ID,K=0
                    NPRINT LAG
                    *BEGIN

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,

                DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.
```

DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. LAG.

			USED	MAXIMUM
RUNNING TIME (SEC)	69.49			
TERMS IN OUTPUT	68			
GENERATED TERMS	248	INPUT SPACE	667	2000
EQUAL TERMS	180	OUTPUT SPACE	533	4740
CANCELLATIONS	0	NR. OF EXPR.	50	260
RECORDS WRITTEN	0	ID. REGISTER	14	500
MULTIPLICATIONS	132601	FUNCT. REG.	39	750

BEGIN 70.19 SECONDS

```
NAMES LAG
COMMON V1,V2,V3,V4,V5,V6,VERT3
S Z,KK
V Q1,Q2,Q3
*FIX
```

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.

EXPR. LAG, V1, V2, V3, V4, V5, V6, VERT3.

BEGIN 70.31 SECONDS

```
BEGIN       70.31  SECONDS

                N R
                C WORKS OUT THE 3-GRAVITON VERTEX
                Z LAG=LAG
          L 2   ID,K**(J+)=KK**(-J)
          L 3   ID,KK=0
                NPRINT LAG
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2P0, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, B01=Z, B02=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)        .30                          USED    MAXIMUM
TERMS IN OUTPUT            56
GENERATED TERMS            56        INPUT SPACE       247       2000
EQUAL TERMS                 0        OUTPUT SPACE      449       4740
CANCELLATIONS               0        NR. OF EXPR.       24        260
RECORDS WRITTEN             3        ID. REGISTER        6        500
MULTIPLICATIONS           377        FUNCT. REG.        14        750

                N R
                Z V1=LAG
          L 2   ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)*
                 D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*D(L5,A3)*D(L6,B3)*
                 Q3(L7)*Q3(L8)
          L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*
                 D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                 D(L7,A3)*D(L8,B3)
                NPRINT V1
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2P0, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
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                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	.34			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	22	260
RECORDS WRITTEN	7	ID. REGISTER	31	500
MULTIPLICATIONS	281	FUNCT. REG.	25	750

```
SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.
                     N R
                     Z V2=LAG
                L 2  ID,ADISD,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)*
                      D(L1,A1)*D(L2,B1)*D(L3,A3)*D(L4,B3)*D(L5,A2)*D(L6,B2)*
                      Q2(L7)*Q2(L8)
                L 3  ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*
                      D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                      D(L7,A2)*D(L8,B2)
                     NPRINT V2
                     *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,

                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.
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                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	1.38			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	23	260
RECORDS WRITTEN	9	ID. REGISTER	31	560
MULTIPLICATIONS	281	FUNCT. REG.	25	750

```
SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.
                     N R
                     Z V3=LAG
                L 2  ID,ADISD,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                      D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*D(L5,A3)*D(L6,B3)*
                      Q3(L7)*Q3(L8)
                L 3  ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                      D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                      D(L7,A3)*D(L8,B3)
                     NPRINT V3
                     *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
                I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
                I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
                I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
                I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
                I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
                I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
                I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
                I1522, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.
```

```
VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	1.93			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	24	260
RECORDS WRITTEN	11	ID. REGISTER	31	500
MULTIPLICATIONS	281	FUNCT. REG.	25	750

```
SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
               I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
               I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
               I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
               I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
               I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
               I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
               I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
               I1522, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=7, SI=7, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z V4=LAG
               L 2  ID,ADISD,PO(L1+,L2+)*PO(L3+,L4+)*P2(L5+,L6+,L7+,L8+)*
                     D(L1,A2)*D(L2,B2)*D(L3,A3)*D(L4,B3)*D(L5,A1)*D(L6,B1)*
                     Q1(L7)*Q1(L8)
               L 3  ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*PO(L7+,L8+)*
                     D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                     D(L7,A1)*D(L8,B1)
                    MPRINT V4
                    *NEXT

SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
               I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
               I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
               I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
               I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
               I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
               I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
               I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
               I1522, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=7, SI=7, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.
```

```
VECTORS      Q1, Q2, Q3.

FUNCTIONS    D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
             DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.        LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	2.48			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	193	4740
CANCELLATIONS	0	NR. OF EXPR.	25	260
RECORDS WRITTEN	13	ID. REGISTER	31	500
MULTIPLICATIONS	281	FUNCT. REG.	25	750

```
SYMBOLS      I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
             I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
             I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
             I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
             I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
             I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
             I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
             I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
             I1522, KK.

INDICES      MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
             CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
             B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS      Q1, Q2, Q3.

FUNCTIONS    D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
             DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.        LAG, V1, V2, V3, V4, V5, V6, VERT3.
                  N R
                  Z V5=LAG
             L 2  ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                   D(L1,A3)*D(L2,B3)*D(L3,A1)*D(L4,B1)*D(L5,A2)*D(L6,B2)
                   Q2(L7)*Q2(L8)
             L 3  ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                   D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                   D(L7,A2)*D(L8,B2)
                  NPRINT V5
                  *NEXT

SYMBOLS      I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
             I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
             I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
             I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
             I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
             I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
             I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
             I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
             I1522, KK.

INDICES      MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=
             CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
             B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=

VECTORS      Q1, Q2, Q3.
```

```
FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.         LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	3.02			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	15	ID. REGISTER	31	500
MULTIPLICATIONS	281	FUNCT. REG.	25	750

```
SYMBOLS       I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
              I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
              I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
              I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
              I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
              I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
              I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
              I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
              I1522, KK.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RD=Z, SI=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, Q3.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.         LAG, V1, V2, V3, V4, V5, V6, VERT3.
                   N R
                   Z V6=LAG
          L 2      ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)*
                    D(L1,A3)*D(L2,B3)*D(L3,A2)*D(L4,B2)*D(L5,A1)*D(L6,B1)*
                    Q1(L7)*Q1(L8)
          L 3      ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*
                    D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                    D(L7,A1)*D(L8,B1)
                   NPRINT V6
                   *NEXT

SYMBOLS       I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
              I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
              I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
              I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
              I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
              I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
              I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
              I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
              I1522, KK.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RD=Z, SI=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, Q3.


FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.
```

```
FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)      3.57                          USED    MAXIMUM
TERMS IN OUTPUT           26
GENERATED TERMS           56      INPUT SPACE          302       2000
EQUAL TERMS               30      OUTPUT SPACE         183       4740
CANCELLATIONS              0      NR. OF EXPR.          27        260
RECORDS WRITTEN           17      ID. REGISTER          31        500
MULTIPLICATIONS          281      FUNCT. REG.           25        750

SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
               I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
               I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
               I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
               I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
               I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
               I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
               I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
               I1522, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z VERT3=V1+V2+V3+V4+V5+V6
                    DELETE LAG,V1,V2,V3,V4,V5,V6
                    *BEGIN

SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2,
               I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11,
               I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12,
               I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12,
               I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12,
               I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121,
               I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321,
               I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521,
               I1522, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)      4.11                          USED    MAXIMUM
TERMS IN OUTPUT           78
```

GENERATED TERMS	156	INPUT SPACE	234	2000
EQUAL TERMS	78	OUTPUT SPACE	459	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	19	ID. REGISTER	1	500
MULTIPLICATIONS	474	FUNCT. REG.	18	750

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, N2, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR. LAG, V1, V2, V3, V4, V5, V6, VERT3.

```
VERT3 =
  + 1./4.*Q2(A1)*Q1(A2)*D(A3,B1)*D(B2,B3)

  + 1./4.*Q2(A1)*Q1(A2)*D(A3,B2)*D(B1,B3)

  + 1./4.*Q2(A1)*D(A2,A3)*Q3(B1)*D(B2,B3)

  + 1./4.*Q2(A1)*D(A2,A3)*D(B1,B3)*Q1(B2)

  + Q2(A1)*D(A2,B2)*D(A3,B3)*Q3(B1)
  * ( - 1./2.*N2 )

  + 1./4.*Q2(A1)*D(A2,B3)*D(A3,B1)*Q1(B2)

  + 1./4.*Q2(A1)*D(A2,B3)*D(A3,B2)*Q3(B1)

  + 1./4.*Q3(A1)*D(A2,A3)*Q2(B1)*D(B2,B3)

  + 1./4.*Q3(A1)*D(A2,A3)*D(B1,B2)*Q1(B3)
```

```
     + 1./4.*Q3(A1)*D(A2,A3)*D(B1,B2)*Q1(B3)

     + 1./4.*Q3(A1)*D(A2,B1)*Q1(A3)*D(B2,B3)

     + 1./4.*Q3(A1)*D(A2,B1)*D(A3,B2)*Q1(B3)

     + Q3(A1)*D(A2,B2)*D(A3,B3)*Q2(B1)
     * ( - 1./2.*N2 )

     + 1./4.*Q3(A1)*D(A2,B3)*Q1(A3)*D(B1,B2)

     + 1./4.*Q3(A1)*D(A2,B3)*D(A3,B2)*Q2(B1)

     + 1./4.*D(A1,A2)*Q1(A3)*Q3(B1)*D(B2,B3)

     + 1./4.*D(A1,A2)*Q1(A3)*D(B1,B2)*Q2(B3)

     + 1./4.*D(A1,A2)*Q2(A3)*D(B1,B2)*Q1(B3)

     + 1./4.*D(A1,A2)*Q2(A3)*D(B1,B3)*Q3(B2)

     + 1./4.*D(A1,A2)*D(A3,B1)*Q3(B2)*Q2(B3)

     + D(A1,A2)*D(A3,B1)*D(B2,B3)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + 1./4.*D(A1,A2)*D(A3,B2)*Q3(B1)*Q1(B3)

     + D(A1,A2)*D(A3,B2)*D(B1,B3)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + D(A1,A2)*D(A3,B3)*D(B1,B2)
```

```
     * ( 1./2.*N2*Q1DQ3 + 1./2.*N2*Q2DQ3 )

     + 1./4.*D(A1,A3)*Q1(A2)*Q2(B1)*D(B2,B3)

     + 1./4.*D(A1,A3)*Q1(A2)*D(B1,B3)*Q3(B2)

     + 1./4.*D(A1,A3)*Q3(A2)*D(B1,B2)*Q2(B3)

     + 1./4.*D(A1,A3)*Q3(A2)*D(B1,B3)*Q1(B2)

     + 1./4.*D(A1,A3)*D(A2,B1)*Q3(B2)*Q2(B3)

     + D(A1,A3)*D(A2,B1)*D(B2,B3)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + D(A1,A3)*D(A2,B2)*D(B1,B3)
     * ( 1./2.*N2*Q1DQ2 + 1./2.*N2*Q2DQ3 )

     + 1./4.*D(A1,A3)*D(A2,B3)*Q2(B1)*Q1(B2)

     + D(A1,A3)*D(A2,B3)*D(B1,B2)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + D(A1,B1)*Q1(A2)*D(A3,B3)*Q3(B2)
     * ( - 1./2.*N2 )

     + D(A1,B1)*Q3(A2)*D(A3,B3)*Q1(B2)
     * ( - 1./2.*N2 )

     + D(A1,B1)*D(A2,A3)*D(B2,B3)
     * ( 1./2.*N2*Q1DQ2 + 1./2.*N2*Q1DQ3 )
```

```
     + D(A1,B1)*D(A2,B2)*Q1(A3)*Q2(B3)
     * ( - 1./2.*N2 )

     + D(A1,B1)*D(A2,B2)*Q2(A3)*Q1(B3)
     * ( - 1./2.*N2 )

     + D(A1,B1)*D(A2,B3)*D(A3,B2)
     * ( 1./2.*N2*Q1DQ2 + 1./2.*N2*Q1DQ3 )

     + 1./4.*D(A1,B2)*Q3(A2)*Q2(A3)*D(B1,B3)

     + 1./4.*D(A1,B2)*Q3(A2)*D(A3,B1)*Q2(B3)

     + 1./4.*D(A1,B2)*D(A2,A3)*Q3(B1)*Q1(B3)

     + D(A1,B2)*D(A2,A3)*D(B1,B3)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + 1./4.*D(A1,B2)*D(A2,B1)*Q1(A3)*Q2(B3)

     + 1./4.*D(A1,B2)*D(A2,B1)*Q2(A3)*Q1(B3)

     + D(A1,B2)*D(A2,B1)*D(A3,B3)
     * ( 1./2.*N2*Q1DQ3 + 1./2.*N2*Q2DQ3 )

     + 1./4.*D(A1,B2)*D(A2,B3)*Q1(A3)*Q3(B1)

     + D(A1,B2)*D(A2,B3)*D(A3,B1)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + 1./4.*D(A1,B3)*Q1(A2)*D(A3,B1)*Q3(B2)
```

```
     + 1./4.*D(A1,B3)*Q1(A2)*D(A3,B2)*Q2(B1)

     + 1./4.*D(A1,B3)*Q3(A2)*Q2(A3)*D(B1,B2)

     + 1./4.*D(A1,B3)*Q3(A2)*D(A3,B1)*Q1(B2)

     + 1./4.*D(A1,B3)*D(A2,A3)*Q2(B1)*Q1(B2)

     + D(A1,B3)*D(A2,A3)*D(B1,B2)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + 1./4.*D(A1,B3)*D(A2,B1)*Q2(A3)*Q3(B2)

     + D(A1,B3)*D(A2,B1)*D(A3,B2)
     * ( - 1./4.*Q1DQ2 - 1./4.*Q1DQ3 - 1./4.*Q2DQ3 )

     + D(A1,B3)*D(A2,B2)*D(A3,B1)
     * ( 1./2.*N2*Q1DQ2 + 1./2.*N2*Q2DQ3 )  +0.
```

APPENDIX IV

THE 3-GRAVITON VERTEX FUNCTION

Einstein's Parametrization

SCHOONSCHIP , VERSION OF APRIL 1, 1977

TIME .36 SECONDS

```
      C  WORKS OUT PH2**3 PART OF F AND G**.5*F
      COMMON R,RR,LAG
      S D1,D2,D1Q,D1PQ,D2Q,D2PQ,U,Z,K,
        I1T11,I1T12,I1T22,
        I2T11,I2T12,I2T21,I2T22,
        I3T11,I3T12,I3T22,
        I4T11,I4T12,I4T21,I4T22,
        I5T11,I5T12,I5T21,I5T22,
        I6T11,I6T12,I6T21,I6T22,
        I7T11,I7T12,I7T21,I7T22,
        I8T11,I8T12,I8T21,I8T22,
        I9T11,I9T12,I9T22,
        I1011,I1012,I1021,I1022,
        I1111,I1112,I1121,I1122,
        I1211,I1212,I1221,I1222,
        I1311,I1312,I1321,I1322,
        I1411,I1412,I1421,I1422,
        I1511,I1512,I1521,I1522
      I NU=Z,NU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=Z,L6=Z,
       L7=Z,L8=Z,L9=Z,RU=Z,SI=Z,AA=Z,BB=Z,CC=Z,AA1=Z,AA2=Z,AA3=Z,
       A1=Z,A2=Z,A3=Z,B1=Z,B2=Z,B3=Z,J,BB1=Z,BB2=Z,BB3=Z,C1=Z,
       C2=Z,C3=Z,E1=Z,E2=Z,E3=Z,S1=Z,S2=Z,S3=Z,S4=Z
      F GN1,GN,GU1,GU,UG,UG1,UG2,P0,P1,P2
      *FIX
```

SYMBOLS I=I, D1, D2, D1Q, D1PQ, D2Q, D2PQ, U, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RU=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, UG1, UG2, P0, P1, P2.

EXPR. R, RR, LAG.

BEGIN .66 SECONDS

```
                  I R
                  Z RR(MU,NU)=(GM1(RO,MU,RO,NU)-GM1(RO,MU,NU,RO)+GM(RO,SI,NU)
                   *GM(SI,MU,RO)-GM(SI,MU,NU)*GM(RO,SI,RO))*K**-3
L 2               ID,GM1(A+,B+,L+,KA+)=1./4.*K*GU1(A,C,KA)*(P1(B,C,L)+P1(C,B,L)
                                                           +P1(C,L,B)+P1(L,C,B)
                                                           -P1(B,L,C)-P1(L,B,C))
                   +1./4.*K*GU(A,C)*(P2(B,C,L,KA)+P2(C,B,L,KA)
                                    +P2(C,L,B,KA)+P2(L,C,B,KA)
                                    -P2(B,L,C,KA)-P2(L,B,C,KA))
L 4               ID,GM(A+,B+,C+)*GM(AA+,BB+,CC+)=1./16.*K**2
                   *GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                             +P1(L1,C,B)+P1(C,L1,B)
                             -P1(B,C,L1)-P1(C,B,L1))
                   *GU(AA,L2)*(P1(BB,L2,CC)+P1(L2,BB,CC)
                              +P1(L2,CC,BB)+P1(CC,L2,BB)
                              -P1(BB,CC,L2)-P1(CC,BB,L2))
L 6               ID,GM(A+,B+,C+)=1./4.*K*GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                                                   +P1(L1,C,B)+P1(C,L1,B)
                                                   -P1(B,C,L1)-P1(C,B,L1))
L 8               ID,GU1(A+,B+,C+)=-1./2.*K*(P1(A,B,C)+P1(B,A,C))
                   +1./4.*K**2*(P1(A,L3,C)*P0(L3,B)+P1(A,L3,C)*P0(B,L3)
                               +P1(L3,A,C)*P0(L3,B)+P1(L3,A,C)*P0(B,L3)
                               +P0(A,L3)*P1(L3,B,C)+P0(A,L3)*P1(B,L3,C)
                               +P0(L3,A)*P1(L3,B,C)+P0(L3,A)*P1(B,L3,C))
                   -1./8.*K**3*(P1(A,L3,C)*P0(L3,L4)*P0(L4,B)
                               +P1(A,L3,C)*P0(L3,L4)*P0(B,L4)
                               +P1(A,L3,C)*P0(L4,L3)*P0(L4,B)
                               +P1(A,L3,C)*P0(L4,L3)*P0(B,L4)
                               +P1(L3,A,C)*P0(L3,L4)*P0(L4,B)
                               +P1(L3,A,C)*P0(L3,L4)*P0(B,L4)
                               +P1(L3,A,C)*P0(L4,L3)*P0(L4,B)
                               +P1(L3,A,C)*P0(L4,L3)*P0(B,L4)
                               +P0(A,L3)*P1(L3,L4,C)*P0(L4,B)
                               +P0(A,L3)*P1(L3,L4,C)*P0(B,L4)
                               +P0(A,L3)*P1(L4,L3,C)*P0(L4,B)
                               +P0(A,L3)*P1(L4,L3,C)*P0(B,L4)
                               +P0(L3,A)*P1(L3,L4,C)*P0(L4,B)
                               +P0(L3,A)*P1(L3,L4,C)*P0(B,L4)
                               +P0(L3,A)*P1(L4,L3,C)*P0(L4,B)
                               +P0(L3,A)*P1(L4,L3,C)*P0(B,L4)
                               +P0(A,L3)*P0(L3,L4)*P1(L4,B,C)
                               +P0(A,L3)*P0(L3,L4)*P1(B,L4,C)
                               +P0(A,L3)*P0(L4,L3)*P1(L4,B,C)
                               +P0(A,L3)*P0(L4,L3)*P1(B,L4,C)
                               +P0(L3,A)*P0(L3,L4)*P1(L4,B,C)
                               +P0(L3,A)*P0(L3,L4)*P1(B,L4,C)
                               +P0(L3,A)*P0(L4,L3)*P1(L4,B,C)
                               +P0(L3,A)*P0(L4,L3)*P1(B,L4,C))
L10               ID,K=0
L11               ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(P0(A,B)+P0(B,A))
                   +1./4.*K**2*(P0(A,L3)*P0(L3,B)+P0(A,L3)*P0(B,L3)
                               +P0(L3,A)*P0(L3,B)+P0(L3,A)*P0(B,L3))
                   -1./8.*K**3*(P0(A,L3)*P0(L3,L4)*P0(L4,B)
                               +P0(A,L3)*P0(L3,L4)*P0(B,L4)
                               +P0(A,L3)*P0(L4,L3)*P0(L4,B)
                               +P0(A,L3)*P0(L4,L3)*P0(B,L4)
                               +P0(L3,A)*P0(L3,L4)*P0(L4,B)
                               +P0(L3,A)*P0(L3,L4)*P0(B,L4)
                               +P0(L3,A)*P0(L4,L3)*P0(L4,B)
                               +P0(L3,A)*P0(L4,L3)*P0(B,L4)))
```

```
                +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                            +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                            +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                            +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                            +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                            +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                            +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                            +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                            +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
L14             ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                            +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                            +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                            +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                            +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                            +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                            +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                            +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                            +PO(L3,A)*PO(L4,L3)*PO(B,L4))
L16             ID,K=0
                NPRINT RR
                *NEXT

SYMBOLS         I=I, D1, D2, D10, D1PO, D20, D2PO, W, Z, K, I1T11, I1T12,
                I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22,
                I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22,
                I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22,
                I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011,
                I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211,
                I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411,
                I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, MU=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, E1=Z, E2=Z,
                E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, UG1, UG2,
                PO, P1, P2.

EXPR.           R, RR, LAG.
```

				USED	MAXIMUM
RUNNING TIME (SEC)	49.07				
TERMS IN OUTPUT	564				
GENERATED TERMS	564	INPUT SPACE		963	2000
EQUAL TERMS	0	OUTPUT SPACE		4369	4749
CANCELLATIONS	0	NR. OF EXPR.		51	250
RECORDS WRITTEN	0	ID. REGISTER		33	500
MULTIPLICATIONS	100929	FUNCT. REG.		35	750

```
N R
Z R=RR(MU,NU)*(D(MU,NU)-1./2.*K*(PO(MU,NU)+PO(NU,MU))
 +1./4.*K**2*(PO(MU,L7)*PO(L7,NU)+PO(MU,L7)*PO(NU,L7)
             +PO(L7,MU)*PO(L7,NU)+PO(L7,MU)*PO(NU,L7))
 -1./8.*K**3*(PO(MU,L7)*PO(L7,L8)*PO(L8,NU)
             +PO(MU,L7)*PO(L7,L8)*PO(NU,L8)
             +PO(MU,L7)*PO(L8,L7)*PO(L8,NU)
             +PO(MU,L7)*PO(L8,L7)*PO(NU,L8)
             +PO(L7,MU)*PO(L7,L8)*PO(L8,NU)
             +PO(L7,MU)*PO(L7,L8)*PO(NU,L8)
```

```
                                        *PO(L7,MU)*PO(L8,L7)*PO(L8,MU)
                                        +PO(L7,MU)*PO(L8,L7)*PO(MU,L8)))
          L 4           ID,K=0
                        UPRINT D
                        *NEXT

SYMBOLS                 I=I, D1, D2, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11, I1T12,
                        I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22,
                        I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22,
                        I6T11, I6T12, I6T22, I6T22, I7T11, I7T12, I7T21, I7T22,
                        I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011,
                        I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211,
                        I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411,
                        I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES                 MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                        L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RD=Z, S1=Z, AA=Z, BB=Z,
                        CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                        B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, E1=Z, E2=Z,
                        E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS               D, DPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                        DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, UG1, UG2,
                        P0, P1, P2.

EXPR.                   R, ER, LAG.

RUNNING TIME (SEC)        75.09                          USED    MAXIMUM
TERMS IN OUTPUT             743
GENERATED TERMS             870        INPUT SPACE       346       2000
EQUAL TERMS                 133        OUTPUT SPACE     4740       4740
CANCELLATIONS                 0        NR. OF EXPR.       27        260
RECORDS WRITTEN              14        ID. REGISTER        3        500
MULTIPLICATIONS           32402        FUNCT. REG.        28        750


SYMBOLS                 I=I, D1, D2, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11, I1T12,
                        I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22,
                        I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22,
                        I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22,
                        I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011,
                        I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211,
                        I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411,
                        I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES                 MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                        L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RD=Z, S1=Z, AA=Z, BB=Z,
                        CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                        B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, E1=Z, E2=Z,
                        E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS               D, DPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                        DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, UG1, UG2,
                        P0, P1, P2.

EXPR.                   R, ER, LAG.

RUNNING TIME (SEC)        75.56                          USED    MAXIMUM
TERMS IN OUTPUT             735
GENERATED TERMS             870        INPUT SPACE       346       2000
EQUAL TERMS                 141        OUTPUT SPACE     1010       7126
CANCELLATIONS                 0        NR. OF EXPR.       27        269
RECORDS WRITTEN              27        ID. REGISTER        3        500
MULTIPLICATIONS           32402        FUNCT. REG.        28        750
```

```
                N R
                Z LAG=2.*K*(1.+.5*K*PO(L8,L8)+K**2*(PO(L8,L8)*PO(L9,L9)/4.
                 -1./16.*(PO(L8,L9)*PO(L9,L9)+PO(L8,L9)*PO(L9,L8)
                 +PO(L9,L8)*PO(L8,L9)+PO(L9,L8)*PO(L9,L8)))
                 +K**3*(PO(L8,L8)*PO(L9,L9)*PO(L10,L10)/48
                 -1./32.*PO(L8,L8)*(PO(L9,L10)*PO(L9,L10)
                                   +PO(L9,L10)*PO(L10,L9)
                                   +PO(L10,L9)*PO(L9,L10)
                                   +PO(L10,L9)*PO(L10,L9))
                 +1./48.*(PO(L8,L9)*PO(L9,L10)*PO(L10,L8)
                         +PO(L8,L9)*PO(L9,L10)*PO(L8,L10)
                         +PO(L8,L9)*PO(L10,L9)*PO(L10,L8)
                         +PO(L8,L9)*PO(L10,L9)*PO(L8,L10)
                         +PO(L9,L8)*PO(L9,L10)*PO(L10,L8)
                         +PO(L9,L8)*PO(L9,L10)*PO(L8,L10)
                         +PO(L9,L8)*PO(L10,L9)*PO(L10,L8)
                         +PO(L9,L8)*PO(L10,L9)*PO(L8,L10))))
        L 5     ID,K=0
                NPRINT LAG
                DELETE R,RR
                *BEGIN

SYMBOLS         I=I, D1, D2, D10, D1PO, D20, D2PO, W, Z, K, I1T11, I1T12,
                I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22,
                I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22,
                I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22,
                I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011,
                I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211,
                I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411,
                I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=7,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=7,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, E1=Z, E2=Z,
                E3=Z, S1=Z, S2=Z, S3=Z, S4=Z, L10.

FUNCTIONS       D, LPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D9,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, UG1, UG2,
                PO, P1, P2.

EXPR.           R, RR, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	121.33			
TERMS IN OUTPUT	903			
GENERATED TERMS	903	INPUT SPACE	404	2000
EQUAL TERMS	0	OUTPUT SPACE	4741	4740
CANCELLATIONS	0	NR. OF EXPR.	30	200
RECORDS WRITTEN	35	ID. REGISTER	3	500
MULTIPLICATIONS	56428	FUNCT. REG.	33	750

```
SYMBOLS         I=I, D1, D2, D10, D1PO, D20, D2PO, W, Z, K, I1T11, I1T12,
                I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22,
                I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22,
                I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22,
                I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011,
                I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211,
                I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411,
                I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=7,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=7,
```

CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z, L10.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, UG1, UG2, P0, P1, P2.

EXPR. R, RR, LAG.

			USED	MAXIMUM
RUNNING TIME (SEC)	122.41			
TERMS IN OUTPUT	903			
GENERATED TERMS	903	INPUT SPACE	404	2000
EQUAL TERMS	0	OUTPUT SPACE	2344	7126
CANCELLATIONS	0	NR. OF EXPR.	30	249
RECORDS WRITTEN	49	ID. REGISTER	8	500
MULTIPLICATIONS	56420	FUNCT. REG.	33	750

```
BEGIN      133.84  SECONDS

                NAMES LAG
                COMMON V1,V2,V3,V4,V5,V6,VERT3
                S Z,KK
                V Q1,Q2,Q3,P
                *FIX

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

```
BEGIN     133.94  SECONDS

                  N R
                  C WORKS OUT THE 3-GRAVITON VERTEX
                  Z LAG=LAG
            L 2   ID,K**(J+)=KK**(-J)
            L 3   ID,KK=0
                  NPRINT LAG
                  *NEXT

SYMBOLS           I=I, Z, K, KK.

INDICES           MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                  L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                  CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                  B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS           Q1, Q2, Q3, P.

FUNCTIONS         D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                  DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.             =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)        7.96                          USED    MAXIMUM
TERMS IN OUTPUT            771
GENERATED TERMS            771        INPUT SPACE        251       2000
EQUAL TERMS                  0        OUTPUT SPACE      4737       4740
CANCELLATIONS                0        NR. OF EXPR.        26        260
RECORDS WRITTEN             77        ID. REGISTER         6        500
MULTIPLICATIONS           4912        FUNCT. REG.         14        750


RUNNING TIME (SEC)        8.90                          USED    MAXIMUM
TERMS IN OUTPUT            771
GENERATED TERMS            771        INPUT SPACE        251       2000
EQUAL TERMS                  0        OUTPUT SPACE      1433       7126
CANCELLATIONS                0        NR. OF EXPR.        26        260
RECORDS WRITTEN             90        ID. REGISTER         6        500
MULTIPLICATIONS           4912        FUNCT. REG.         14        750

                  N R
                  Z V1=LAG
            L 2   ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                   D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*D(L5,A3)*D(L6,B3)*
                   Q3(L7)*Q3(L8)
            L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                   D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                   D(L7,A3)*D(L8,B3)
                  NPRINT V1
                  *NEXT

SYMBOLS           I=I, Z, K, KK.

INDICES           MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                  L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                  CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                  B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS           Q1, Q2, Q3, P.

FUNCTIONS         D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                  DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.
```

```
EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	15.21			
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	308	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	22	260
RECORDS WRITTEN	94	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z V2=LAG
               L 2  ID,ADISO,PO(L1+,L2+)*PO(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                     D(L1,A1)*D(L2,B1)*D(L3,A3)*D(L4,B3)*D(L5,A2)*D(L6,B2)*
                     Q2(L7)*Q2(L8)
               L 3  ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*PO(L7+,L8+)=
                     D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                     D(L7,A2)*D(L8,B2)
                    NPRINT V2
                    *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	21.09			
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	308	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	23	260
RECORDS WRITTEN	98	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
```

```
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
                     N R
                     Z V3=LAG
           L 2       ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                      D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*D(L5,A3)*D(L6,B3)*
                      Q3(L7)*Q3(L8)
           L 3       ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                      D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                      D(L7,A3)*D(L8,B3)
                     NPRINT V3
                     *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	26.93			
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	308	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	24	260
RECORDS WRITTEN	102	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
                     N R
                     Z V4=LAG
           L 2       ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                      D(L1,A2)*D(L2,B2)*D(L3,A3)*D(L4,B3)*D(L5,A1)*D(L6,B1)*
                      Q1(L7)*Q1(L8)
           L 3       ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                      D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                      D(L7,A1)*D(L8,B1)
                     NPRINT V4
```

```
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)      32.75                          USED    MAXIMUM
TERMS IN OUTPUT           144
GENERATED TERMS           771        INPUT SPACE        308       2000
EQUAL TERMS               541        OUTPUT SPACE      1551       4740
CANCELLATIONS              86        NR. OF EXPR.        25        260
RECORDS WRITTEN           106        ID. REGISTER        31        500
MULTIPLICATIONS          3856        FUNCT. REG.         25        750


SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
                     N R
                     Z V5=LAG
          L 2        ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                      D(L1,A3)*D(L2,B3)*D(L3,A1)*D(L4,B1)*D(L5,A2)*D(L6,B2)*
                      Q2(L7)*Q2(L8)
          L 3        ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                      D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                      D(L7,A2)*D(L8,B2)
                     NPRINT V5
                     *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)      38.62                          USED    MAXIMUM
```

```
TERMS IN OUTPUT          144
GENERATED TERMS          771          INPUT SPACE          308        2000
EQUAL TERMS              541          OUTPUT SPACE        1551        4740
CANCELLATIONS             86          NR. OF EXPR.          26         260
RECORDS WRITTEN          110          ID. REGISTER          31         500
MULTIPLICATIONS         3856          FUNCT. REG.           25         750


SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z V6=LAG
          L 2       ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*D(L3,A2)*D(L4,B2)*D(L5,A1)*D(L6,B1)*
                     Q1(L7)*Q1(L8)
          L 3       ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                     D(L7,A1)*D(L8,B1)
                    NPRINT V6
                    *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)      44.46                          USED    MAXIMUM
TERMS IN OUTPUT           144
GENERATED TERMS           771          INPUT SPACE        308        2000
EQUAL TERMS               541          OUTPUT SPACE      1551        4740
CANCELLATIONS              86          NR. OF EXPR.        27         260
RECORDS WRITTEN           114          ID. REGISTER        31         500
MULTIPLICATIONS          3856          FUNCT. REG.         25         750


SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.
```

```
FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z VERT3=V1+V2+V3+V4+V5+V6
                    DELETE LAG,V1,V2,V3,V4,V5,V6
                    *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	49.21			
TERMS IN OUTPUT	495			
GENERATED TERMS	864	INPUT SPACE	235	2000
EQUAL TERMS	369	OUTPUT SPACE	3166	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	118	ID. REGISTER	1	500
MULTIPLICATIONS	2598	FUNCT. REG.	18	750

```
SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, VERT3.

 VERT3 =

   - 1./2.*Q1(A1)*Q1(A2)*D(A3,B1)*D(B2,B3)

   - 1./2.*Q1(A1)*Q1(A2)*D(A3,B2)*D(B1,B3)

   + 1./2.*Q1(A1)*Q1(A2)*D(A3,B3)*D(B1,B2)

   - 1./2.*Q1(A1)*Q2(A2)*D(A3,B1)*D(B2,B3)
```

```
- 1./2.*Q1(A1)*Q2(A2)*D(A3,B2)*D(B1,B3)

+ 1./2.*Q1(A1)*Q2(A2)*D(A3,B3)*D(B1,B2)

- 1./2.*Q1(A1)*Q3(A2)*D(A3,B1)*D(B2,B3)

- 1./2.*Q1(A1)*Q3(A2)*D(A3,B2)*D(B1,B3)

+ 1./2.*Q1(A1)*Q3(A2)*D(A3,B3)*D(B1,B2)

+ 1./2.*Q1(A1)*D(A2,A3)*Q1(B1)*D(B2,B3)

+ 1./2.*Q1(A1)*D(A2,A3)*Q2(B1)*D(B2,B3)

+ 1./2.*Q1(A1)*D(A2,A3)*Q3(B1)*D(B2,B3)

- 1./2.*Q1(A1)*D(A2,A3)*D(B1,B2)*Q1(B3)

- 1./2.*Q1(A1)*D(A2,A3)*D(B1,B2)*Q2(B3)

- 1./2.*Q1(A1)*D(A2,A3)*D(B1,B2)*Q3(B3)

- 1./2.*Q1(A1)*D(A2,A3)*D(B1,B3)*Q1(B2)

- 1./2.*Q1(A1)*D(A2,A3)*D(B1,B3)*Q2(B2)

- 1./2.*Q1(A1)*D(A2,A3)*D(B1,B3)*Q3(B2)

- 1./2.*Q1(A1)*D(A2,B1)*Q1(A3)*D(B2,B3)

- 1./2.*Q1(A1)*D(A2,B1)*Q2(A3)*D(B2,B3)
```

```
     - 1./2.*Q1(A1)*Q2(A2)*D(A3,B2)*D(B1,B3)

     + 1./2.*Q1(A1)*Q2(A2)*D(A3,B3)*D(B1,B2)

     - 1./2.*Q1(A1)*Q3(A2)*D(A3,B1)*D(B2,B3)

     - 1./2.*Q1(A1)*Q3(A2)*D(A3,B2)*D(B1,B3)

     + 1./2.*Q1(A1)*Q3(A2)*D(A3,B3)*D(B1,B2)

     + 1./2.*Q1(A1)*D(A2,A3)*Q1(B1)*D(B2,B3)

     + 1./2.*Q1(A1)*D(A2,A3)*Q2(B1)*D(B2,B3)

     + 1./2.*Q1(A1)*D(A2,A3)*Q3(B1)*D(B2,B3)

     - 1./2.*Q1(A1)*D(A2,A3)*D(B1,B2)*Q1(B3)

     - 1./2.*Q1(A1)*D(A2,A3)*D(B1,B2)*Q2(B3)

     - 1./2.*Q1(A1)*D(A2,A3)*D(B1,B2)*Q3(B3)

     - 1./2.*Q1(A1)*D(A2,A3)*D(B1,B3)*Q1(B2)

     - 1./2.*Q1(A1)*D(A2,A3)*D(B1,B3)*Q2(B2)

     - 1./2.*Q1(A1)*D(A2,A3)*D(B1,B3)*Q3(B2)

     - 1./2.*Q1(A1)*D(A2,B1)*Q1(A3)*D(B2,B3)

     - 1./2.*Q1(A1)*D(A2,B1)*Q2(A3)*D(B2,B3)

     - 1./2.*Q1(A1)*D(A2,B1)*Q3(A3)*D(B2,B3)
```

```
- 1./2.*Q1(A1)*D(A2,B1)*Q3(A3)*D(B2,B3)
- 1./2.*Q1(A1)*D(A2,B1)*D(A3,B2)*Q1(B3)
- 1./2.*Q1(A1)*D(A2,B1)*D(A3,B2)*Q2(B3)
- 1./2.*Q1(A1)*D(A2,B1)*D(A3,B2)*Q3(B3)
+ 1./2.*Q1(A1)*D(A2,B1)*D(A3,B3)*Q1(B2)
+ 1./2.*Q1(A1)*D(A2,B1)*D(A3,B3)*Q2(B2)
+ 1./2.*Q1(A1)*D(A2,B1)*D(A3,B3)*Q3(B2)
+ 1./2.*Q1(A1)*D(A2,B2)*Q1(A3)*D(B1,B3)
+ 1./2.*Q1(A1)*D(A2,B2)*Q2(A3)*D(B1,B3)
+ 1./2.*Q1(A1)*D(A2,B2)*Q3(A3)*D(B1,B3)
+ 1./2.*Q1(A1)*D(A2,B2)*D(A3,B1)*Q1(B3)
+ 1./2.*Q1(A1)*D(A2,B2)*D(A3,B1)*Q2(B3)
+ 1./2.*Q1(A1)*D(A2,B2)*D(A3,B1)*Q3(B3)
- 1./2.*Q1(A1)*D(A2,B2)*D(A3,B3)*Q1(B1)
- 1./2.*Q1(A1)*D(A2,B2)*D(A3,B3)*Q2(B1)
- 1./2.*Q1(A1)*D(A2,B2)*D(A3,B3)*Q3(B1)
```

```
- 1./2.*Q1(A1)*D(A2,B3)*Q1(A3)*D(B1,B2)
- 1./2.*Q1(A1)*D(A2,B3)*Q2(A3)*D(B1,B2)
- 1./2.*Q1(A1)*D(A2,B3)*Q3(A3)*D(B1,B2)
- 1./2.*Q1(A1)*D(A2,B3)*D(A3,B1)*Q1(B2)
- 1./2.*Q1(A1)*D(A2,B3)*D(A3,B1)*Q2(B2)
- 1./2.*Q1(A1)*D(A2,B3)*D(A3,B1)*Q3(B2)
+ 1./2.*Q1(A1)*D(A2,B3)*D(A3,B2)*Q1(B1)
+ 1./2.*Q1(A1)*D(A2,B3)*D(A3,B2)*Q2(B1)
+ 1./2.*Q1(A1)*D(A2,B3)*D(A3,B2)*Q3(B1)
- 1./4.*Q2(A1)*Q1(A2)*D(A3,B1)*D(B2,B3)
- 1./4.*Q2(A1)*Q1(A2)*D(A3,B2)*D(B1,B3)
+ 1./4.*Q2(A1)*Q1(A2)*D(A3,B3)*D(B1,B2)
- 1./2.*Q2(A1)*Q2(A2)*D(A3,B1)*D(B2,B3)
- 1./2.*Q2(A1)*Q2(A2)*D(A3,B2)*D(B1,B3)
+ 1./2.*Q2(A1)*Q2(A2)*D(A3,B3)*D(B1,B2)
- 1./4.*Q2(A1)*Q3(A2)*D(A3,B1)*D(B2,B3)
```

```
- 1./4.*Q2(A1)*Q3(A2)*D(A3,B2)*D(B1,B3)
+ 1./2.*Q2(A1)*Q3(A2)*D(A3,B3)*D(B1,B2)
+ 1./2.*Q2(A1)*D(A2,A3)*Q1(B1)*D(B2,B3)
+ Q2(A1)*D(A2,A3)*Q2(B1)*D(B2,B3)
+ 3./4.*Q2(A1)*D(A2,A3)*Q3(B1)*D(B2,B3)
- 1./4.*Q2(A1)*D(A2,A3)*D(B1,B2)*Q1(B3)
- 1./2.*Q2(A1)*D(A2,A3)*D(B1,B2)*Q2(B3)
- 1./2.*Q2(A1)*D(A2,A3)*D(B1,B2)*Q3(B3)
- 1./4.*Q2(A1)*D(A2,A3)*D(B1,B3)*Q1(B2)
- 1./2.*Q2(A1)*D(A2,A3)*D(B1,B3)*Q2(B2)
- 1./4.*Q2(A1)*D(A2,A3)*D(B1,B3)*Q3(B2)
- 1./4.*Q2(A1)*D(A2,B1)*Q1(A3)*D(B2,B3)
- 1./2.*Q2(A1)*D(A2,B1)*Q2(A3)*D(B2,B3)
- 1./2.*Q2(A1)*D(A2,B1)*Q3(A3)*D(B2,B3)
- 1./4.*Q2(A1)*D(A2,B1)*D(A3,B2)*Q1(B3)
- 1./2.*Q2(A1)*D(A2,B1)*D(A3,B2)*Q2(B3)
```

```
- 1./2.*Q2(A1)*D(A2,B1)*D(A3,B2)*Q3(B3)
+ 1./4.*Q2(A1)*D(A2,B1)*D(A3,B3)*Q1(B2)
+ 1./2.*Q2(A1)*D(A2,B1)*D(A3,B3)*Q2(B2)
+ 1./2.*Q2(A1)*D(A2,B1)*D(A3,B3)*Q3(B2)
+ 1./2.*Q2(A1)*D(A2,B2)*Q1(A3)*D(B1,B3)
+ Q2(A1)*D(A2,B2)*Q2(A3)*D(B1,B3)
+ 1./2.*Q2(A1)*D(A2,B2)*Q3(A3)*D(B1,B3)
+ 1./2.*Q2(A1)*D(A2,B2)*D(A3,B1)*Q1(B3)
+ Q2(A1)*D(A2,B2)*D(A3,B1)*Q2(B3)
+ 1./2.*Q2(A1)*D(A2,B2)*D(A3,B1)*Q3(B3)
- 1./2.*Q2(A1)*D(A2,B2)*D(A3,B3)*Q1(B1)
- Q2(A1)*D(A2,B2)*D(A3,B3)*Q2(B1)
- 1./2.*Q2(A1)*D(A2,B2)*D(A3,B3)*Q3(B1)
- 1./4.*Q2(A1)*D(A2,B3)*Q1(A3)*D(B1,B2)
- 1./2.*Q2(A1)*D(A2,B3)*Q2(A3)*D(B1,B2)
- 1./2.*Q2(A1)*D(A2,B3)*Q3(A3)*D(B1,B2)
```

```
- 1./4.*Q2(A1)*D(A2,B3)*D(A3,B1)*Q1(B2)

- 1./2.*Q2(A1)*D(A2,B3)*D(A3,B1)*Q2(B2)

- 1./4.*Q2(A1)*D(A2,B3)*D(A3,B1)*Q3(B2)

+ 1./2.*Q2(A1)*D(A2,B3)*D(A3,B2)*Q1(B1)

+ Q2(A1)*D(A2,B3)*D(A3,B2)*Q2(B1)

+ 3./4.*Q2(A1)*D(A2,B3)*D(A3,B2)*Q3(B1)

- 1./4.*Q3(A1)*Q1(A2)*D(A3,B1)*D(B2,B3)

- 1./4.*Q3(A1)*Q1(A2)*D(A3,B2)*D(B1,B3)

+ 1./2.*Q3(A1)*Q1(A2)*D(A3,B3)*D(B1,B2)

- 1./2.*Q3(A1)*Q2(A2)*D(A3,B1)*D(B2,B3)

- 1./2.*Q3(A1)*Q2(A2)*D(A3,B2)*D(B1,B3)

+ 1./2.*Q3(A1)*Q2(A2)*D(A3,B3)*D(B1,B2)

- 1./2.*Q3(A1)*Q3(A2)*D(A3,B1)*D(B2,B3)

- 1./2.*Q3(A1)*Q3(A2)*D(A3,B2)*D(B1,B3)

+ Q3(A1)*Q3(A2)*D(A3,B3)*D(B1,B2)

+ 1./2.*Q3(A1)*D(A2,A3)*Q1(B1)*D(B2,B3)
```

```
+ 3./4.*Q3(A1)*D(A2,A3)*Q2(B1)*D(B2,B3)

+ Q3(A1)*D(A2,A3)*Q3(B1)*D(B2,B3)

- 1./4.*Q3(A1)*D(A2,A3)*D(B1,B2)*Q1(B3)

- 1./4.*Q3(A1)*D(A2,A3)*D(B1,B2)*Q2(B3)

- 1./2.*Q3(A1)*D(A2,A3)*D(B1,B2)*Q3(B3)

- 1./4.*Q3(A1)*D(A2,A3)*D(B1,B3)*Q1(B2)

- 1./2.*Q3(A1)*D(A2,A3)*D(B1,B3)*Q2(B2)

- 1./2.*Q3(A1)*D(A2,A3)*D(B1,B3)*Q3(B2)

- 1./4.*Q3(A1)*D(A2,B1)*Q1(A3)*D(B2,B3)

- 1./4.*Q3(A1)*D(A2,B1)*Q2(A3)*D(B2,B3)

- 1./2.*Q3(A1)*D(A2,B1)*Q3(A3)*D(B2,B3)

- 1./4.*Q3(A1)*D(A2,B1)*D(A3,B2)*Q1(B3)

- 1./4.*Q3(A1)*D(A2,B1)*D(A3,B2)*Q2(B3)

- 1./2.*Q3(A1)*D(A2,B1)*D(A3,B2)*Q3(B3)

+ 1./2.*Q3(A1)*D(A2,B1)*D(A3,B3)*Q1(B2)

+ 1./2.*Q3(A1)*D(A2,B1)*D(A3,B3)*Q2(B2)
```

```
+ Q3(A1)*D(A2,B1)*D(A3,B3)*Q3(B2)

+ 1./4.*Q3(A1)*D(A2,B2)*Q1(A3)*D(B1,B3)

+ 1./2.*Q3(A1)*D(A2,B2)*Q2(A3)*D(B1,B3)

+ 1./2.*Q3(A1)*D(A2,B2)*Q3(A3)*D(B1,B3)

+ 1./4.*Q3(A1)*D(A2,B2)*D(A3,B1)*Q1(B3)

+ 1./2.*Q3(A1)*D(A2,B2)*D(A3,B1)*Q2(B3)

+ 1./2.*Q3(A1)*D(A2,B2)*D(A3,B1)*Q3(B3)

- 1./2.*Q3(A1)*D(A2,B2)*D(A3,B3)*Q1(B1)

- 1./2.*Q3(A1)*D(A2,B2)*D(A3,B3)*Q2(B1)

- Q3(A1)*D(A2,B2)*D(A3,B3)*Q3(B1)

- 1./4.*Q3(A1)*D(A2,B3)*Q1(A3)*D(B1,B2)

- 1./4.*Q3(A1)*D(A2,B3)*Q2(A3)*D(B1,B2)

- 1./2.*Q3(A1)*D(A2,B3)*Q3(A3)*D(B1,B2)

- 1./4.*Q3(A1)*D(A2,B3)*D(A3,B1)*Q1(B2)

- 1./2.*Q3(A1)*D(A2,B3)*D(A3,B1)*Q2(B2)

- 1./2.*Q3(A1)*D(A2,B3)*D(A3,B1)*Q3(B2)
```

```
     + 1./2.*Q3(A1)*D(A2,B3)*D(A3,B2)*Q1(B1)

     + 3./4.*Q3(A1)*D(A2,B3)*D(A3,B2)*Q2(B1)

     + Q3(A1)*D(A2,B3)*D(A3,B2)*Q3(B1)

     - 1./2.*D(A1,A2)*Q1(A3)*Q1(B1)*D(B2,B3)

     - 1./4.*D(A1,A2)*Q1(A3)*Q2(B1)*D(B2,B3)

     - 1./4.*D(A1,A2)*Q1(A3)*Q3(B1)*D(B2,B3)

     + D(A1,A2)*Q1(A3)*D(B1,B2)*Q1(B3)

     + 3./4.*D(A1,A2)*Q1(A3)*D(B1,B2)*Q2(B3)

     + 1./2.*D(A1,A2)*Q1(A3)*D(B1,B2)*Q3(B3)

     - 1./2.*D(A1,A2)*Q1(A3)*D(B1,B3)*Q1(B2)

     - 1./2.*D(A1,A2)*Q1(A3)*D(B1,B3)*Q2(B2)

     - 1./4.*D(A1,A2)*Q1(A3)*D(B1,B3)*Q3(B2)

     - 1./2.*D(A1,A2)*Q2(A3)*Q1(B1)*D(B2,B3)

     - 1./2.*D(A1,A2)*Q2(A3)*Q2(B1)*D(B2,B3)

     - 1./4.*D(A1,A2)*Q2(A3)*Q3(B1)*D(B2,B3)

     + 3./4.*D(A1,A2)*Q2(A3)*D(B1,B2)*Q1(B3)
```

```
+ D(A1,A2)*Q2(A3)*D(B1,B2)*Q2(B3)

+ 1./2.*D(A1,A2)*Q2(A3)*D(B1,B2)*Q3(B3)

- 1./4.*D(A1,A2)*Q2(A3)*D(B1,B3)*Q1(B2)

- 1./2.*D(A1,A2)*Q2(A3)*D(B1,B3)*Q2(B2)

- 1./4.*D(A1,A2)*Q2(A3)*D(B1,B3)*Q3(B2)

- 1./2.*D(A1,A2)*Q3(A3)*Q1(B1)*D(B2,B3)

- 1./2.*D(A1,A2)*Q3(A3)*Q2(B1)*D(B2,B3)

- 1./2.*D(A1,A2)*Q3(A3)*Q3(B1)*D(B2,B3)

+ 1./2.*D(A1,A2)*Q3(A3)*D(B1,B2)*Q1(B3)

+ 1./2.*D(A1,A2)*Q3(A3)*D(B1,B2)*Q2(B3)

+ 1./2.*D(A1,A2)*Q3(A3)*D(B1,B2)*Q3(B3)

- 1./2.*D(A1,A2)*Q3(A3)*D(B1,B3)*Q1(B2)

- 1./2.*D(A1,A2)*Q3(A3)*D(B1,B3)*Q2(B2)

- 1./2.*D(A1,A2)*Q3(A3)*D(B1,B3)*Q3(B2)

- 1./2.*D(A1,A2)*D(A3,B1)*Q1(B2)*Q1(B3)

- 1./4.*D(A1,A2)*D(A3,B1)*Q1(B2)*Q2(B3)
```

```
- 1./2.*D(A1,A2)*D(A3,B1)*Q1(B2)*Q3(B3)

- 1./2.*D(A1,A2)*D(A3,B1)*Q2(B2)*Q1(B3)

- 1./2.*D(A1,A2)*D(A3,B1)*Q2(B2)*Q2(B3)

- 1./2.*D(A1,A2)*D(A3,B1)*Q2(B2)*Q3(B3)

- 1./4.*D(A1,A2)*D(A3,B1)*Q3(B2)*Q1(B3)

- 1./4.*D(A1,A2)*D(A3,B1)*Q3(B2)*Q2(B3)

- 1./2.*D(A1,A2)*D(A3,B1)*Q3(B2)*Q3(B3)

+ D(A1,A2)*D(A3,B1)*D(B2,B3)
* ( 1./2.*Q1DQ1 + 3./4.*Q1DQ2 + 3./4.*Q1DQ3 + 1./2.*Q2DQ2 + 3./4.*Q2DQ3 + 1./2.*Q3DQ3 )

- 1./2.*D(A1,A2)*D(A3,B2)*Q1(B1)*Q1(B3)

- 1./2.*D(A1,A2)*D(A3,B2)*Q1(B1)*Q2(B3)

- 1./2.*D(A1,A2)*D(A3,B2)*Q1(B1)*Q3(B3)

- 1./4.*D(A1,A2)*D(A3,B2)*Q2(B1)*Q1(B3)

- 1./2.*D(A1,A2)*D(A3,B2)*Q2(B1)*Q2(B3)

- 1./2.*D(A1,A2)*D(A3,B2)*Q2(B1)*Q3(B3)

- 1./4.*D(A1,A2)*D(A3,B2)*Q3(B1)*Q1(B3)

- 1./4.*D(A1,A2)*D(A3,B2)*Q3(B1)*Q2(B3)
```




```
- 1./2.*D(A1,A2)*D(A3,B2)*Q3(B1)*Q3(B3)

+ D(A1,A2)*D(A3,B2)*D(B1,B3)
* ( 1./2.*Q1DQ1 + 3./4.*Q1DQ2 + 3./4.*Q1DQ3 + 1./2.*Q2DQ2 + 3./4.*Q2DQ3 + 1./2.*Q3DQ3 )

+ 1./2.*D(A1,A2)*D(A3,B3)*Q1(B1)*Q1(B2)

+ 1./2.*D(A1,A2)*D(A3,B3)*Q1(B1)*Q2(B2)

+ 1./2.*D(A1,A2)*D(A3,B3)*Q1(B1)*Q3(B2)

+ 1./4.*D(A1,A2)*D(A3,B3)*Q2(B1)*Q1(B2)

+ 1./2.*D(A1,A2)*D(A3,B3)*Q2(B1)*Q2(B2)

+ 1./2.*D(A1,A2)*D(A3,B3)*Q2(B1)*Q3(B2)

+ 1./2.*D(A1,A2)*D(A3,B3)*Q3(B1)*Q1(B2)

+ 1./2.*D(A1,A2)*D(A3,B3)*Q3(B1)*Q2(B2)

+ D(A1,A2)*D(A3,B3)*Q3(B1)*Q3(B2)

+ D(A1,A2)*D(A3,B3)*D(B1,B2)
* ( - 1./2.*Q1DQ1 - 3./4.*Q1DQ2 - 1./2.*Q1DQ3 - 1./2.*Q2DQ2 - 1./2.*Q2DQ3 - 1./2.*Q3DQ3 )

- 1./2.*D(A1,A3)*Q1(A2)*Q1(B1)*D(B2,B3)

- 1./4.*D(A1,A3)*Q1(A2)*Q2(B1)*D(B2,B3)

- 1./4.*D(A1,A3)*Q1(A2)*Q3(B1)*D(B2,B3)
```

```
- 1./2.*D(A1,A3)*Q1(A2)*D(B1,B2)*Q1(B3)

- 1./4.*D(A1,A3)*Q1(A2)*D(B1,B2)*Q2(B3)

- 1./2.*D(A1,A3)*Q1(A2)*D(B1,B2)*Q3(B3)

+ D(A1,A3)*Q1(A2)*D(B1,B3)*Q1(B2)

+ 1./2.*D(A1,A3)*Q1(A2)*D(B1,B3)*Q2(B2)

+ 3./4.*D(A1,A3)*Q1(A2)*D(B1,B3)*Q3(B2)

- 1./2.*D(A1,A3)*Q2(A2)*Q1(B1)*D(B2,B3)

- 1./2.*D(A1,A3)*Q2(A2)*Q2(B1)*D(B2,B3)

- 1./2.*D(A1,A3)*Q2(A2)*Q3(B1)*D(B2,B3)

- 1./2.*D(A1,A3)*Q2(A2)*D(B1,B2)*Q1(B3)

- 1./2.*D(A1,A3)*Q2(A2)*D(B1,B2)*Q2(B3)

- 1./2.*D(A1,A3)*Q2(A2)*D(B1,B2)*Q3(B3)

+ 1./2.*D(A1,A3)*Q2(A2)*D(B1,B3)*Q1(B2)

+ 1./2.*D(A1,A3)*Q2(A2)*D(B1,B3)*Q2(B2)

+ 1./2.*D(A1,A3)*Q2(A2)*D(B1,B3)*Q3(B2)

- 1./2.*D(A1,A3)*Q3(A2)*Q1(B1)*D(B2,B3)
```

```
     - 1./4.*D(A1,A3)*Q3(A2)*Q2(B1)*D(B2,B3)

     - 1./2.*D(A1,A3)*Q3(A2)*Q3(B1)*D(B2,B3)

     - 1./4.*D(A1,A3)*Q3(A2)*D(B1,B2)*Q1(B3)

     - 1./4.*D(A1,A3)*Q3(A2)*D(B1,B2)*Q2(B3)

     - 1./2.*D(A1,A3)*Q3(A2)*D(B1,B2)*Q3(B3)

     + 3./4.*D(A1,A3)*Q3(A2)*D(B1,B3)*Q1(B2)

     + 1./2.*D(A1,A3)*Q3(A2)*D(B1,B3)*Q2(B2)

     + D(A1,A3)*Q3(A2)*D(B1,B3)*Q3(B2)

     - 1./2.*D(A1,A3)*D(A2,B1)*Q1(B2)*Q1(B3)

     - 1./4.*D(A1,A3)*D(A2,B1)*Q1(B2)*Q2(B3)

     - 1./2.*D(A1,A3)*D(A2,B1)*Q1(B2)*Q3(B3)

     - 1./2.*D(A1,A3)*D(A2,B1)*Q2(B2)*Q1(B3)

     - 1./2.*D(A1,A3)*D(A2,B1)*Q2(B2)*Q2(B3)

     - 1./2.*D(A1,A3)*D(A2,B1)*Q2(B2)*Q3(B3)

     - 1./4.*D(A1,A3)*D(A2,B1)*Q3(B2)*Q1(B3)

     - 1./4.*D(A1,A3)*D(A2,B1)*Q3(B2)*Q2(B3)
```

```
- 1./4.*D(A1,A3)*D(A2,B3)*Q2(B1)*Q1(B2)

- 1./2.*D(A1,A3)*D(A2,B3)*Q2(B1)*Q2(B2)

- 1./4.*D(A1,A3)*D(A2,B3)*Q2(B1)*Q3(B2)

- 1./4.*D(A1,A3)*D(A2,B3)*Q3(B1)*Q1(B2)

- 1./2.*D(A1,A3)*D(A2,B3)*Q3(B1)*Q2(B2)

- 1./2.*D(A1,A3)*D(A2,B3)*Q3(B1)*Q3(B2)

+ D(A1,A3)*D(A2,B3)*D(B1,B2)
* ( 1./2.*Q1DQ1 + 3./4.*Q1DQ2 + 3./4.*Q1DQ3 + 1./2.*Q2DQ2 + 3./4.*Q2DQ3 + 1./2.*Q3DQ3 )

+ D(A1,B1)*Q1(A2)*Q1(A3)*D(B2,B3)

+ 1./2.*D(A1,B1)*Q1(A2)*Q2(A3)*D(B2,B3)

+ 1./2.*D(A1,B1)*Q1(A2)*Q3(A3)*D(B2,B3)

+ D(A1,B1)*Q1(A2)*D(A3,B2)*Q1(B3)

+ 1./2.*D(A1,B1)*Q1(A2)*D(A3,B2)*Q2(B3)

+ 1./2.*D(A1,B1)*Q1(A2)*D(A3,B2)*Q3(B3)

- D(A1,B1)*Q1(A2)*D(A3,B3)*Q1(B2)

- 1./2.*D(A1,B1)*Q1(A2)*D(A3,B3)*Q2(B2)
```

```
- 1./2.*D(A1,B1)*Q1(A2)*D(A3,B3)*Q3(B2)
+ 1./2.*D(A1,B1)*Q2(A2)*Q1(A3)*D(B2,B3)
+ 1./2.*D(A1,B1)*Q2(A2)*Q2(A3)*D(B2,B3)
+ 1./2.*D(A1,B1)*Q2(A2)*Q3(A3)*D(B2,B3)
+ 1./2.*D(A1,B1)*Q2(A2)*D(A3,B2)*Q1(B3)
+ 1./2.*D(A1,B1)*Q2(A2)*D(A3,B2)*Q2(B3)
+ 1./2.*D(A1,B1)*Q2(A2)*D(A3,B2)*Q3(B3)
- 1./2.*D(A1,B1)*Q2(A2)*D(A3,B3)*Q1(B2)
- 1./2.*D(A1,B1)*Q2(A2)*D(A3,B3)*Q2(B2)
- 1./2.*D(A1,B1)*Q2(A2)*D(A3,B3)*Q3(B2)
+ 1./2.*D(A1,B1)*Q3(A2)*Q1(A3)*D(B2,B3)
+ 1./4.*D(A1,B1)*Q3(A2)*Q2(A3)*D(B2,B3)
+ 1./2.*D(A1,B1)*Q3(A2)*Q3(A3)*D(B2,B3)
+ 1./2.*D(A1,B1)*Q3(A2)*D(A3,B2)*Q1(B3)
+ 1./4.*D(A1,B1)*Q3(A2)*D(A3,B2)*Q2(B3)
+ 1./2.*D(A1,B1)*Q3(A2)*D(A3,B2)*Q3(B3)
```

```
- 1./2.*D(A1,B1)*Q3(A2)*D(A3,B3)*Q1(B2)

- 1./2.*D(A1,B1)*Q3(A2)*D(A3,B3)*Q2(B2)

- D(A1,B1)*Q3(A2)*D(A3,B3)*Q3(B2)

+ D(A1,B1)*D(A2,A3)*Q1(B2)*Q1(B3)

+ 1./2.*D(A1,B1)*D(A2,A3)*Q1(B2)*Q2(B3)

+ 1./2.*D(A1,B1)*D(A2,A3)*Q1(B2)*Q3(B3)

+ 1./2.*D(A1,B1)*D(A2,A3)*Q2(B2)*Q1(B3)

+ 1./2.*D(A1,B1)*D(A2,A3)*Q2(B2)*Q2(B3)

+ 1./2.*D(A1,B1)*D(A2,A3)*Q2(B2)*Q3(B3)

+ 1./2.*D(A1,B1)*D(A2,A3)*Q3(B2)*Q1(B3)

+ 1./4.*D(A1,B1)*D(A2,A3)*Q3(B2)*Q2(B3)

+ 1./2.*D(A1,B1)*D(A2,A3)*Q3(B2)*Q3(B3)

+ D(A1,B1)*D(A2,A3)*D(B2,B3)
* ( - 1./2.*Q1DQ1 - 1./2.*Q1DQ2 - 1./2.*Q1DQ3 - 1./2.*Q2DQ2 - 3./4.*Q2DQ3 - 1./2.*Q3DQ3 )

- D(A1,B1)*D(A2,B2)*Q1(A3)*Q1(B3)

- 1./2.*D(A1,B1)*D(A2,B2)*Q1(A3)*Q2(B3)

- 1./2.*D(A1,B1)*D(A2,B2)*Q1(A3)*Q3(B3)
```

```
- 1./2.*D(A1,B1)*D(A2,B2)*Q2(A3)*Q1(B3)

- D(A1,B1)*D(A2,B2)*Q2(A3)*Q2(B3)

- 1./2.*D(A1,B1)*D(A2,B2)*Q2(A3)*Q3(B3)

- 1./2.*D(A1,B1)*D(A2,B2)*Q3(A3)*Q1(B3)

- 1./2.*D(A1,B1)*D(A2,B2)*Q3(A3)*Q2(B3)

- 1./2.*D(A1,B1)*D(A2,B2)*Q3(A3)*Q3(B3)

+ D(A1,B1)*D(A2,B2)*D(A3,B3)
* ( 1./2.*Q1DQ1 + 1./2.*Q1DQ2 + 1./2.*Q1DQ3 + 1./2.*Q2DQ2 + 1./2.*Q2DQ3 + 1./2.*Q3DQ3 )

+ D(A1,B1)*D(A2,B3)*Q1(A3)*Q1(B2)

+ 1./2.*D(A1,B1)*D(A2,B3)*Q1(A3)*Q2(B2)

+ 1./2.*D(A1,B1)*D(A2,B3)*Q1(A3)*Q3(B2)

+ 1./2.*D(A1,B1)*D(A2,B3)*Q2(A3)*Q1(B2)

+ 1./2.*D(A1,B1)*D(A2,B3)*Q2(A3)*Q2(B2)

+ 1./4.*D(A1,B1)*D(A2,B3)*Q2(A3)*Q3(B2)

+ 1./2.*D(A1,B1)*D(A2,B3)*Q3(A3)*Q1(B2)

+ 1./2.*D(A1,B1)*D(A2,B3)*Q3(A3)*Q2(B2)
```




```
+ 1./2.*D(A1,B1)*D(A2,B3)*Q3(A3)*Q3(B2)
```



```
+ D(A1,B1)*D(A2,B3)*D(A3,B2)
* ( - 1./2.*Q1DQ1 - 1./2.*Q1DQ2 - 1./2.*Q1DQ3 - 1./2.*Q2DQ2 - 3./4.*Q2DQ3 - 1./2.*Q3DQ3 )

- 1./2.*D(A1,B2)*Q1(A2)*Q1(A3)*D(B1,B3)

- 1./4.*D(A1,B2)*Q1(A2)*Q2(A3)*D(B1,B3)

- 1./2.*D(A1,B2)*Q1(A2)*Q3(A3)*D(B1,B3)

- 1./2.*D(A1,B2)*Q1(A2)*D(A3,B1)*Q1(B3)

- 1./4.*D(A1,B2)*Q1(A2)*D(A3,B1)*Q2(B3)

- 1./2.*D(A1,B2)*Q1(A2)*D(A3,B1)*Q3(B3)

+ 1./2.*D(A1,B2)*Q1(A2)*D(A3,B3)*Q1(B1)

+ 1./4.*D(A1,B2)*Q1(A2)*D(A3,B3)*Q2(B1)

+ 1./2.*D(A1,B2)*Q1(A2)*D(A3,B3)*Q3(B1)

- 1./2.*D(A1,B2)*Q2(A2)*Q1(A3)*D(B1,B3)

- 1./2.*D(A1,B2)*Q2(A2)*Q2(A3)*D(B1,B3)

- 1./2.*D(A1,B2)*Q2(A2)*Q3(A3)*D(B1,B3)

- 1./2.*D(A1,B2)*Q2(A2)*D(A3,B1)*Q1(B3)

- 1./2.*D(A1,B2)*Q2(A2)*D(A3,B1)*Q2(B3)
```

```
- 1./2.*D(A1,B2)*Q2(A2)*D(A3,B1)*Q3(B3)

+ 1./2.*D(A1,B2)*Q2(A2)*D(A3,B3)*Q1(B1)

+ 1./2.*D(A1,B2)*Q2(A2)*D(A3,B3)*Q2(B1)

+ 1./2.*D(A1,B2)*Q2(A2)*D(A3,B3)*Q3(B1)

- 1./4.*D(A1,B2)*Q3(A2)*Q1(A3)*D(B1,B3)

- 1./4.*D(A1,B2)*Q3(A2)*Q2(A3)*D(B1,B3)

- 1./2.*D(A1,B2)*Q3(A2)*Q3(A3)*D(B1,B3)

- 1./4.*D(A1,B2)*Q3(A2)*D(A3,B1)*Q1(B3)

- 1./4.*D(A1,B2)*Q3(A2)*D(A3,B1)*Q2(B3)

- 1./2.*D(A1,B2)*Q3(A2)*D(A3,B1)*Q3(B3)

+ 1./2.*D(A1,B2)*Q3(A2)*D(A3,B3)*Q1(B1)

+ 1./2.*D(A1,B2)*Q3(A2)*D(A3,B3)*Q2(B1)

+ D(A1,B2)*Q3(A2)*D(A3,B3)*Q3(B1)

- 1./2.*D(A1,B2)*D(A2,A3)*Q1(B1)*Q1(B3)

- 1./2.*D(A1,B2)*D(A2,A3)*Q1(B1)*Q2(B3)

- 1./2.*D(A1,B2)*D(A2,A3)*Q1(B1)*Q3(B3)
```

```
- 1./4.*D(A1,B2)*D(A2,A3)*Q2(B1)*Q1(B3)

- 1./2.*D(A1,B2)*D(A2,A3)*Q2(B1)*Q2(B3)

- 1./2.*D(A1,B2)*D(A2,A3)*Q2(B1)*Q3(B3)

- 1./4.*D(A1,B2)*D(A2,A3)*Q3(B1)*Q1(B3)

- 1./4.*D(A1,B2)*D(A2,A3)*Q3(B1)*Q2(B3)

- 1./2.*D(A1,B2)*D(A2,A3)*Q3(B1)*Q3(B3)

+ D(A1,B2)*D(A2,A3)*D(B1,B3)
* ( 1./2.*Q1DQ1 + 3./4.*Q1DQ2 + 3./4.*Q1DQ3 + 1./2.*Q2DQ2 + 3./4.*Q2DQ3 + 1./2.*Q3DQ3 )

+ D(A1,B2)*D(A2,B1)*Q1(A3)*Q1(B3)

+ 3./4.*D(A1,B2)*D(A2,B1)*Q1(A3)*Q2(B3)

+ 1./2.*D(A1,B2)*D(A2,B1)*Q1(A3)*Q3(B3)

+ 3./4.*D(A1,B2)*D(A2,B1)*Q2(A3)*Q1(B3)

+ D(A1,B2)*D(A2,B1)*Q2(A3)*Q2(B3)

+ 1./2.*D(A1,B2)*D(A2,B1)*Q2(A3)*Q3(B3)

+ 1./2.*D(A1,B2)*D(A2,B1)*Q3(A3)*Q1(B3)

+ 1./2.*D(A1,B2)*D(A2,B1)*Q3(A3)*Q2(B3)
```

```
+ 1./2.*D(A1,B2)*D(A2,B1)*Q3(A3)*Q3(B3)
```



```
+ D(A1,B2)*D(A2,B1)*D(A3,B3)
* ( - 1./2.*Q1DQ1 - 3./4.*Q1DQ2 - 1./2.*Q1DQ3 - 1./2.*Q2DQ2 - 1./2.*Q2DQ3 - 1./2.*Q3DQ3 )

- 1./2.*D(A1,B2)*D(A2,B3)*Q1(A3)*Q1(B1)

- 1./4.*D(A1,B2)*D(A2,B3)*Q1(A3)*Q2(B1)

- 1./4.*D(A1,B2)*D(A2,B3)*Q1(A3)*Q3(B1)

- 1./2.*D(A1,B2)*D(A2,B3)*Q2(A3)*Q1(B1)

- 1./2.*D(A1,B2)*D(A2,B3)*Q2(A3)*Q2(B1)

- 1./4.*D(A1,B2)*D(A2,B3)*Q2(A3)*Q3(B1)

- 1./2.*D(A1,B2)*D(A2,B3)*Q3(A3)*Q1(B1)

- 1./2.*D(A1,B2)*D(A2,B3)*Q3(A3)*Q2(B1)

- 1./2.*D(A1,B2)*D(A2,B3)*Q3(A3)*Q3(B1)

+ D(A1,B2)*D(A2,B3)*D(A3,B1)
* ( 1./2.*Q1DQ1 + 3./4.*Q1DQ2 + 3./4.*Q1DQ3 + 1./2.*Q2DQ2 + 3./4.*Q2DQ3 + 1./2.*Q3DQ3 )

- 1./2.*D(A1,B3)*Q1(A2)*Q1(A3)*D(B1,B2)

- 1./4.*D(A1,B3)*Q1(A2)*Q2(A3)*D(B1,B2)

- 1./2.*D(A1,B3)*Q1(A2)*Q3(A3)*D(B1,B2)
```

```
+ D(A1,B3)*Q1(A2)*D(A3,B1)*Q1(B2)

+ 1./2.*D(A1,B3)*Q1(A2)*D(A3,B1)*Q2(B2)

+ 3./4.*D(A1,B3)*Q1(A2)*D(A3,B1)*Q3(B2)

- 1./2.*D(A1,B3)*Q1(A2)*D(A3,B2)*Q1(B1)

- 1./4.*D(A1,B3)*Q1(A2)*D(A3,B2)*Q2(B1)

- 1./4.*D(A1,B3)*Q1(A2)*D(A3,B2)*Q3(B1)

- 1./2.*D(A1,B3)*Q2(A2)*Q1(A3)*D(B1,B2)

- 1./2.*D(A1,B3)*Q2(A2)*Q2(A3)*D(B1,B2)

- 1./2.*D(A1,B3)*Q2(A2)*Q3(A3)*D(B1,B2)

+ 1./2.*D(A1,B3)*Q2(A2)*D(A3,B1)*Q1(B2)

+ 1./2.*D(A1,B3)*Q2(A2)*D(A3,B1)*Q2(B2)

+ 1./2.*D(A1,B3)*Q2(A2)*D(A3,B1)*Q3(B2)

- 1./2.*D(A1,B3)*Q2(A2)*D(A3,B2)*Q1(B1)

- 1./2.*D(A1,B3)*Q2(A2)*D(A3,B2)*Q2(B1)

- 1./2.*D(A1,B3)*Q2(A2)*D(A3,B2)*Q3(B1)

- 1./4.*D(A1,B3)*Q3(A2)*Q1(A3)*D(B1,B2)
```




```
- 1./4.*D(A1,B3)*Q3(A2)*Q2(A3)*D(B1,B2)

- 1./2.*D(A1,B3)*Q3(A2)*Q3(A3)*D(B1,B2)

+ 3./4.*D(A1,B3)*Q3(A2)*D(A3,B1)*Q1(B2)

+ 1./2.*D(A1,B3)*Q3(A2)*D(A3,B1)*Q2(B2)

+ D(A1,B3)*Q3(A2)*D(A3,B1)*Q3(B2)

- 1./2.*D(A1,B3)*Q3(A2)*D(A3,B2)*Q1(B1)

- 1./4.*D(A1,B3)*Q3(A2)*D(A3,B2)*Q2(B1)

- 1./2.*D(A1,B3)*Q3(A2)*D(A3,B2)*Q3(B1)

- 1./2.*D(A1,B3)*D(A2,A3)*Q1(B1)*Q1(B2)

- 1./2.*D(A1,B3)*D(A2,A3)*Q1(B1)*Q2(B2)

- 1./2.*D(A1,B3)*D(A2,A3)*Q1(B1)*Q3(B2)

- 1./4.*D(A1,B3)*D(A2,A3)*Q2(B1)*Q1(B2)

- 1./2.*D(A1,B3)*D(A2,A3)*Q2(B1)*Q2(B2)

- 1./4.*D(A1,B3)*D(A2,A3)*Q2(B1)*Q3(B2)

- 1./4.*D(A1,B3)*D(A2,A3)*Q3(B1)*Q1(B2)

- 1./2.*D(A1,B3)*D(A2,A3)*Q3(B1)*Q2(B2)
```

```
- 1./2.*D(A1,B3)*D(A2,A3)*Q3(B1)*Q3(B2)

+ D(A1,B3)*D(A2,A3)*D(B1,B2)
* ( 1./2.*Q1DQ1 + 3./4.*Q1DQ2 + 3./4.*Q1DQ3 + 1./2.*Q2DQ2 + 3./4.*Q2DQ3 + 1./2.*Q3DQ3 )

- 1./2.*D(A1,B3)*D(A2,B1)*Q1(A3)*Q1(B2)

- 1./2.*D(A1,B3)*D(A2,B1)*Q1(A3)*Q2(B2)

- 1./4.*D(A1,B3)*D(A2,B1)*Q1(A3)*Q3(B2)

- 1./4.*D(A1,B3)*D(A2,B1)*Q2(A3)*Q1(B2)

- 1./2.*D(A1,B3)*D(A2,B1)*Q2(A3)*Q2(B2)

- 1./4.*D(A1,B3)*D(A2,B1)*Q2(A3)*Q3(B2)

- 1./2.*D(A1,B3)*D(A2,B1)*Q3(A3)*Q1(B2)

- 1./2.*D(A1,B3)*D(A2,B1)*Q3(A3)*Q2(B2)

- 1./2.*D(A1,B3)*D(A2,B1)*Q3(A3)*Q3(B2)

+ D(A1,B3)*D(A2,B1)*D(A3,B2)
* ( 1./2.*Q1DQ1 + 3./4.*Q1DQ2 + 3./4.*Q1DQ3 + 1./2.*Q2DQ2 + 3./4.*Q2DQ3 + 1./2.*Q3DQ3 )

+ 1./2.*D(A1,B3)*D(A2,B2)*Q1(A3)*Q1(B1)

+ 1./2.*D(A1,B3)*D(A2,B2)*Q1(A3)*Q2(B1)

+ 1./4.*D(A1,B3)*D(A2,B2)*Q1(A3)*Q3(B1)
```


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```
+ 1./2.*D(A1,B3)*D(A2,B2)*Q2(A3)*Q1(B1)

+ D(A1,B3)*D(A2,B2)*Q2(A3)*Q2(B1)

+ 1./2.*D(A1,B3)*D(A2,B2)*Q2(A3)*Q3(B1)

+ 1./2.*D(A1,B3)*D(A2,B2)*Q3(A3)*Q1(B1)

+ 1./2.*D(A1,B3)*D(A2,B2)*Q3(A3)*Q2(B1)

+ 1./2.*D(A1,B3)*D(A2,B2)*Q3(A3)*Q3(B1)

+ D(A1,B3)*D(A2,B2)*D(A3,B1)
* ( - 1./2.*Q1DQ1 - 1./2.*Q1DQ2 - 3./4.*Q1DQ3 - 1./2.*Q2DQ2 - 1./2.*Q2DQ3 - 1./2.*Q3DQ3 )  +0.

                N R
                Z VERT3=VERT3
        L 2     ID,Q1(MU+)=-Q2(MU)-Q3(MU)
        L 3     ID,2,DOTPR,Q1(MU+)=-Q2(MU)-Q3(MU)
                DELETE VERT3
                *BEGIN

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0. VERT3.

RUNNING TIME (SEC)      55.97                          USED    MAXIMUM
TERMS IN OUTPUT           191
GENERATED TERMS           885        INPUT SPACE        254       2000
EQUAL TERMS               507        OUTPUT SPACE      2067       4740
CANCELLATIONS             187        NR. OF EXPR.        24        260
RECORDS WRITTEN           128        ID. REGISTER         7        500
MULTIPLICATIONS          3226        FUNCT. REG.         18        750

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
```

```
BEGIN      191.00  SECONDS

                *END

SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z. L1=Z. L2=Z, L3=Z.
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z.
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z. B2=Z.
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UC=C, UBG, DD=U, DB.
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1. GU, P0. P1. P2.

EXPR.          =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, VERT3.

RUNNING TIME (SEC)        .06                          USED    MAXIMUM
TERMS IN OUTPUT             0
GENERATED TERMS             0      INPUT SPACE          182       2000
EQUAL TERMS                 0      OUTPUT SPACE           0       4740
CANCELLATIONS               0      NR. OF EXPR.          17        260
RECORDS WRITTEN           133      ID. REGISTER           1        500
MULTIPLICATIONS             0      FUNCT. REG.            0        750

END OF RUN.    TIME      191.08  SECONDS
```

APPENDIX V

THE ONE-LOOP GRAVITON CONTRIBUTION TO THE GRAVITON SELF-ENERGY

-GENERAL α AND THE LIMIT $\alpha \to 0$-

Goldberg's Parametrization

SCHOONSCHIP , VERSION OF APRIL 1, 1977

TIME .30 SECONDS

```
      C WORKS OUT PH1**3 PART OF R AND G**.F*P
      COMMON LAG
      S ALFA,D1,D2,D1Q,D1PQ,D2Q,D2PQ,W,W1,Z,K,
        I1T11,I1T12, I1T22,
        I2T11,I2T12,I2T21,I2T22,
        I3T11,I3T12,I3T22,
        I4T11,I4T12,I4T21,I4T22,
        I5T11,I5T12,I5T21,I5T22,
        I6T11,I6T12,I6T21,I6T22,
        I7T11,I7T12,I7T21,I7T22,
        I8T11,I8T12,I8T21,I8T22,
        I9T11,I9T12,I9T22,
        I1011,I1012,I1021,I1022,
        I1111,I1112,I1121,I1122,
        I1211,I1212,I1221,I1222,
        I1311,I1312,I1321,I1322,
        I1411,I1412,I1421,I1422,
        I1511,I1512,I1521,I1522
      I MU=Z,NU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=Z,L6=Z,
       L7=Z,L8=Z,L9=Z,RO=Z,SI=Z,AA=Z,BB=Z,CC=Z,AA1=Z,AA2=Z,AA3=Z,
       A1=Z,A2=Z,A3=Z,B1=Z,B2=Z,B3=Z,J,BB1=Z,BB2=Z,BB3=Z,LA=Z,
       S1=Z,S2=Z,S3=Z,S4=Z
      F GU,PO,P1
      *FIX
```

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.

EXPR. LAG.

```
BEGIN          .66  SECONDS

                    U B
                    Z LAG=1./2.*K**-3*(W1*(D(RO,SI)+1./2.*K*(PO(RO,SI)+PO(SI,RO)))
                          1./4.*(GU(LA,MU)+GU(MU,LA))*(GU(KA,NU)+GU(NU,KA))
                         -1./2.*(D(RO,SI)+1./2.*K*(PO(RO,SI)+PO(SI,RO)))*
                          1./4.*(GU(MU,KA)+GU(KA,MU))*(GU(LA,NU)+GU(NU,LA))
                         -2*W1*D(SI,KA)*D(RO,LA)+1./2.*(GU(MU,NU)+GU(NU,MU)))*
                          1./4.*K**2*(P2(MU,KA,RO)+P1(KA,MU,RO))
                                    *(P2(LA,NU,SI)+P1(NU,LA,SI))
              L 4         ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                           +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                                       +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                           -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                                       +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                                       +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                                       +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                                       +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                                       +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                                       +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                                       +PO(L3,A)*PO(L4,L3)*PO(B,L4)))
                                     *(D(AA,BB)-1./2.*K*(PO(AA,BB)+PO(BB,AA))
                           +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                                       +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                           -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                                       +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                                       +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                                       +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                                       +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                                       +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                                       +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                                       +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
              L 7         ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                           +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                                       +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                           -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                                       +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                                       +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                                       +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                                       +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                                       +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                                       +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                                       +PO(L3,A)*PO(L4,L3)*PO(B,L4))
              L 9         ID,K=0
                          UPRINT LAG
                          *BEGIN

SYMBOLS                 I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11,
                        I1T12, I1T21, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                        I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                        I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                        I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                        I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                        I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                        I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522.

INDICES                 MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                        L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                        CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                        B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS               D, DPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                        DT, DS=U, DX, DK, DP, DF=U, GU, PO, P1.
```

EXPR. LAG.

			USED	MAXIMUM
RUNNING TIME (SEC)	71.06			
TERMS IN OUTPUT	68			
GENERATED TERMS	248	INPUT SPACE	667	2000
EQUAL TERMS	180	OUTPUT SPACE	533	4740
CANCELLATIONS	0	NR. OF EXPR.	50	260
RECORDS WRITTEN	0	ID. REGISTER	14	500
MULTIPLICATIONS	132601	FUNCT. REG.	39	750

BEGIN 71.78 SECONDS

```
NAMES LAG
COMMON V1,V2,V3,V4,V5,V6,VERT3
S Z,KK
V Q1,Q2,Q3
*FIX
```

SYMBOLS I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3.

FUNCTIONS D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. LAG, V1, V2, V3, V4, V5, V6, VERT3.

BEGIN 71.90 SECONDS

```
BEGIN      71.90  SECONDS

                N R
                C WORKS OUT THE 3-GRAVITON VERTEX
                Z LAG=LAG
          L 2   ID,K**(J+)=KK**(-J)
          L 3   ID,KK=0
                NPRINT LAG
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)        .30                          USED    MAXIMUM
TERMS IN OUTPUT            56
GENERATED TERMS            56      INPUT SPACE          247       2000
EQUAL TERMS                 0      OUTPUT SPACE         449       4740
CANCELLATIONS               0      NR. OF EXPR.          24        260
RECORDS WRITTEN             3      ID. REGISTER           6        500
MULTIPLICATIONS           377      FUNCT. REG.           14        750

                N R
                Z V1=LAG
          L 2   ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                 D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*D(L5,A3)*D(L6,B3)*
                 Q3(L7)*Q3(L8)
          L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                 D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                 D(L7,A3)*D(L8,B3)
                NPRINT V1
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
```

```
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=1, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	.07			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	22	260
RECORDS WRITTEN	7	ID. REGISTER	31	500
MULTIPLICATIONS	201	FUNCT. REG.	25	750

```
SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=1, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.           LAG, V1, V2, V3, V4, V5, V6, VERT3.
                     N R
                     Z V2=LAG
                L 2  ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                      D(L1,A1)*D(L2,B1)*D(L3,A3)*D(L4,B3)*D(L5,A2)*D(L6,B2)*
                      Q2(L7)*Q2(L8)
                L 3  ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                      D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                      D(L7,A2)*D(L8,B2)
                     NPRINT V2
                     *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,


                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.
```

B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR. LAG, V1, V2, V3, V4, V5, V6, VERT3.

			USED	MAXIMUM
RUNNING TIME (SEC)	1.44			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	193	4740
CANCELLATIONS	0	NR. OF EXPR.	23	260
RECORDS WRITTEN	9	ID. REGISTER	31	500
MULTIPLICATIONS	281	FUNCT. REG.	25	750

SYMBOLS I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR. LAG, V1, V2, V3, V4, V5, V6, VERT3.

```
     N R
     Z V3=LAG
L 2  ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)*
      D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*D(L5,A3)*D(L6,B3)*
      Q3(L7)*Q3(L8)
L 3  ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*
      D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
      D(L7,A3)*D(L8,B3)
     NPRINT V3
     *NEXT
```

SYMBOLS I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3

```
VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	2.01			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	24	250
RECORDS WRITTEN	11	ID. REGISTER	31	500
MULTIPLICATIONS	201	FUNCT. REG.	25	750

```
SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1P0, D2Q, D2P0, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R1=Z, S1=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N B
                    Z V4=LAG
          L 2       ID,ADISD,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                     D(L1,A2)*D(L2,B2)*D(L3,A3)*D(L4,B3)*D(L5,A1)*D(L6,B1)*
                     Q1(L7)*Q1(L8)
          L 3       ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                     D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                     D(L7,A1)*D(L8,B1)
                    NPRINT V4
                    *NEXT

SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1P0, D2Q, D2P0, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R1=Z, S1=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.
```

```
VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	2.59			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	25	260
RECORDS WRITTEN	13	ID. REGISTER	31	500
MULTIPLICATIONS	281	FUNCT. REG.	25	750

```
SYMBOLS        I=I, ALFA, D1, D2, D10, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, ST=Z, AA=Z, B8=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z V5=LAG
               L 2  ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*D(L3,A1)*D(L4,B1)*D(L5,A2)*D(L6,B2)*
                     Q2(L7)*Q2(L8)
               L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                     D(L7,A2)*D(L8,B2)
                    NPRINT V5
                    *NEXT

SYMBOLS        I=I, ALFA, D1, D2, D10, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, ST=Z, AA=Z, B8=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
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FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	3.16			
TERMS IN OUTPUT	26			
GENERATED TERMS	56	INPUT SPACE	302	2000
EQUAL TERMS	30	OUTPUT SPACE	183	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	15	ID. REGISTER	31	500
MULTIPLICATIONS	281	FUNCT. REG.	25	750

```
SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R1=Z, S1=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z V6=LAG
          L 2       ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*D(L3,A2)*D(L4,B2)*D(L5,A1)*D(L6,B1)*
                     Q1(L7)*Q1(L8)
          L 3       ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                     D(L7,A1)*D(L8,B1)
                    NPRINT V6
                    *NEXT

SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R1=Z, S1=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.
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FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)      3.75                          USED    MAXIMUM
TERMS IN OUTPUT           20
GENERATED TERMS           56      INPUT SPACE        302      2000
EQUAL TERMS               30      OUTPUT SPACE       183      4740
CANCELLATIONS              9      NR. OF EXPR.        27       260
RECORDS WRITTEN           17      ID. REGISTER        31       500
MULTIPLICATIONS          281      FUNCT. REG.         25       750

SYMBOLS        I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.
                    N R
                    Z VERT3=V1+V2+V3+V4+V5+V6
                    NPRINT VERT3
                    DELETE LAG,V1,V2,V3,V4,V5,V6
                    *BEGIN

SYMBOLS        I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR.          LAG, V1, V2, V3, V4, V5, V6, VERT3.

RUNNING TIME (SEC)      4.32                          USED    MAXIMUM
```

TERMS IN OUTPUT	78			
GENERATED TERMS	156	INPUT SPACE	234	2000
EQUAL TERMS	78	OUTPUT SPACE	459	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	29	ID. REGISTER	1	500
MULTIPLICATIONS	474	FUNCT. REG.	18	750

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, B0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1, P2.

EXPR. LAG, V1, V2, V3, V4, V5, V6, VERT3.

BEGIN 76.42 SECONDS

```
BEGIN      76.42  SECONDS

     NAMES VERT3
     C CONTRIBUTIONS TO THE GRAVITON SELF-ENERGY
     COMMON VV1,VV2,VG1,VG2,PP1,PP2,LOOP,GHOST,LOOP,GHOST,
            VV3,VV4,VG3,VG4,PP3,PP4
     V P,Q,K1,K2,K3
     X GG(A1,B1,A2,B2)=1./2.*((D(A1,A2)*D(B1,B2)
                              +D(A1,B2)*D(A2,B1)
                              -D2*D(A1,B1)*D(A2,B2))*PDP**-1
                              +D1*(2*D(A1,B1)*P(A2)*P(B2)
                                  +2*D(A2,B2)*P(A1)*P(B1)
                                  -D(A1,A2)*P(B1)*P(B2)
                                  -D(A1,B2)*P(A2)*P(B1)
                                  -D(A2,B1)*P(A1)*P(B2)
                                  -D(B1,B2)*P(A1)*P(A2))*PDP**-2)
     X V(RO,SI,L,MU)=1./2.*(-K1(MU)*K1(RO)*D(L,SI)
                            -K1(MU)*K1(SI)*D(L,RO)
                            +2*K3(RO)*K3(SI)*D(L,MU)
                            +K1(RO)*K3(SI)*D(L,MU)
                            +K1(SI)*K3(RO)*D(L,MU)
                            -K1(RO)*K3(MU)*D(L,SI)
                            -K1(SI)*K3(MU)*D(L,RO))
     *FIX.

SYMBOLS    I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, M, M1, Z, K, I1T11,
           I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
           I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
           I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
           I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
           I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
           I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
           I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
           KK.

INDICES    MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
           L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PO=Z, SI=Z, AA=Z, BB=Z,
           CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
           B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS    Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS  D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
           DT, DS=U, DX, DK, DP, DF=U, GU, PG, P1.

EXPR.      =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
           PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
           PP3, PP4, GG=3, V=2.
```

```
                N R
                Z VV1=VERT3
                Z VG1=V(A1,B1,A2,A3)
                Z PP1=1./2.*((D(A2,AA2)*D(B2,BB2)
                             +D(A2,BB2)*D(AA2,B2)
                        -D2*D(A2,B2)*D(AA2,BB2))*D10
                             +D1*(2*D(A2,B2)*Q2(AA2)*Q2(BB2)
                                +2*D(AA2,BB2)*Q2(A2)*Q2(B2)
                                -D(A2,AA2)*Q2(B2)*Q2(BB2)
                                -D(A2,BB2)*Q2(AA2)*Q2(B2)
                                -D(AA2,B2)*Q2(A2)*Q2(BB2)
                                -D(B2,BB2)*Q2(A2)*Q2(AA2))*D20)
L 3             ID Q1(MU+)=P(MU)
L 3             AL Q2(MU+)=-Q(MU)
L 3             AL Q3(MU+)=Q(MU)-P(MU)
L 4             ID,2,DOTPR,Q1(MU+)=P(MU)
L 6             ID,2,DOTPR,Q2(MU+)=-Q(MU)
L 8             ID,2,DOTPR,Q3(MU+)=Q(MU)-P(MU)
L10             ID K1(MU+)=P(MU)
L10             AL K2(MU+)=-Q(MU)
L10             AL K3(MU+)=Q(MU)-P(MU)
                NPRINT VV1,VG1,PP1
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, QQ=Z, ST=Z, A4=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PG, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
                PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
                PP3, PP4, GG=3, V=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	1.13			
TERMS IN OUTPUT	112			
GENERATED TERMS	153	INPUT SPACE	460	2000
EQUAL TERMS	26	OUTPUT SPACE	785	4740
CANCELLATIONS	15	NR. OF EXPR.	42	260
RECORDS WRITTEN	23	ID. REGISTER	28	500
MULTIPLICATIONS	983	FUNCT. REG.	8	750

```
                N R
                Z VV2=VERT3*D(A1,AA1)*D(B1,BB1)*D(A2,AA2)*D(B2,BB2)
                          *D(A3,AA3)*D(B3,BB3)
                Z VG2=V(AA1,BB1,AA2,AA3)
                Z PP2=1./2.*((D(A3,AA3)*D(B3,BB3)

                             +D(A3,BB3)*D(AA3,B3)
                        -D2*D(A3,B3)*D(AA3,BB3))*D1PQ
```

```
                                    +D(A3,BB3)*D(AA3,B3)
                                -D2*D(A3,B3)*D(AA3,BB3))*D2PQ
                                    +D1*(2*D(A3,B3)*Q3(AA3)*Q3(BB3)
                                        +2*D(AA3,BB3)*Q3(A3)*Q3(B3)
                                       -D(A3,AA3)*Q3(B3)*Q3(BB3)
                                       -D(A3,BB3)*Q3(AA3)*Q3(B3)
                                       -D(AA3,B3)*Q3(A3)*Q3(BB3)
                                       -D(B3,BB3)*Q3(A3)*Q3(AA3))*D2PQ)
L 3             ID Q1(MU+)=-P(MU)
L 3             AL Q2(MU+)=Q(MU)
L 3             AL Q3(MU+)=P(MU)-Q(MU)
L 4             ID,2,DOTPR,Q1(MU+)=-P(MU)
L 6             ID,2,DOTPR,Q2(MU+)=Q(MU)
L 8             ID,2,DOTPR,Q3(MU+)=P(MU)-Q(MU)
L10             ID K1(MU+)=-P(MU)
L10             AL K2(MU+)=P(MU)-Q(MU)
L10             AL K3(MU+)= Q(MU)
                NPRINT VV2,VG2,PP2
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, B0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
                DT, DS=U, DX, DK, DP, DF=U, GU, PU, PL.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
                PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
                PP3, PP4, GG=3, V=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	2.45			
TERMS IN OUTPUT	132			
GENERATED TERMS	164	INPUT SPACE	468	2000
EQUAL TERMS	20	OUTPUT SPACE	855	4740
CANCELLATIONS	12	NR. OF EXPR.	45	260
RECORDS WRITTEN	30	ID. REGISTER	28	500
MULTIPLICATIONS	871	FUNCT. REG.	19	750

```
SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
```

```
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, BD=Z, ST=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
                PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
                PP3, PP4, GG=3, V=2.
                     N R
                     Z LOOP=VV1*PP1
                     Z GHOST=VG1*D(A2,AA3)*D(A3,AA2)*D10*D1P0*VG2
                     UPRINT LOOP,GHOST
                     *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, U, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, BD=Z, ST=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
                PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
                PP3, PP4, GG=3, V=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	5.77			
TERMS IN OUTPUT	313			
GENERATED TERMS	917	INPUT SPACE	349	2000
EQUAL TERMS	506	OUTPUT SPACE	2437	4740
CANCELLATIONS	98	NR. OF EXPR.	35	260
RECORDS WRITTEN	37	ID. REGISTER	1	500
MULTIPLICATIONS	5504	FUNCT. REG.	48	750

```
SYMBOLS         I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, BD=Z, ST=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
```

```
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PG, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
                PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
                PP3, PP4, GG=3, V=2.
                     N R
                     Z LOOP=LOOP*PP2
                     NPRINT LOOP
                     *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, ST=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PG, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
                PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
                PP3, PP4, GG=3, V=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	39.65			
TERMS IN OUTPUT	4982			
GENERATED TERMS	7857	INPUT SPACE	341	2000
EQUAL TERMS	2430	OUTPUT SPACE	4739	4740
CANCELLATIONS	437	NR. OF EXPR.	36	260
RECORDS WRITTEN	113	ID. REGISTER	1	500
MULTIPLICATIONS	47143	FUNCT. REG.	50	750

```
SYMBOLS         I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, ST=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.
```

```
FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.         =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
              PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
              PP3, PP4, GG=3, V=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	47.29			
TERMS IN OUTPUT	1675			
GENERATED TERMS	7857	INPUT SPACE	341	2000
EQUAL TERMS	5134	OUTPUT SPACE	6154	7126
CANCELLATIONS	1048	NR. OF EXPR.	36	260
RECORDS WRITTEN	143	ID. REGISTER	1	500
MULTIPLICATIONS	47143	FUNCT. REG.	50	750

```
N R
Z LOOP=LOOP*VV2
NPRINT LOOP
DELETE VV1,VV2,VG1,VG2,PP1,PP2
*BEGIN

SYMBOLS       I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
              I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
              I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
              I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
              I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
              I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
              I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
              I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
              KK.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.         =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,
              PP1, PP2, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4,
              PP3, PP4, GG=3, V=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	74.15			
TERMS IN OUTPUT	698			
GENERATED TERMS	8192	INPUT SPACE	340	2000
EQUAL TERMS	6680	OUTPUT SPACE	3797	4740
CANCELLATIONS	814	NR. OF EXPR.	37	260
RECORDS WRITTEN	156	ID. REGISTER	1	500
MULTIPLICATIONS	49153	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	99.42			
TERMS IN OUTPUT	4705			
GENERATED TERMS	16384	INPUT SPACE	340	2000
EQUAL TERMS	10592	OUTPUT SPACE	4740	4740
CANCELLATIONS	1087	NR. OF EXPR.	37	260
RECORDS WRITTEN	212	ID. REGISTER	1	500
MULTIPLICATIONS	98305	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	125.85			
TERMS IN OUTPUT	9474			
GENERATED TERMS	24576	INPUT SPACE	340	2000
EQUAL TERMS	13971	OUTPUT SPACE	4740	4740
CANCELLATIONS	1131	NR. OF EXPR.	37	260
RECORDS WRITTEN	280	ID. REGISTER	1	500
MULTIPLICATIONS	147457	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	151.50			
TERMS IN OUTPUT	15869			
GENERATED TERMS	32768	INPUT SPACE	340	2000
EQUAL TERMS	15741	OUTPUT SPACE	4740	4740
CANCELLATIONS	1158	NR. OF EXPR.	37	260
RECORDS WRITTEN	372	ID. REGISTER	1	500
MULTIPLICATIONS	196609	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	177.84			
TERMS IN OUTPUT	21223			
GENERATED TERMS	40960	INPUT SPACE	340	2000
EQUAL TERMS	18547	OUTPUT SPACE	4740	4740
CANCELLATIONS	1190	NR. OF EXPR.	37	260
RECORDS WRITTEN	448	ID. REGISTER	1	500
MULTIPLICATIONS	245761	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	203.46			
TERMS IN OUTPUT	27660			
GENERATED TERMS	49152	INPUT SPACE	340	2000
EQUAL TERMS	20264	OUTPUT SPACE	4740	4740
CANCELLATIONS	1220	NR. OF EXPR.	37	260
RECORDS WRITTEN	540	ID. REGISTER	1	500
MULTIPLICATIONS	294913	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	229.03			
TERMS IN OUTPUT	34769			
GENERATED TERMS	57344	INPUT SPACE	340	2000
EQUAL TERMS	21329	OUTPUT SPACE	4740	4740
CANCELLATIONS	1246	NR. OF EXPR.	37	260
RECORDS WRITTEN	642	ID. REGISTER	1	500
MULTIPLICATIONS	344065	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	255.31			
TERMS IN OUTPUT	41578			
GENERATED TERMS	65536	INPUT SPACE	340	2000
EQUAL TERMS	22693	OUTPUT SPACE	4740	4740
CANCELLATIONS	1265	NR. OF EXPR.	37	260
RECORDS WRITTEN	740	ID. REGISTER	1	500
MULTIPLICATIONS	393217	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	280.45			
TERMS IN OUTPUT	47606			
GENERATED TERMS	73728	INPUT SPACE	340	2000
EQUAL TERMS	24836	OUTPUT SPACE	4740	4740
CANCELLATIONS	1286	NR. OF EXPR.	37	260
RECORDS WRITTEN	825	ID. REGISTER	1	500
MULTIPLICATIONS	442369	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	305.67			

TERMS IN OUTPUT	53942			
GENERATED TERMS	81920	INPUT SPACE	340	2000
EQUAL TERMS	26654	OUTPUT SPACE	4740	4740
CANCELLATIONS	1324	NR. OF EXPR.	37	260
RECORDS WRITTEN	915	ID. REGISTER	1	500
MULTIPLICATIONS	491521	FUNCT. REG.	49	750

RUNNING TIME (SEC)	331.28		USED	MAXIMUM
TERMS IN OUTPUT	60970			
GENERATED TERMS	90112	INPUT SPACE	340	2000
EQUAL TERMS	27795	OUTPUT SPACE	4740	4740
CANCELLATIONS	1347	NR. OF EXPR.	37	260
RECORDS WRITTEN	1015	ID. REGISTER	1	500
MULTIPLICATIONS	540673	FUNCT. REG.	49	750

RUNNING TIME (SEC)	357.18		USED	MAXIMUM
TERMS IN OUTPUT	68084			
GENERATED TERMS	98304	INPUT SPACE	340	2000
EQUAL TERMS	28858	OUTPUT SPACE	4740	4740
CANCELLATIONS	1362	NR. OF EXPR.	37	260
RECORDS WRITTEN	1115	ID. REGISTER	1	500
MULTIPLICATIONS	589825	FUNCT. REG.	49	750

RUNNING TIME (SEC)	382.74		USED	MAXIMUM
TERMS IN OUTPUT	75191			
GENERATED TERMS	106496	INPUT SPACE	340	2000
EQUAL TERMS	29924	OUTPUT SPACE	4740	4740
CANCELLATIONS	1381	NR. OF EXPR.	37	260
RECORDS WRITTEN	1216	ID. REGISTER	1	500
MULTIPLICATIONS	638977	FUNCT. REG.	49	750

RUNNING TIME (SEC)	408.23		USED	MAXIMUM
TERMS IN OUTPUT	82507			
GENERATED TERMS	114688	INPUT SPACE	340	2000
EQUAL TERMS	30785	OUTPUT SPACE	4740	4740
CANCELLATIONS	1396	NR. OF EXPR.	37	260
RECORDS WRITTEN	1320	ID. REGISTER	1	500
MULTIPLICATIONS	688129	FUNCT. REG.	49	750

RUNNING TIME (SEC)	433.91		USED	MAXIMUM
TERMS IN OUTPUT	89412			
GENERATED TERMS	122880	INPUT SPACE	340	2000
EQUAL TERMS	32066	OUTPUT SPACE	4740	4740
CANCELLATIONS	1402	NR. OF EXPR.	37	260
RECORDS WRITTEN	1410	ID. REGISTER	1	500
MULTIPLICATIONS	737281	FUNCT. REG.	49	750

RUNNING TIME (SEC)	459.31		USED	MAXIMUM
TERMS IN OUTPUT	96710			
GENERATED TERMS	131072	INPUT SPACE	340	2000
EQUAL TERMS	32959	OUTPUT SPACE	4740	4740
CANCELLATIONS	1403	NR. OF EXPR.	37	260
RECORDS WRITTEN	1523	ID. REGISTER	1	500
MULTIPLICATIONS	786433	FUNCT. REG.	49	750

RUNNING TIME (SEC)	484.99		USED	MAXIMUM
TERMS IN OUTPUT	103542			

GENERATED TERMS	139264	INPUT SPACE	340	2000
EQUAL TERMS	34312	OUTPUT SPACE	4740	4740
CANCELLATIONS	1410	NR. OF EXPR.	37	260
RECORDS WRITTEN	1621	ID. REGISTER	1	500
MULTIPLICATIONS	835585	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	510.59			
TERMS IN OUTPUT	111026			
GENERATED TERMS	147456	INPUT SPACE	340	2000
EQUAL TERMS	35017	OUTPUT SPACE	4740	4740
CANCELLATIONS	1413	NR. OF EXPR.	37	260
RECORDS WRITTEN	1727	ID. REGISTER	1	500
MULTIPLICATIONS	884737	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	536.43			
TERMS IN OUTPUT	118743			
GENERATED TERMS	155648	INPUT SPACE	342	2000
EQUAL TERMS	35491	OUTPUT SPACE	4740	4740
CANCELLATIONS	1414	NR. OF EXPR.	37	260
RECORDS WRITTEN	1837	ID. REGISTER	1	500
MULTIPLICATIONS	933889	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	562.04			
TERMS IN OUTPUT	125397			
GENERATED TERMS	163840	INPUT SPACE	342	2000
EQUAL TERMS	37011	OUTPUT SPACE	4740	4740
CANCELLATIONS	1432	NR. OF EXPR.	37	260
RECORDS WRITTEN	1932	ID. REGISTER	1	500
MULTIPLICATIONS	983041	FUNCT. REG.	49	750

			USED	MAXIMUM
RUNNING TIME (SEC)	563.01			
TERMS IN OUTPUT	125624			
GENERATED TERMS	164150	INPUT SPACE	342	2000
EQUAL TERMS	37093	OUTPUT SPACE	4740	4740
CANCELLATIONS	1433	NR. OF EXPR.	37	260
RECORDS WRITTEN	1936	ID. REGISTER	1	500
MULTIPLICATIONS	984901	FUNCT. REG.	49	750

SYMBOLS I=I, ALFA, D1, D2, D10, D1PQ, D20, D2P0, W, V1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, D8, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2,

```
BEGIN     822.41  SECONDS

          NAMES LOOP,GHOST
          COMMON TT0,TT1,TT2,TT3
          *FIX

SYMBOLS   I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11,
          I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
          I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
          I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
          I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
          I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
          I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
          I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
          KK.

INDICES   MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
          L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
          CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
          B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS   Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB,
          DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.     =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
          =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
          PP4, GG=3, V=2, TT0, TT1, TT2, TT3.
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```
BEGIN     822.55  SECONDS

          C THIS SECTION DOES THE Q( INTERNAL MTM.) -INTEGRATIONS

          Z LOOP=LOOP
          Z GHOST=GHOST
L 2       ID QDQ**3*D1Q=0
L 2       AL QDQ**2*D1Q=0
L 2       AL QDQ*D1Q=0
L 2       AL QDQ**4*D2Q=0
L 2       AL QDQ**3*D2Q=0
L 2       AL QDQ**2*D2Q=0
L 3       ID  PDQ*QDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
            *D2Q*D1PQ
           =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3))
             *I1011
            +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
              D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
             *I1111
            +P(S1)*P(S2)*P(S3)*P(S4)
             *I1211
L 5       ID  PDQ*QDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
            *D2Q*D2PQ
           =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
            *I1012
            +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
              D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2))
           *I1112
            +P(S1)*P(S2)*P(S3)*P(S4)
            *I1212

L 7       ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D1Q*D1PQ
           =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
             *I1311
            +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
              D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
            *I1411
            +P(S1)*P(S2)*P(S3)*P(S4)
            *I1511
L 9       ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D1Q*D2PQ
           =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
             *I1312
            +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
              D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
            *I1412
            +P(S1)*P(S2)*P(S3)*P(S4)
            *I1512
L11       ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D2Q*D1PQ
           =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
            *I1321
            +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
              D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
            *I1421
            +P(S1)*P(S2)*P(S3)*P(S4)
            *I1521
L13       ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D2Q*D2PQ
           =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
            *I1322
            +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
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                    D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
                  *I1422
                   +P(S1)*P(S2)*P(S3)*P(S4)
                   *I1522

        L15       ID  QDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
                    *D2Q*D1PQ
                   =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
                    *I9T11
                    +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
                      D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
                    *I8T11
                    +P(S1)*P(S2)*P(S3)*P(S4)
                    *I7T11
        L17       ID  QDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
                    *D2Q*D2PQ
                   =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
                    *I9T12
                    +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
                      D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
                    *I8T12
                    +P(S1)*P(S2)*P(S3)*P(S4)
                    *I7T12

        L19       ID  QDQ*PDQ*Q(S1+)*Q(S2+)*Q(S3+)
                    *D2Q*D1PQ
                    =P(S1)*P(S2)*P(S3)*(PDP*I7T11 +3*I8T11)
                    +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S 1))
                     *(I9T11+PDP*I8T11)
        L21       ID  QDQ*PDQ*Q(S1+)*Q(S2+)*Q(S3+)
                    *D2Q*D2PQ
                    =P(S1)*P(S2)*P(S3)*(PDP*I7T12 +3*I8T12)
                    +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S 1))
                     *(I9T12+PDP*I8T12)

        L23       ID  QDQ*PDQ**2*Q(S1+)*Q(S2+)
                    *D2Q*D1PQ
                    =P(S1)*P(S2)*(2*I9T11+5*PDP* I8T11+PDP**2*I7T11)
                    +D(S1,S2)*(PDP*I9T11+PDP**2*I8T11)

                  *YEP

SYMBOLS           I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, IJT11,
                  I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                  I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                  I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                  I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                  I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                  I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                  I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                  KK.

INDICES           MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                  L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
                  CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                  B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS           Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS         D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                  DT, DS=U, DX, DK, DP, DF=U, GU, PQ, P1.

EXPR.             =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
                  =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
```

			USED	MAXIMUM
RUNNING TIME (SEC)	23.51			
TERMS IN OUTPUT	3453			
GENERATED TERMS	3602	INPUT SPACE	1101	2000
EQUAL TERMS	133	OUTPUT SPACE	4737	4740
CANCELLATIONS	16	NR. OF EXPR.	79	260
RECORDS WRITTEN	4255	ID. REGISTER	198	500
MULTIPLICATIONS	25929	FUNCT. REG.	10	750

			USED	MAXIMUM
RUNNING TIME (SEC)	25.23			
TERMS IN OUTPUT	3413			
GENERATED TERMS	3602	INPUT SPACE	1101	2000
EQUAL TERMS	170	OUTPUT SPACE	7123	7126
CANCELLATIONS	17	NR. OF EXPR.	79	260
RECORDS WRITTEN	4279	ID. REGISTER	198	500
MULTIPLICATIONS	25929	FUNCT. REG.	10	750

			USED	MAXIMUM
RUNNING TIME (SEC)	26.01			
TERMS IN OUTPUT	3403			
GENERATED TERMS	3602	INPUT SPACE	1101	2000
EQUAL TERMS	182	OUTPUT SPACE	5101	7126
CANCELLATIONS	17	NR. OF EXPR.	79	260
RECORDS WRITTEN	4295	ID. REGISTER	198	500
MULTIPLICATIONS	25929	FUNCT. REG.	10	750

```
L 1     ID  QDQ*PDQ**2*Q(S1+)*Q(S2+)
              *D2Q*D2PQ
              =P(S1)*P(S2)*(2*I9T12+5*PDP* I8T12+PDP**2*I7T12)
              +D(S1,S2)*(PDP*I9T12+PDP**2*I8T12)

L 3     ID  PDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D1Q*D1PQ
             =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
              *I1011
              +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
                D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
              *I1111
              +P(S1)*P(S2)*P(S3)*P(S4)
              *I1211
L 5     ID  PDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D1Q*D2PQ
             =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
              *I1012
              +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
                D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
              *I1112
              +P(S1)*P(S2)*P(S3)*P(S4)
              *I1212
L 7     ID  PDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D2Q*D1PQ
             =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
              *I1021
              +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
                D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
              *I1121
              +P(S1)*P(S2)*P(S3)*P(S4)
              *I1221
L 9     ID  PDQ*Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)
              *D2Q*D2PQ
             =(D(S1,S2)*D(S3,S4)+D(S1,S4)*D(S2,S3)+D(S2,S4)*D(S1,S3) )
              *I1022


              +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
                D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2) )
```

```
                +(D(S1,S2)*P(S3)*P(S4)+D(S2,S3)*P(S1)*P(S4)+D(S2,S4)*P(S1)*P(S3)+
                  D(S1,S3)*P(S2)*P(S4)+D(S1,S4)*P(S2)*P(S3)+D(S3,S4)*P(S1)*P(S2)
                *I1122
                +P(S1)*P(S2)*P(S3)*P(S4)
                *I1222

L11         ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)
                *D1Q*D1PQ
                =P(S1)*P(S2)*P(S3)*(PDP*I1211+3*I1111)
                 +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S1))
                *(I1011+PDP*I1111)
L13         ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)
                *D1Q*D2PQ
                =P(S1)*P(S2)*P(S3)*(PDP*I1212+3*I1112)
                 +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S1))
                *(I1012+PDP*I1112 )
L15         ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)
                *D2Q*D1PQ
                =P(S1)*P(S2)*P(S3)*(PDP*I1221+3*I1121)
                 +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S1))
                *(I1021+PDP*I1121 )
L17         ID  PDQ**2*Q(S1+)*Q(S2+)*Q(S3+)
                *D2Q*D2PQ
                =P(S1)*P(S2)*P(S3)*(PDP*I1222+3*I1122)
                 +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S1))
                *(I1022+PDP*I1122 )

L19         ID  PDQ**3*Q(S1+)*Q(S2+)*D1Q*D1PQ
                =P(S1)*P(S2)*(2*I1011+5*PDP*I1111+PDP**2*I1211)
                +D(S1,S2)*(PDP*I1011+PDP**2*I1111)
L21         ID  PDQ**3*Q(S1+)*Q(S2+)*D1Q*D2PQ
                =P(S1)*P(S2)*(2*I1012+5*PDP*I1112+PDP**2*I1212)
                +D(S1,S2)*(PDP*I1012+PDP**2*I1112)
               *YEP

SYMBOLS     I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
            I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
            I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
            I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
            I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
            I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
            I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
            I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
            KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, B0=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.       =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
            =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
            PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT    3403 ,TERMS IN     3403

RUNNING TIME (SEC)      43.98                          USED    MAXIMUM
TERMS IN OUTPUT          3773
GENERATED TERMS          4002        INPUT SPACE        898       2000
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        L 2       ID QDQ*Q(S1+)*Q(S2+)*D2Q*D2PQ
                    =D(S1,S2)*I3T12+P(S1)*P(S2)*I4T12
        L 3       ID QDQ*PDQ*Q(S1+)*D2Q*D1PQ
                    =P(S1)*I3T11+PDP*P(S1)*I4T11
        L 4       ID QDQ*PDQ*Q(S1+)*D2Q*D2PQ
                    =P(S1)*I3T12+PDP*P(S1)*I4T12
        L 5       ID QDQ*PDQ**2*D2Q*D1PQ=PDP*I3T11+PDP**2*I4T11
        L 6       ID QDQ*PDQ**2*D2Q*D2PQ=PDP*I3T12+PDP**2*I4T12
                  *YEP

SYMBOLS       I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
              I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
              I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
              I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
              I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
              I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
              I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
              I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
              KK.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.         =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
              =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
              PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT      4152 ,TERMS IN      4152

RUNNING TIME (SEC)      130.35                          USED    MAXIMUM
TERMS IN OUTPUT           4292
GENERATED TERMS           4503      INPUT SPACE          429       2000
EQUAL TERMS                197      OUTPUT SPACE        4738       4740
CANCELLATIONS               14      NR. OF EXPR.          40        260
RECORDS WRITTEN           4780      ID. REGISTER          63        500
MULTIPLICATIONS           9700      FUNCT. REG.            4        750


RUNNING TIME (SEC)      132.91                          USED    MAXIMUM
TERMS IN OUTPUT           4132
GENERATED TERMS           4503      INPUT SPACE          429       2000
EQUAL TERMS                346      OUTPUT SPACE        7126       7126
CANCELLATIONS               25      NR. OF EXPR.          40        260
RECORDS WRITTEN           4811      ID. REGISTER          63        500
MULTIPLICATIONS           9708      FUNCT. REG.            4        750


RUNNING TIME (SEC)      134.71                          USED    MAXIMUM
TERMS IN OUTPUT           4063
GENERATED TERMS           4503      INPUT SPACE          429       2000
EQUAL TERMS                410      OUTPUT SPACE        7123       7126
CANCELLATIONS               30      NR. OF EXPR.          40        260
RECORDS WRITTEN           4827      ID. REGISTER          63        500
MULTIPLICATIONS           9700      FUNCT. REG.            4        750


RUNNING TIME (SEC)      134.85                          USED    MAXIMUM
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                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R7=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PG, PL.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
                =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
                PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT       3723 ,TERMS IN      3723

RUNNING TIME (SEC)      63.19
TERMS IN OUTPUT          3935
GENERATED TERMS          4345
EQUAL TERMS               393
CANCELLATIONS              17
RECORDS WRITTEN          4443
MULTIPLICATIONS          9850

                                                USED    MAXIMUM
INPUT SPACE                                      603       2000
OUTPUT SPACE                                    4740       4740
NR. OF EXPR.                                      54        260
ID. REGISTER                                     115        500
FUNCT. REG.                                        5        750


RUNNING TIME (SEC)      65.28
TERMS IN OUTPUT          3781
GENERATED TERMS          4345
EQUAL TERMS               542
CANCELLATIONS              22
RECORDS WRITTEN          4471
MULTIPLICATIONS          9850

                                                USED    MAXIMUM
INPUT SPACE                                      603       2000
OUTPUT SPACE                                    7125       7126
NR. OF EXPR.                                      54        260
ID. REGISTER                                     115        500
FUNCT. REG.                                        5        750


RUNNING TIME (SEC)      66.55
TERMS IN OUTPUT          3742
GENERATED TERMS          4345
EQUAL TERMS               580
CANCELLATIONS              23
RECORDS WRITTEN          4487
MULTIPLICATIONS          9850

                                                USED    MAXIMUM
INPUT SPACE                                      603       2000
OUTPUT SPACE                                    6297       7126
NR. OF EXPR.                                      54        260
ID. REGISTER                                     115        500
FUNCT. REG.                                        5        750

        L 1     ID Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)*D10*D1PQ
                =P(S1)*P(S2)*P(S3)*P(S4)*I7T11
                +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
                +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
                *I8T11
                +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                *I9T11
        L 3     ID,ADIS0,QD0*Q(S3+)*Q(S4+)*D10*D1PQ
                =D(S1,S2)*P(S1)*P(S2)*P(S3)*P(S4)*I7T11
                +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
                +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
                *D(S1,S2)*I8T11
                +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                *D(S1,S2)*I9T11
        L 5     ID,ADIS0,QD0**2*D10*D1PQ
                =D(S1,S2)*D(S3,S4)*P(S1)*P(S2)*P(S3)*P(S4)*I7T11
                +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
                +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
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```
                *D(S1,S2)*D(S3,S4)*I8T11
               +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
               *D(S1,S2)*D(S3,S4)*I9T11
L 7            ID Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)*D10*D2PQ
                 = P(S1)*P(S2)*P(S3)*P(S4)*I7T12
               +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
               +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
                *I8T12
               +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                *I9T12

L 9            ID Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)*D20*D1PQ
               =P(S1)*P(S2)*P(S3)*P(S4)*I7T21
               +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
               +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
               *I8T21
               +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                *I9T12

L11            ID Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)*D20*D2PQ
                 =P(S1)*P(S2)*P(S3)*P(S4)*I7T22
               +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
               +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
                *I8T22
               +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                *I9T22

L13            ID PDQ*Q(S1+)*Q(S2+)*Q(S3+)
                  *D1Q*D1PQ
                 =PDP*P(S1)*P(S2)*P(S3)
                 *I7T11
                 +(PDP*P(S3)*D(S1,S2)+PDP*P(S2)*D(S1,S3)
                 +PDP*P(S1)*D(S2,S3)+3*P(S1)*P(S2)*P(S3))
                  *I8T11
                 +(P(S3)*D(S1,S2)+P(S2)*D(S1,S3)+P(S1)*D(S2,S3))
                 *I9T11
L15            ID PDQ*Q(S1+)*Q(S2+)*Q(S3+)
                  *D1Q*D2PQ
                 =PDP*P(S1)*P(S2)*P(S3)
                  *I7T12
                 +(PDP*P(S3)*D(S1,S2)+PDP*P(S2)*D(S1,S3)
                 +PDP*P(S1)*D(S2,S3)+3*P(S1)*P(S2)*P(S3))
                  *I8T12
                 +(P(S3)*D(S1,S2)+P(S2)*D(S1,S3)+P(S1)*D(S2,S3))
                  *I9T12
L17            ID PDQ*Q(S1+)*Q(S2+)*Q(S3+)
                  *D2Q*D1PQ
                 =PDP*P(S1)*P(S2)*P(S3)
                  *I7T21
                 +(PDP*P(S3)*D(S1,S2)+PDP*P(S2)*D(S1,S3)
                 +PDP*P(S1)*D(S2,S3)+3*P(S1)*P(S2)*P(S3))
                  *I8T21
                 +(P(S3)*D(S1,S2)+P(S2)*D(S1,S3)+P(S1)*D(S2,S3))
                  *I9T12
L19            ID PDQ*Q(S1+)*Q(S2+)*Q(S3+)
                  *D2Q*D2PQ
                 =PDP*P(S1)*P(S2)*P(S3)
                  *I7T22
                 +(PDP*P(S3)*D(S1,S2)+PDP*P(S2)*D(S1,S3)
                 +PDP*P(S1)*D(S2,S3)+3*P(S1)*P(S2)*P(S3))
                  *I8T22
                 +(P(S3)*D(S1,S2)+P(S2)*D(S1,S3)+P(S1)*D(S2,S3))
                  *I9T22
               *YEP
```

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,

SYMBOLS I=I, ALFA, D1, D2, D10, D1PQ, D20, D200, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, DG=C, DDG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0, =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT 3742 ,TERMS IN 3742

			USED	MAXIMUM
RUNNING TIME (SEC)	91.17			
TERMS IN OUTPUT	4737			
GENERATED TERMS	4959	INPUT SPACE	954	2000
EQUAL TERMS	217	OUTPUT SPACE	4739	4740
CANCELLATIONS	5	NR. OF EXPR.	64	260
RECORDS WRITTEN	4552	ID. REGISTER	123	500
MULTIPLICATIONS	10384	FUNCT. REG.	6	750

			USED	MAXIMUM
RUNNING TIME (SEC)	93.74			
TERMS IN OUTPUT	4166			
GENERATED TERMS	4959	INPUT SPACE	954	2000
EQUAL TERMS	756	OUTPUT SPACE	7124	7126
CANCELLATIONS	37	NR. OF EXPR.	64	260
RECORDS WRITTEN	4584	ID. REGISTER	123	500
MULTIPLICATIONS	10384	FUNCT. REG.	6	750

			USED	MAXIMUM
RUNNING TIME (SEC)	95.26			
TERMS IN OUTPUT	4151			
GENERATED TERMS	4959	INPUT SPACE	954	2000
EQUAL TERMS	771	OUTPUT SPACE	7127	7126
CANCELLATIONS	37	NR. OF EXPR.	64	260
RECORDS WRITTEN	4602	ID. REGISTER	123	500
MULTIPLICATIONS	10384	FUNCT. REG.	6	750

			USED	MAXIMUM
RUNNING TIME (SEC)	95.55			
TERMS IN OUTPUT	4151			
GENERATED TERMS	4959	INPUT SPACE	954	2000
EQUAL TERMS	771	OUTPUT SPACE	842	7126
CANCELLATIONS	37	NR. OF EXPR.	64	260
RECORDS WRITTEN	4618	ID. REGISTER	123	500
MULTIPLICATIONS	10384	FUNCT. REG.	6	750

L 1 ID PD0**2*D(S1+)*D(S2+)
*D10*D1PQ

```
          =PDP**2*P(S1)*P(S2)
           *I7T11
          +(PDP**2*D(S1,S2)+5*PDP*P(S1)*P(S2))
            *I8T11
           +(PDP*D(S1,S2)+2*P(S1)*P(S2))
          *I9T11
L 3       ID PDQ**2*Q(S1+)*Q(S2+)
           *D1Q*D2PQ
          =PDP**2*P(S1)*P(S2)
           *I7T12
          +(PDP**2*D(S1,S2)+5*PDP*P(S1)*P(S2))
           *I8T12
           +(PDP*D(S1,S2)+2*P(S1)*P(S2))
           *I9T12
L 5       ID PDQ**2*Q(S1+)*Q(S2+)
           *D2Q*D1PQ
          =PDP**2*P(S1)*P(S2)
           *I7T21
          +(PDP**2*D(S1,S2)+5*PDP*P(S1)*P(S2))
           *I8T21
           +(PDP*D(S1,S2)+2*P(S1)*P(S2))
           *I9T12
L 7       ID PDQ**2*Q(S1+)*Q(S2+)
           *D2Q*D2PQ
          =PDP**2*P(S1)*P(S2)
           *I7T22
          +(PDP**2*D(S1,S2)+5*PDP*P(S1)*P(S2))
           *I8T22
           +(PDP*D(S1,S2)+2*P(S1)*P(S2))
           *I9T22
L 9       ID PDQ**3*Q(S1+)*D1Q*D1PQ
          =PDP**3*P(S1)*I7T11
          +6*PDP**2*P(S1)*I8T11
          +3*PDP*P(S1)*I9T11
L10       ID PDQ**3*Q(S1+)*D1Q*D2PQ
          =PDP**3*P(S1)*I7T12
          +6*PDP**2*P(S1)*I8T12
          +3*PDP*P(S1)*I9T12
L11       ID PDQ**3*Q(S1+)*D2Q*D1PQ
          =PDP**3*P(S1)*I7T21
          +6*PDP**2*P(S1)*I8T21
          +3*PDP*P(S1)*I9T12
L12       ID PDQ**3*Q(S1+)*D2Q*D2PQ
          =PDP**3*P(S1)*I7T22
          +6*PDP**2*P(S1)*I8T22
          +3*PDP*P(S1)*I9T22
L13       ID PDQ**4*D1Q*D1PQ
          =PDP**4*I7T11
          +6*PDP**3*I8T11
          +3*PDP**2*I9T11
L14       ID PDQ**4*D1Q*D2PQ
          =PDP**4*I7T12
          +6*PDP**3*I8T12
          +3*PDP**2*I9T12
L15       ID PDQ**4*D2Q*D1PQ
          =PDP**4*I7T21
          +6*PDP**3*I8T21
          +3*PDP**2*I9T12
L16       ID PDQ**4*D2Q*D2PQ
          =PDP**4*I7T22
          +6*PDP**3*I8T22
          +3*PDP**2*I9T22

          *YEP
```




SYMBOLS I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R1=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P6, P1.

EXPR. =0, =0, =0, =U, =0, =U, =0, VERT3, =0, =0, =0, =0, =0, =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT 4151 ,TERMS IN 4151

			USED	MAXIMUM
RUNNING TIME (SEC)	113.45			
TERMS IN OUTPUT	4465			
GENERATED TERMS	4843	INPUT SPACE	655	2000
EQUAL TERMS	349	OUTPUT SPACE	4738	4740
CANCELLATIONS	29	NR. OF EXPR.	54	260
RECORDS WRITTEN	4667	ID. REGISTER	109	500
MULTIPLICATIONS	10678	FUNCT. REG.	4	750

			USED	MAXIMUM
RUNNING TIME (SEC)	116.03			
TERMS IN OUTPUT	4214			
GENERATED TERMS	4843	INPUT SPACE	653	2000
EQUAL TERMS	574	OUTPUT SPACE	7126	7126
CANCELLATIONS	55	NR. OF EXPR.	54	260
RECORDS WRITTEN	4700	ID. REGISTER	109	500
MULTIPLICATIONS	10678	FUNCT. REG.	4	750

			USED	MAXIMUM
RUNNING TIME (SEC)	117.79			
TERMS IN OUTPUT	4152			
GENERATED TERMS	4843	INPUT SPACE	655	2000
EQUAL TERMS	623	OUTPUT SPACE	7125	7126
CANCELLATIONS	68	NR. OF EXPR.	54	260
RECORDS WRITTEN	4710	ID. REGISTER	109	500
MULTIPLICATIONS	10678	FUNCT. REG.	4	750

			USED	MAXIMUM
RUNNING TIME (SEC)	110.08			
TERMS IN OUTPUT	4152			
GENERATED TERMS	4843	INPUT SPACE	655	2000
EQUAL TERMS	623	OUTPUT SPACE	900	7126
CANCELLATIONS	68	NR. OF EXPR.	54	260
RECORDS WRITTEN	4734	ID. REGISTER	109	500
MULTIPLICATIONS	10678	FUNCT. REG.	4	750

L 1 ID QD0*Q(S1+)*Q(S2+)*P20*D1P0
=D(S1,S2)*I3T11+P(S1)*P(S2)*I4T11

EQUAL TERMS	227	OUTPUT SPACE	4738	4744
CANCELLATIONS	2	NR. OF EXPR.	73	260
RECORDS WRITTEN	4345	ID. REGISTER	140	500
MULTIPLICATIONS	8910	FUNCT. REG.	10	750

			USED	MAXIMUM
RUNNING TIME (SEC)	45.91			
TERMS IN OUTPUT	3740			
GENERATED TERMS	4002	INPUT SPACE	809	2060
EQUAL TERMS	260	OUTPUT SPACE	7125	7126
CANCELLATIONS	2	NR. OF EXPR.	73	260
RECORDS WRITTEN	4372	ID. REGISTER	140	500
MULTIPLICATIONS	8910	FUNCT. REG.	10	750

			USED	MAXIMUM
RUNNING TIME (SEC)	47.04			
TERMS IN OUTPUT	3723			
GENERATED TERMS	4002	INPUT SPACE	809	2060
EQUAL TERMS	275	OUTPUT SPACE	6329	7126
CANCELLATIONS	4	NR. OF EXPR.	73	260
RECORDS WRITTEN	4388	ID. REGISTER	149	500
MULTIPLICATIONS	8910	FUNCT. REG.	10	750

```
        L 1     ID  PDQ**3*Q(S1+)*Q(S2+)*D2Q*D1PQ
                  =P(S1)*P(S2)*(2*I1021+5*PDP*I1121+PDP**2*I1221)
                  +D(S1,S2)*(PDP*I1021+PDP**2*I1121)
        L 3     ID  PDQ**3*Q(S1+)*Q(S2+)*D2Q*D2PQ
                  =P(S1)*P(S2)*(2*I1022+5*PDP*I1122+PDP**2*I1222)
                  +D(S1,S2)*(PDP*I1022+PDP**2*I1122)

        L 5     ID  QDQ*Q(S1+)*Q(S2+)*Q(S3+)*D2Q*D1PQ
                  =P(S1)*P(S2)*P(S3)*I5T11
                   +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S1))
                  *I6T11
        L 7     ID  QDQ*Q(S1+)*Q(S2+)*Q(S3+)*D2Q*D2PQ
                  =P(S1)*P(S2)*P(S3)*I5T12
                   +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S2,S1))
                  *I6T12

        L 9     ID  QDQ*PDQ*Q(S1+)*Q(S2+)*D2Q*D1PQ
                  =D(S1,S2)*PDP*I6T11
                  +P(S1)*P(S2)*(PDP*I5T11+2*I6T11)
        L11     ID  QDQ*PDQ*Q(S1+)*Q(S2+)*D2Q*D2PQ
                  =D(S1,S2)*PDP*I6T12
                  +P(S1)*P(S2)*(PDP*I5T12+2*I6T12)


        L13     ID  QDQ*PDQ**2*Q(S1+)*D2Q*D1PQ
                  =P(S1)*(PDP**2*I5T11+3*PDP*I6T11)
        L15     ID  QDQ*PDQ**2*Q(S1+)*D2Q*D2PQ
                  =P(S1)*(PDP**2*I5T12+3*PDP*I6T12)

        L17     ID  QDQ*PDQ**3*D2Q*D1PQ
                  =PDP**3*I5T11+3*PDP**2*I6T11
        L18     ID  QDQ*PDQ**3*D2Q*D2PQ
                  =PDP**3*I5T12+3*PDP**2*I6T12
                *YEP
```

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,

TERMS IN OUTPUT	4063			
GENERATED TERMS	4503	INPUT SPACE	429	2000
EQUAL TERMS	410	OUTPUT SPACE	77	7126
CANCELLATIONS	30	NR. OF EXPR.	46	260
RECORDS WRITTEN	4843	ID. REGISTER	63	500
MULTIPLICATIONS	9708	FUNCT. REG.	4	750

```
      L 1     ID Q(S1+)*Q(S2+)*Q(S3+)*D1Q*D1PQ
               =P(S1)*P(S2)*P(S3)*I5T11
               +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T11
      L 3     ID QDQ*PDQ*D1Q*D1PQ
               =P(S3)*D(S1,S2)*(P(S1)*P(S2)*P(S3)*I5T11
               +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T11)
      L 6     ID QDQ*Q(S1+)*D1Q*D1PQ
               =D(S2,S3)*(P(S1)*P(S2)*P(S3)*I5T11
               +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T11)
      L 9     ID Q(S1+)*Q(S2+)*Q(S3+)*D1Q*D2PQ
                =P(S1)*P(S2)*P(S3)*I5T12
               +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T12
      L11     ID Q(S1+)*Q(S2+)*Q(S3+)*D2Q*D1PQ
                =P(S1)*P(S2)*P(S3)*I5T21
               +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T21
      L13     ID Q(S1+)*Q(S2+)*Q(S3+)*D2Q*D2PQ
                =P(S1)*P(S2)*P(S3)*I5T22
               +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T22

      L15     ID PDQ*Q(S1+)*Q(S2+)*D1Q*D1PQ
                =PDP*P(S1)*P(S2)*I5T11
                +(2*P(S1)*P(S2)+PDP*D(S1,S2))*I6T11
      L17     ID PDQ*Q(S1+)*Q(S2+)*D1Q*D2PQ
                =PDP*P(S1)*P(S2)*I5T12
                +(2*P(S1)*P(S2)+PDP*D(S1,S2))*I6T12
      L19     ID PDQ*Q(S1+)*Q(S2+)*D2Q*D1PQ
                =PDP*P(S1)*P(S2)*I5T21
                +(2*P(S1)*P(S2)+PDP*D(S1,S2))*I6T21
      L21     ID PDQ*Q(S1+)*Q(S2+)*D2Q*D2PQ
                =PDP*P(S1)*P(S2)*I5T22
                +(2*P(S1)*P(S2)+PDP*D(S1,S2))*I6T22
              *YEP
```

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, P, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P1=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0, =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT 4063 ,TERMS IN 4063

			USED	MAXIMUM
RUNNING TIME (SEC)	158.92			
TERMS IN OUTPUT	4924			
GENERATED TERMS	5143	INPUT SPACE	634	2000
EQUAL TERMS	215	OUTPUT SPACE	4738	4740
CANCELLATIONS	4	NR. OF EXPR.	56	260
RECORDS WRITTEN	4896	ID. REGISTER	107	500
MULTIPLICATIONS	12062	FUNCT. REG.	5	750

			USED	MAXIMUM
RUNNING TIME (SEC)	162.20			
TERMS IN OUTPUT	4350			
GENERATED TERMS	5143	INPUT SPACE	634	2000
EQUAL TERMS	755	OUTPUT SPACE	7124	7126
CANCELLATIONS	30	NR. OF EXPR.	56	260
RECORDS WRITTEN	4929	ID. REGISTER	107	500
MULTIPLICATIONS	12062	FUNCT. REG.	5	750

			USED	MAXIMUM
RUNNING TIME (SEC)	164.24			
TERMS IN OUTPUT	4234			
GENERATED TERMS	5143	INPUT SPACE	634	2000
EQUAL TERMS	877	OUTPUT SPACE	7126	7126
CANCELLATIONS	32	NR. OF EXPR.	56	260
RECORDS WRITTEN	4946	ID. REGISTER	107	500
MULTIPLICATIONS	12062	FUNCT. REG.	5	750

			USED	MAXIMUM
RUNNING TIME (SEC)	164.43			
TERMS IN OUTPUT	4211			
GENERATED TERMS	5143	INPUT SPACE	634	2000
EQUAL TERMS	894	OUTPUT SPACE	457	7126
CANCELLATIONS	38	NR. OF EXPR.	56	260
RECORDS WRITTEN	4962	ID. REGISTER	107	500
MULTIPLICATIONS	12062	FUNCT. REG.	5	750

```
L 1     ID PDQ**2*Q(S1+)*D1Q*D1PQ
          =PDP**2*P(S1)*I5T11
          +3*PDP*P(S1)*I6T11
L 2     ID PDQ**2*Q(S1+)*D1Q*D2PQ
          =PDP**2*P(S1)*I5T12
          +3*PDP*P(S1)*I6T12
L 3     ID PDQ**2*Q(S1+)*D2Q*D1PQ
          =PDP**2*P(S1)*I5T21
          +3*PDP*P(S1)*I6T21
L 4     ID PDQ**2*Q(S1+)*D2Q*D2PQ
          =PDP**2*P(S1)*I5T22
          +3*PDP*P(S1)*I6T22
L 5     ID PDQ**3*D1Q*D1PQ
          =PDP**3*I5T11
          +3*PDP**2*I6T11
L 6     ID PDQ**3*D1Q*D2PQ
          =PDP**3*I5T12
          +3*PDP**2*I6T12
L 7     ID PDQ**3*D2Q*D1PQ
          =PDP**3*I5T21
          +3*PDP**2*I6T21
L 8     ID PDQ**3*D2Q*D2PQ
          =PDP**3*I5T22
          +3*PDP**2*I6T22

L 9     ID QDQ*Q(S1+)*D2Q*D1PQ=P(S1)*I2T11

        *YEP
```

```
                *YEP

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P7=Z, S7=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PG, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
                =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
                PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT       4211 ,TERMS IN      4211

RUNNING TIME (SEC)     178.44                          USED    MAXIMUM
TERMS IN OUTPUT          4221
GENERATED TERMS          4472        INPUT SPACE        463       2000
EQUAL TERMS               231        OUTPUT SPACE      4738       4740
CANCELLATIONS              20        NR. OF EXPR.        43        260
RECORDS WRITTEN          5005        ID. REGISTER        74        500
MULTIPLICATIONS          9562        FUNCT. REG.          3        750


RUNNING TIME (SEC)     181.43                          USED    MAXIMUM
TERMS IN OUTPUT          4062
GENERATED TERMS          4472        INPUT SPACE        463       2000
EQUAL TERMS               370        OUTPUT SPACE      7126       7126
CANCELLATIONS              32        NR. OF EXPR.        43        260
RECORDS WRITTEN          5034        ID. REGISTER        74        500
MULTIPLICATIONS          9562        FUNCT. REG.          3        750


RUNNING TIME (SEC)     183.54                          USED    MAXIMUM
TERMS IN OUTPUT          3960
GENERATED TERMS          4472        INPUT SPACE        463       2000
EQUAL TERMS               476        OUTPUT SPACE      6279       7126
CANCELLATIONS              36        NR. OF EXPR.        43        260
RECORDS WRITTEN          5050        ID. REGISTER        74        500
MULTIPLICATIONS          9562        FUNCT. REG.          3        750

        L 1     ID QDQ*Q(S1+)*D2Q*D2PQ=P(S1)*I2T12
        L 2     ID QDQ*PDQ*D2Q*D1PQ=PDP*I2T11
        L 3     ID QDQ*PDQ*D2Q*D2PQ=PDP*I2T12

        L 4     ID Q(S1+)*Q(S2+)*D1Q*D1PQ
                 =D(S1,S2)*I3T11+P(S1)*P(S2)*I4T11
        L 5     ID,ADISD,QDQ*D1Q*D1PQ
                 =D(S1,S2)*(D(S1,S2)*I3T11+P(S1)*P(S2)*I4T11)
        L 7     ID Q(S1+)*Q(S2+)*D1Q*D2PQ
                 =D(S1,S2)*I3T12+P(S1)*P(S2)*I4T12
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```
L 8         ID Q(S1+)*Q(S2+)*D20*D1PQ
             =D(S1,S2)*I3T12+P(S1)*P(S2)*I4T21
L 9         ID Q(S1+)*Q(S2+)*D20*D2PQ
             =D(S1,S2)*I3T22+P(S1)*P(S2)*I4T22

L10         ID PDQ*Q(S1+)*D10*D1PQ
              =P(S1)*I3T11+PDP*P(S1)*I4T11
L11         ID PDQ*Q(S1+)*D10*D2PQ
              =P(S1)*I3T12+PDP*P(S1)*I4T12
            *YEP

SYMBOLS     I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
            I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
            I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
            I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
            I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
            I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
            I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
            I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
            KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPF=I, G=I, GI, G5=1, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.       =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =C, =0,
            =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
            PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT    3960 ,TERMS IN     3960

RUNNING TIME (SEC)     202.30                          USED    MAXIMUM
TERMS IN OUTPUT          4345
GENERATED TERMS          4465      INPUT SPACE          485       2000
EQUAL TERMS               115      OUTPUT SPACE        4741       4740
CANCELLATIONS               5      NR. OF EXPR.          45        260
RECORDS WRITTEN          5107      ID. REGISTER          89        500
MULTIPLICATIONS         10062      FUNCT. REG.            4        750


RUNNING TIME (SEC)     205.69                          USED    MAXIMUM
TERMS IN OUTPUT          3985
GENERATED TERMS          4465      INPUT SPACE          485       2000
EQUAL TERMS               451      OUTPUT SPACE        7125       7126
CANCELLATIONS              29      NR. OF EXPR.          45        260
RECORDS WRITTEN          5134      ID. REGISTER          89        500
MULTIPLICATIONS         10062      FUNCT. REG.            4        750


RUNNING TIME (SEC)     207.79                          USED    MAXIMUM
TERMS IN OUTPUT          3868
GENERATED TERMS          4465      INPUT SPACE          485       2000
EQUAL TERMS               558      OUTPUT SPACE        5445       7126
CANCELLATIONS              39      NR. OF EXPR.          45        260
RECORDS WRITTEN          5150      ID. REGISTER          89        500
MULTIPLICATIONS         10062      FUNCT. REG.            4        750

        L 1         ID PDQ*Q(S1+)*D20*D1PQ

                     =P(S1)*I3T12+PDP*P(S1)*I4T21
```

```
                =P(S1)*I3T12+PDP*P(S1)*I4T21
L 2         ID PD0*Q(S1+)*D20*D2P0
                =P(S1)*I3T22+PDP*P(S1)*I4T22
L 3         ID PD0**2*D10*D1P0
                =PDP*I3T11+PDP**2*I4T11
L 4         ID PD0**2*D10*D2P0
                =PDP*I3T12+PDP**2*I4T12
L 5         ID PD0**2*D20*D1P0
                =PDP*I3T12+PDP**2*I4T21
L 6         ID PD0**2*D20*D2P0
                =PDP*I3T22+PDP**2*I4T22
L 7         ID  0D0*D20*D1P0=I1T11
L 8         ID  0D0*D20*D2P0=I1T12

L 9         ID Q(S1+)*D10*D1P0=P(S1)*I2T11
L10         ID Q(S1+)*D10*D2P0=P(S1)*I2T12
L11         ID Q(S1+)*D20*D1P0=P(S1)*I2T21
L12         ID Q(S1+)*D20*D2P0=P(S1)*I2T22
L13         ID PD0*D10*D1P0
                =PDP*I2T11
L14         ID PD0*D10*D2P0
                =PDP*I2T12
L15         ID PD0*D20*D1P0
                =PDP*I2T21
L16         ID PD0*D20*D2P0
                =PDP*I2T22


L17         ID D10*D1P0=I1T11
L18         ID D10*D2P0=I1T12
L19         ID D20*D1P0=I1T12
L20         ID D20*D2P0=I1T22
            *YEP
```

SYMBOLS I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0, =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

TERMS OUT 3868 ,TERMS IN 3868

			USED	MAXIMUM
RUNNING TIME (SEC)	229.08			
TERMS IN OUTPUT	3838			
GENERATED TERMS	4077	INPUT SPACE	545	2000
EQUAL TERMS	229	OUTPUT SPACE	4741	4740

CANCELLATIONS	19	NR. OF EXPR.	54	260
RECORDS WRITTEN	5197	ID. REGISTER	137	500
MULTIPLICATIONS	9434	FUNCT. REG.	3	750

RUNNING TIME (SEC)	232.10		USED	MAXIMUM
TERMS IN OUTPUT	3649			
GENERATED TERMS	4077	INPUT SPACE	545	2000
EQUAL TERMS	408	OUTPUT SPACE	7126	7126
CANCELLATIONS	20	NR. OF EXPR.	54	260
RECORDS WRITTEN	5218	ID. REGISTER	137	500
MULTIPLICATIONS	9434	FUNCT. REG.	3	750

RUNNING TIME (SEC)	233.39		USED	MAXIMUM
TERMS IN OUTPUT	3565			
GENERATED TERMS	4077	INPUT SPACE	545	2000
EQUAL TERMS	486	OUTPUT SPACE	3573	7126
CANCELLATIONS	26	NR. OF EXPR.	54	260
RECORDS WRITTEN	5234	ID. REGISTER	137	500
MULTIPLICATIONS	9434	FUNCT. REG.	3	750

```
L 1       ID I1T11=64*W**2*PDP**2-16*PDP**2
L 1       AL I1T12=-128*PDP*W**3+32*PDP*W+192*PDP*W**2-48*PDP
L 1       AL I1T22=32*(4*W**2-1)*(2*W**2-9*W+9)
L 1       AL I2T11=32*W**2*PDP**2-8*PDP**2
L 1       AL I2T12=-64*PDP*W**3+16*PDP*W+64*PDP*W**2-16*PDP
L 1       AL I2T21=-64*PDP*W**3+128*PDP*W**2+16*PDP*W-32*PDP
L 1       AL I2T22=16*(2*W**2-9*W+9)*(4*W**2-1)
L 1       AL I3T11=-8*W*PDP**3-4*PDP**3
L 1       AL I3T12=16*PDP**2*W**2-4*PDP**2
L 1       AL I3T22=-32*PDP*W**3+64*PDP*W**2+8*PDP*W-16*PDP
L 1       AL I4T11=16*W**2*PDP**2+8*W*PDP**2
L 1       AL I4T12=-32*PDP*W**3+8*PDP*W
L 1       AL I4T21=-32*PDP*W**3+64*PDP*W**2+8*PDP*W-16*PDP
L 1       AL I4T22=(W**2-4*W+3)*(64*W**2-16)
L 1       AL I5T11=8*PDP**2*W**2+12*PDP**2*W+4*PDP**2
L 1       AL I5T12=-16*PDP*W**3-24*PDP*W**2-8*PDP*W
L 1       AL I5T21=-16*PDP*W**3+24*PDP*W**2+16*PDP*W
L 1       AL I5T22=32*W**4-96*W**3-8*W**2+24*W
L 1       AL I6T11=-4*W*PDP**3-2*PDP**3
L 1       AL I6T12=8*PDP**2*W**2+4*PDP**2*W
L 1       AL I6T21=8*PDP**2*W**2-4*PDP**2*W-4*PDP**2
L 1       AL I6T22=-16*PDP*W**3+32*PDP*W**2+4*PDP*W-8*PDP
L 1       AL I7T11=4*PDP**2*W**2+12*PDP**2*W+8*PDP**2
L 1       AL I7T12=(W**2+3*W+2)*(-8*PDP*W-4*PDP)
L 1       AL I7T21=(-4*PDP*W+8*PDP)*(2*W**2+3*W+1)
L 1       AL I7T22= 8*(W**2-2*W-3)*(2*W**2+W)
L 1       AL I8T11=-2*PDP**3*W-2*PDP**3
L 1       AL I8T12=4*PDP**2*W**2+6*PDP**2*W+2*PDP**2
L 1       AL I8T21=PDP**2*(4*W**2-2*W-2)
L 1       AL I8T22=-8*PDP*W**3+12*PDP*W**2+8*PDP*W
L 1       AL I9T11=PDP**4
L 1       AL I9T12=-PDP**3*2*W-PDP**3
L 1       AL I9T22= 4*PDP**2*W**2-2*PDP**2*W-2*PDP**2
L 1       AL I1011=PDP**5/2
L 1       AL I1012=-PDP**4*(W+1)
L 1       AL I1021=-PDP**4*W
L 1       AL I1022=PDP**3*(W-1)*(2*W+1)
L 1       AL I1111=-PDP**4*(W+1)
L 1       AL I1112= 2*PDP**3*(W+1)**2
L 1       AL I1121=2*PDP**3*(W**2-W-1)
L 1       AL I1122=2*PDP**2*(2*W+1)*(-W**2+2*W+3)
L 1       AL I1211=2*PDP**3*(W+1)*(W+2)

L 1       AL I1212=-4*PDP**2*(W+1)**2*(W+2)
```

```
L 1         AL I1212=-4*PDP**2*(W+1)**2*(W+2)
L 1         AL I1221=4*PDP**2*(W+1)*(2+2*W-W**2)
L 1         AL I1222=4*PDP*(2*W+1)*(W+1)*(W**2-3*W-2)
L 1         AL I1311=PDP**6/4
L 1         AL I1312=-PDP**5*(2*W+3)/4
L 1         AL I1321=PDP**5*(1-2*W)/4
L 1         AL I1322=PDP**4*(2*W**2-W-2)/2
L 1         AL I1411=-PDP**5*(W+1)/2
L 1         AL I1412=PDP**4*(2*W**2+5*W+3)/2
L 1         AL I1421=PDP**4*(2*W**2-3*W-3)/2
L 1         AL I1422=PDP**3*(-2*W**3+3*W**2+7*W+3)
L 1         AL I1511=PDP**4*(W**2+3*W+2)
L 1         AL I1512=-PDP**3*(W**2+3*W+2)*(2*W+3)
L 1         AL I1521=PDP**3*(-2*W**3+3*W**2+11*W+6)
L 2         AL I1522=PDP**2*(4*W**4-6*W**3-34*W**2-36*W-12)
L 3         ID Z=2*W
            HPRINT LOOP,GHOST
            *NEXT
```

SYMBOLS I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=7, L1=7, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=7, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=7, S2=7, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DS, DT, DS=U, DX, DK, DP, DF=U, GU, PC, P1.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0, =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

			USED	MAXIMUM
RUNNING TIME (SEC)	263.31			
TERMS IN OUTPUT	506			
GENERATED TERMS	8192	INPUT SPACE	1158	2000
EQUAL TERMS	7243	OUTPUT SPACE	3881	4740
CANCELLATIONS	443	NR. OF EXPR.	137	260
RECORDS WRITTEN	5242	ID. REGISTER	117	500
MULTIPLICATIONS	38126	FUNCT. REG.	3	750

TERMS OUT 3565 ,TERMS IN 3565

			USED	MAXIMUM
RUNNING TIME (SEC)	272.11			
TERMS IN OUTPUT	616			
GENERATED TERMS	10626	INPUT SPACE	1158	2000
EQUAL TERMS	9450	OUTPUT SPACE	2528	4740
CANCELLATIONS	552	NR. OF EXPR.	137	260
RECORDS WRITTEN	5242	ID. REGISTER	117	500
MULTIPLICATIONS	49188	FUNCT. REG.	3	750

```
            H R
            Z GP1=LOOP
```

```
                Z GU1=GHOST
        L 2     ID D1=1+ALFA
        L 2     AL D2=2+ALFA
        L 2     AL W1=W-1
                *NEXT

SYMBOLS     I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
            I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
            I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
            I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
            I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
            I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
            I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
            I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
            KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, B0=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.       =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
            =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
            PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

RUNNING TIME (SEC)    280.99                          USED    MAXIMUM
TERMS IN OUTPUT          214
GENERATED TERMS         4400     INPUT SPACE          367       2000
EQUAL TERMS             4065     OUTPUT SPACE        1253       4740
CANCELLATIONS            121     NR. OF EXPR.          35        260
RECORDS WRITTEN         5255     ID. REGISTER           7        500
MULTIPLICATIONS        20130     FUNCT. REG.           18        750

SYMBOLS     I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11,
            I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
            I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
            I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
            I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
            I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
            I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
            I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
            KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, B0=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.       =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
            =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
            PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

 GR1 =
```




CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
+ P(AA1)*P(A1)*P(B1)*P(BBL)
* ( 224.*ALFA*W*PDP**2 - 280.*ALFA*W**2*PDP**2 - 672.*ALFA*W**3*PDP**2 + 1408.*ALFA*W**4*PDP**2 - 1024.*ALFA
*W**5*PDP**2 + 256.*ALFA*W**6*PDP**2 - 64.*ALFA*PDP**2 + 288.*ALFA**2*W*PDP**2 + 64.*ALFA**2*W**2*PDP**2
- 992.*ALFA**2*W**3*PDP**2 + 1344.*ALFA**2*W**4*PDP**2 - 640.*ALFA**2*W**5*PDP**2 + 128.*ALFA**2*W**6*PDP**2
 - 96.*ALFA**2*PDP**2 + 32.*W*PDP**2 - 160.*W**2*PDP**2 - 28.*W**3*PDP**2 + 364.*W**4*PDP**2 - 404.*W**5*PDP**2
 + 136.*W**6*PDP**2 )

+ P(AA2)*P(A2)*P(B2,PDL)
* ( - 88.*ALFA*W*PDP**3 + 24.*ALFA*W**2*PDP**3 + 280.*ALFA*W**3*PDP**3 - 464.*ALFA*W**4*PDP**3 + 288.*ALFA
*W**5*PDP**3 - 64.*ALFA*W**6*PDP**3 + 24.*ALFA*PDP**3 - 92.*ALFA**2*W*PDP**3 - 32.*ALFA**2*W**2*PDP**3
+ 324.*ALFA**2*W**3*PDP**3 - 376.*ALFA**2*W**4*PDP**3 + 176.*ALFA**2*W**5*PDP**3 - 32.*ALFA**2*W**6*PDP**3
 + 32.*ALFA**2*PDP**3 - W*PDP**3 + 18.*W**2*PDP**3 - 9.*W**3*PDP**3 - 74.*W**4*PDP**3 + 96.*W**5*PDP**3
- 32.*W**6*PDP**3 + 2.*PDP**3 )

+ P(AA1)*D(A1,B1)*P(BB1)
* ( - 104.*ALFA*W*PDP**3 - 72.*ALFA*W**2*PDP**3 + 416.*ALFA*W**3*PDP**3 - 416.*ALFA*W**4*PDP**3 + 128.*ALFA
*W**5*PDP**3 + 48.*ALFA*PDP**3 - 96.*ALFA**2*W*PDP**3 - 128.*ALFA**2*W**2*PDP**3 + 368.*ALFA**2*W**3*PDP**3
 - 256.*ALFA**2*W**4*PDP**3 + 64.*ALFA**2*W**5*PDP**3 + 48.*ALFA**2*PDP**3 - 32.*W*PDP**3 + 46.*W**2*PDP**3
 + 88.*W**3*PDP**3 - 166.*W**4*PDP**3 + 68.*W**5*PDP**3 - 4.*PDP**3 )

+ P(AA1)*D(A1,BB1)*P(B1)
* ( - 88.*ALFA*W*PDP**3 + 24.*ALFA*W**2*PDP**3 + 280.*ALFA*W**3*PDP**3 - 464.*ALFA*W**4*PDP**3 + 288.*ALFA
*W**5*PDP**3 - 64.*ALFA*W**6*PDP**3 + 24.*ALFA*PDP**3 - 92.*ALFA**2*W*PDP**3 - 32.*ALFA**2*W**2*PDP**3
+ 324.*ALFA**2*W**3*PDP**3 - 376.*ALFA**2*W**4*PDP**3 + 176.*ALFA**2*W**5*PDP**3 - 32.*ALFA**2*W**6*PDP**3
 + 32.*ALFA**2*PDP**3 - W*PDP**3 + 18.*W**2*PDP**3 - 9.*W**3*PDP**3 - 74.*W**4*PDP**3 + 96.*W**5*PDP**3
- 32.*W**6*PDP**3 + 2.*PDP**3 )

+ D(AA1,A1)*P(B1)*P(BB1)
* ( - 88.*ALFA*W*PDP**3 + 24.*ALFA*W**2*PDP**3 + 280.*ALFA*W**3*PDP**3 - 464.*ALFA*W**4*PDP**3 + 288.*ALFA
*W**5*PDP**3 - 64.*ALFA*W**6*PDP**3 + 24.*ALFA*PDP**3 - 92.*ALFA**2*W*PDP**3 - 32.*ALFA**2*W**2*PDP**3
+ 324.*ALFA**2*W**3*PDP**3 - 376.*ALFA**2*W**4*PDP**3 + 176.*ALFA**2*W**5*PDP**3 - 32.*ALFA**2*W**6*PDP**3
 + 32.*ALFA**2*PDP**3 - W*PDP**3 + 18.*W**2*PDP**3 - 9.*W**3*PDP**3 - 74.*W**4*PDP**3 + 96.*W**5*PDP**3
```

CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

```
- 32.*W**6*PDP**3 + 2.*PDP**3 )

+ D(AA1,A1)*D(B1,BB1)
* ( 88.*ALFA*W*PDP**4 - 24.*ALFA*W**2*PDP**4 - 280.*ALFA*W**3*PDP**4 + 464.*ALFA*W**4*PDP**4 - 288.*ALFA*W**5
*PDP**4 + 64.*ALFA*W**6*PDP**4 - 24.*ALFA*PDP**4 + 92.*ALFA**2*W*PDP**4 + 32.*ALFA**2*W**2*PDP**4 - 324.*ALFA**2
*W**3*PDP**4 + 376.*ALFA**2*W**4*PDP**4 - 176.*ALFA**2*W**5*PDP**4 + 32.*ALFA**2*W**6*PDP**4 - 32.*ALFA**2
*PDP**4 + W*PDP**4 - 24.*W**2*PDP**4 + 13.*W**3*PDP**4 + 74.*W**4*PDP**4 - 96.*W**5*PDP**4 + 32.*W**6*PDP**4)


+ D(AA1,B1)*P(A1)*P(BB1)
* ( - 88.*ALFA*W*PDP**3 + 24.*ALFA*W**2*PDP**3 + 280.*ALFA*W**3*PDP**3 - 464.*ALFA*W**4*PDP**3 + 288.*ALFA
*W**5*PDP**3 - 64.*ALFA*W**6*PDP**3 + 24.*ALFA*PDP**3 - 92.*ALFA**2*W*PDP**3 - 32.*ALFA**2*W**2*PDP**3
+ 324.*ALFA**2*W**3*PDP**3 - 376.*ALFA**2*W**4*PDP**3 + 176.*ALFA**2*W**5*PDP**3 - 32.*ALFA**2*W**6*PDP**3
 + 32.*ALFA**2*PDP**3 - W*PDP**3 + 28.*W**2*PDP**3 - 9.*W**3*PDP**3 - 74.*W**4*PDP**3 + 96.*W**5*PDP**3
- 32.*W**6*PDP**3 + 2.*PDP**3 )

+ D(AA1,B1)*D(A1,BB1)
* ( 88.*ALFA*W*PDP**4 - 24.*ALFA*W**2*PDP**4 - 280.*ALFA*W**3*PDP**4 + 464.*ALFA*W**4*PDP**4 - 288.*ALFA*W**5
*PDP**4 + 64.*ALFA*W**6*PDP**4 - 24.*ALFA*PDP**4 + 92.*ALFA**2*W*PDP**4 + 32.*ALFA**2*W**2*PDP**4 - 324.*ALFA**2
*W**3*PDP**4 + 376.*ALFA**2*W**4*PDP**4 - 176.*ALFA**2*W**5*PDP**4 + 32.*ALFA**2*W**6*PDP**4 - 32.*ALFA**2
*PDP**4 + W*PDP**4 - 24.*W**2*PDP**4 + 13.*W**3*PDP**4 + 74.*W**4*PDP**4 - 96.*W**5*PDP**4 + 32.*W**6*PDP**4)


+ D(AA1,BB1)*P(A1)*P(B1)
* ( - 104.*ALFA*W*PDP**3 - 72.*ALFA*W**2*PDP**3 + 416.*ALFA*W**3*PDP**3 - 416.*ALFA*W**4*PDP**3 + 128.*ALFA
*W**5*PDP**3 + 48.*ALFA*PDP**3 - 96.*ALFA**2*W*PDP**3 - 128.*ALFA**2*W**2*PDP**3 + 368.*ALFA**2*W**3*PDP**3
 - 256.*ALFA**2*W**4*PDP**3 + 64.*ALFA**2*W**5*PDP**3 + 48.*ALFA**2*PDP**3 - 32.*W*PDP**3 + 46.*W**2*PDP**3
 + 88.*W**3*PDP**3 - 136.*W**4*PDP**3 + 68.*W**5*PDP**3 - 4.*PDP**3 )

+ D(AA1,BB1)*D(A1,B1)
* ( 96.*ALFA*W*PDP**4 + 136.*ALFA*W**2*PDP**4 - 400.*ALFA*W**3*PDP**4 + 288.*ALFA*W**4*PDP**4 - 64.*ALFA*W**5
*PDP**4 - 56.*ALFA*PDP**4 + 84.*ALFA**2*W*PDP**4 + 180.*ALFA**2*W**2*PDP**4 - 328.*ALFA**2*W**3*PDP**4

+ 176.*ALFA**2*W**4*PDP**4 - 32.*ALFA**2*W**5*PDP**4 - 56.*ALFA**2*PDP**4 + 25.*W*PDP**4 - 16.*W**2*PDP**4
```

```
  + 176.*ALFA**2*W**4*PDP**4 - 32.*ALFA**2*W**5*PDP**4 - 56.*ALFA**2*PDP**4 + 25.*W*PDP**4 - 16.*W**2*PDP**4
   - 75.*W**3*PDP**4 + 98.*W**4*PDP**4 - 32.*W**5*PDP**4 )


GH1 =
  + P(AA1)*P(A1)*P(B1)*P(BB1)
  * ( - 16.*W*PDP**2 + 24.*W**2*PDP**2 + 8.*W**3*PDP**2 - 16.*PDP**2 )

  + P(AA1)*P(A1)*D(B1,BB1)
  * ( PDP**3 )

  + P(AA1)*D(A1,B1)*P(BB1)
  * ( 4.*W*PDP**3 + 4.*W**2*PDP**3 + 2.*PDP**3 )

  + P(AA1)*D(A1,BB1)*P(B1)
  * ( PDP**3 )

  + D(AA1,A1)*P(B1)*P(BB1)
  * ( PDP**3 )

  + D(AA1,A1)*D(B1,BB1)
  * ( 2.*W*PDP**4 )

  + D(AA1,B1)*P(A1)*P(BB1)
  * ( PDP**3 )

  + D(AA1,B1)*D(A1,BB1)
  * ( 2.*W*PDP**4 )

  + D(AA1,BB1)*P(A1)*P(B1)
  * ( 4.*W*PDP**3 + 4.*W**2*PDP**3 + 2.*PDP**3 )
```

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
   + D(AA1,BB1)*D(A1,B1)

   * ( 2.*W*PDP**4 )  +0.
```

190

```
                N R
                C COMBINATORICS FACTORS INCLUDED
                Z TT1=1./2.*LOOP-(W-1)**2*GHOST
        L 3     ID W1=W-1
                DELETE LOOP,GHOST
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, PQ, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
                =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
                PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

RUNNING TIME (SEC)     284.80                          USED    MAXIMUM
TERMS IN OUTPUT          289
GENERATED TERMS         1568        INPUT SPACE        362       2000
EQUAL TERMS             1185        OUTPUT SPACE      1467       4740
CANCELLATIONS             94        NR. OF EXPR.        33        260
RECORDS WRITTEN         5255        ID. REGISTER         3        500
MULTIPLICATIONS         5811        FUNCT. REG.         19        750


SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
```

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
          DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.     =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
          =0, LOOP, GHOST, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3,
          PP4, GG=3, V=2, TT0, TT1, TT2, TT3.

 TT1 =

   + P(AA1)*P(A1)*P(B1)*P(BB1)
   * ( - 36.*D1*D2*W*PDP**2 + 4.*D1*D2*W**2*PDP**2 + 120.*D1*D2*W**3*PDP**2 - 104.*D1*D2*W**4*PDP**2 + 16.*D1
   *D2*W**5*PDP**2 - 164.*D1*W*PDP**2 - 160.*D1*W**2*PDP**2 + 600.*D1*W**3*PDP**2 - 468.*D1*W**4*PDP**2
   + 112.*D1*W**5*PDP**2 + 80.*D1*PDP**2 + 166.*D1**2*W*PDP**2 + 26.*D1**2*W**2*PDP**2 - 568.*D1**2*W**3*PDP**2
    + 696.*D1**2*W**4*PDP**2 - 336.*D1**2*W**5*PDP**2 + 64.*D1**2*W**6*PDP**2 - 48.*D1**2*PDP**2 - 4.*D2*W*PDP**2
    + 24.*D2*W**2*PDP**2 + 32.*D2*W**3*PDP**2 - 36.*D2*W**4*PDP**2 - 16.*D2*PDP**2 + 14.*D2**2*W*PDP**2
   + 2.*D2**2*W**2*PDP**2 - 48.*D2**2*W**3*PDP**2 + 32.*D2**2*W**4*PDP**2 + 22.*W*PDP**2 - 20.*W**2*PDP**2
   - 102.*W**3*PDP**2 + 98.*W**4*PDP**2 - 18.*W**5*PDP**2 + 4.*W**6*PDP**2 + 16.*PDP**2 )

   + P(AA1)*P(A1)*D(B1,BB1)
   * ( - 4.*D1*D2*W*PDP**3 + 12.*D1*D2*W**3*PDP**3 - 8.*D1*D2*W**4*PDP**3 + D1*D2*PDP**3 + 53.*D1*W*PDP**3
   + 49.*D1*W**2*PDP**3 - 194.*D1*W**3*PDP**3 + 148.*D1*W**4*PDP**3 - 32.*D1*W**5*PDP**3 - 25.*D1*PDP**3
   - 42.*D1**2*W*PDP**3 - 16.*D1**2*W**2*PDP**3 + 150.*D1**2*W**3*PDP**3 - 180.*D1**2*W**4*PDP**3 + 99.*D1**2
   *W**5*PDP**3 - 16.*D1**2*W**6*PDP**3 + 31./2.*D1**2*PDP**3 - D2*W*PDP**3 - 5.*D2*W**2*PDP**3 - 2.*D2*W**3*PDP**3
    + 4.*D2*W**4*PDP**3 + 5.*D2*PDP**3 - 1./2.*D2**2*PDP**3 + 1./2.*W*PDP**3 - 15.*W**2*PDP**3 + 39./2.*W**3*PDP**3
    + 3.*W**4*PDP**3 - 8.*W**5*PDP**3 - 1./2.*PDP**3 )

   + P(AA1)*D(A1,B1)*P(BB1)
   * ( 2.*D1*D2*W*PDP**3 - 14.*D1*D2*W**2*PDP**3 + 4.*D1*D2*W**3*PDP**3 + 6.*D1*D2*PDP**3 + 48.*D1*W*PDP**3
   + 108.*D1*W**2*PDP**3 - 172.*D1*W**3*PDP**3 + 48.*D1*W**4*PDP**3 - 32.*D1*PDP**3 - 49.*D1**2*W*PDP**3
   - 54.*D1**2*W**2*PDP**3 + 180.*D1**2*W**3*PDP**3 - 128.*D1**2*W**4*PDP**3 + 32.*D1**2*W**5*PDP**3 + 20.*D1**2
   *PDP**3 - 4.*D2*W*PDP**3 - 10.*D2*W**2*PDP**3 + 6.*D2*W**3*PDP**3 + 6.*D2*PDP**3 - D2**2*W*PDP**3 + 4.*D2**2
   *W**2*PDP**3 - 2.*D2**2*PDP**3 - 7.*W*PDP**3 + 3.*W**2*PDP**3 + 18.*W**3*PDP**3 - 7.*W**4*PDP**2 + 2.*W**5
   *PDP**3 - 4.*PDP**3 )

   + P(AA1)*D(A1,BB1)*P(B1)
   * ( - 4.*D1*D2*W*PDP**3 + 12.*D1*D2*W**3*PDP**3 - 8.*D1*D2*W**4*PDP**3 + D1*D2*PDP**3 + 53.*D1*W*PDP**3
   + 49.*D1*W**2*PDP**3 - 194.*D1*W**3*PDP**3 + 148.*D1*W**4*PDP**3 - 32.*D1*W**5*PDP**3 - 25.*D1*PDP**3
```

CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

```
- 42.*D1**2*W*PDP**3 - 16.*D1**2*W**2*PDP**3 + 150.*D1**2*W**3*PDP**3 - 180.*D1**2*W**4*PDP**3 + 88.*D1**2
*W**5*PDP**3 - 16.*D1**2*W**6*PDP**3 + 31./2.*D1**2*PDP**3 - D2*W*PDP**3 - 5.*D2*W**2*PDP**3 - 2.*D2*W**3*PDP**3
 + 4.*D2*W**4*PDP**3 + 5.*D2*PDP**3 - 1./2.*D2**2*PDP**3 + 1./2.*W*PDP**3 - 15.*W**2*PDP**3 + 39./2.*W**3*PDP**3
 + 3.*W**4*PDP**3 - 8.*W**5*PDP**3 - 1./2.*PDP**3 )

+ D(AA1,A1)*P(B1)*P(BB1)
* ( - 4.*D1*D2*W*PDP**3 + 12.*D1*D2*W**3*PDP**3 - 8.*D1*D2*W**4*PDP**3 + D1*D2*PDP**3 + 53.*D1*W*PDP**3
+ 49.*D1*W**2*PDP**3 - 194.*D1*W**3*PDP**3 + 148.*D1*W**4*PDP**3 - 32.*D1*W**5*PDP**3 - 25.*D1*PDP**3
- 42.*D1**2*W*PDP**3 - 16.*D1**2*W**2*PDP**3 + 150.*D1**2*W**3*PDP**3 - 180.*D1**2*W**4*PDP**3 + 88.*D1**2
*W**5*PDP**3 - 16.*D1**2*W**6*PDP**3 + 31./2.*D1**2*PDP**3 - D2*W*PDP**3 - 5.*D2*W**2*PDP**3 - 2.*D2*W**3*PDP**3
 + 4.*D2*W**4*PDP**3 + 5.*D2*PDP**3 - 1./2.*D2**2*PDP**3 + 1./2.*W*PDP**3 - 15.*W**2*PDP**3 + 39./2.*W**3*PDP**3
 + 3.*W**4*PDP**3 - 8.*W**5*PDP**3 - 1./2.*PDP**3 )

+ D(AA1,A1)*D(B1,BB1)
* ( 4.*D1*D2*W*PDP**4 - 12.*D1*D2*W**3*PDP**4 + 8.*D1*D2*W**4*PDP**4 - D1*D2*PDP**4 - 53.*D1*W*PDP**4
- 46.*D1*W**2*PDP**4 + 192.*D1*W**3*PDP**4 - 148.*D1*W**4*PDP**4 + 32.*D1*W**5*PDP**4 + 24.*D1*PDP**4
+ 42.*D1**2*W*PDP**4 + 16.*D1**2*W**2*PDP**4 - 150.*D1**2*W**3*PDP**4 + 180.*D1**2*W**4*PDP**4 - 88.*D1**2
*W**5*PDP**4 + 16.*D1**2*W**6*PDP**4 - 31./2.*D1**2*PDP**4 + D2*W*PDP**4 + 2.*D2*W**2*PDP**4 + 4.*D2*W**3*PDP**4
 - 4.*D2*W**4*PDP**4 - 4.*D2*PDP**4 + 1./2.*D2**2*PDP**4 - 1./2.*W*PDP**4 + 18.*W**2*PDP**4 - 43./2.*W**3*PDP**4
 - 3.*W**4*PDP**4 + 8.*W**5*PDP**4 - 1./2.*PDP**4 )

+ D(AA1,B1)*P(A1)*P(BB1)
* ( - 4.*D1*D2*W*PDP**3 + 12.*D1*D2*W**3*PDP**3 - 8.*D1*D2*W**4*PDP**3 + D1*D2*PDP**3 + 53.*D1*W*PDP**3
+ 49.*D1*W**2*PDP**3 - 194.*D1*W**3*PDP**3 + 148.*D1*W**4*PDP**3 - 32.*D1*W**5*PDP**3 - 25.*D1*PDP**3
- 42.*D1**2*W*PDP**3 - 16.*D1**2*W**2*PDP**3 + 150.*D1**2*W**3*PDP**3 - 180.*D1**2*W**4*PDP**3 + 88.*D1**2
*W**5*PDP**3 - 16.*D1**2*W**6*PDP**3 + 31./2.*D1**2*PDP**3 - D2*W*PDP**3 - 5.*D2*W**2*PDP**3 - 2.*D2*W**3*PDP**3
 + 4.*D2*W**4*PDP**3 + 5.*D2*PDP**3 - 1./2.*D2**2*PDP**3 + 1./2.*W*PDP**3 - 15.*W**2*PDP**3 + 39./2.*W**3*PDP**3
 + 3.*W**4*PDP**3 - 8.*W**5*PDP**3 - 1./2.*PDP**3 )

+ D(AA1,B1)*D(A1,BB1)
* ( 4.*D1*D2*W*PDP**4 - 12.*D1*D2*W**3*PDP**4 + 8.*D1*D2*W**4*PDP**4 - D1*D2*PDP**4 - 53.*D1*W*PDP**4
- 46.*D1*W**2*PDP**4 + 192.*D1*W**3*PDP**4 - 148.*D1*W**4*PDP**4 + 32.*D1*W**5*PDP**4 + 24.*D1*PDP**4
```

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
+ 42.*D1**2*W*PDP**4 + 25.*D1**2*W**2*PDP**4 - 250.*D1**2*W**3*PDP**4 + 180.*D1**2*W**4*PDP**4 - 88.*D1**2
*W**5*PDP**4 + 16.*D1**2*W**6*PDP**4 - 31./2.*D1**2*PDP**4 + D2*W*PDP**4 + 2.*D2*W**2*PDP**4 + 4.*D2*W**3*PDP**4
 - 4.*D2*W**4*PDP**4 - 4.*D2*PDP**4 + 1./2.*D2**2*PDP**4 - 1./2.*W*PDP**4 + 18.*W**2*PDP**4 - 43./2.*W**3*PDP**4
 - 3.*W**4*PDP**4 + 8.*W**5*PDP**4 - 1./2.*PDP**4 )

+ D(AA1,BB1)*P(A1)*P(B1)
* ( 2.*D1*D2*W*PDP**3 - 14.*D1*D2*W**2*PDP**3 + 4.*D1*D2*W**3*PDP**3 + 6.*D1*D2*PDP**3 + 48.*D1*W*PDP**3
+ 108.*D1*W**2*PDP**3 - 170.*D1*W**3*PDP**3 + 48.*D1*W**4*PDP**3 - 32.*D1*PDP**3 - 49.*D1**2*W*PDP**3
- 54.*D1**2*W**2*PDP**3 + 80.*D1**2*W**3*PDP**3 - 128.*D1**2*W**4*PDP**3 + 32.*D1**2*W**5*PDP**3 + 20.*D1**2
*PDP**3 - 4.*D2*W*PDP**3 - 10.*D2*W**2*PDP**3 + 5.*D2*W**3*PDP**3 + 6.*D2*PDP**3 - D2**2*W*PDP**3 + 4.*D2**2
*W**2*PDP**3 - 2.*D2**2*PDP**3 - 7.*W*PDP**3 + 3.*W**2*PDP**3 + 18.*W**3*PDP**3 - 7.*W**4*PDP**3 + 2.*W**5
*PDP**3 - 8.*PDP**3 )

+ D(AA1,BB1)*D(A1,B1)
* ( 4.*D1*D2*W*PDP**4 + 20.*D1*D2*W**2*PDP**4 - 12.*D1*D2*W**3*PDP**4 - 3.*D1*D2*PDP**4 - 42.*D1*W*PDP**4
- 117.*D1*W**2*PDP**4 + 136.*D1*W**3*PDP**4 - 32.*D1*W**4*PDP**4 + 32.*D1*PDP**4 + 38.*D1**2*W*PDP**4
+ 80.*D1**2*W**2*PDP**4 - 152.*D1**2*W**3*PDP**4 + 88.*D1**2*W**4*PDP**4 - 16.*D1**2*W**5*PDP**4
 - 51./2.*D1**2*PDP**4 + 2.*D2*W*PDP**4 - 5.*D2*W**2*PDP**4 + 4.*D2*W**3*PDP**4 - 2.*D2*PDP**4 + 1./2.*D2**2
*PDP**4 + 5./2.*W*PDP**4 + 23.*W**2*PDP**4 - 15./2.*W**3*PDP**4 - 7.*W**4*PDP**4 + 3./2.*PDP**4 )  +0.

                H R
                Z TT1=TT1
        L 2     ID D1=1+ALFA
        L 2     AL D2=2+ALFA
                *BEGIN

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.
```

CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
=0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
GG=3, V=2, TT0, TT1, TT2, TT3.

			USED	MAXIMUM
RUNNING TIME (SEC)	207.08			
TERMS IN OUTPUT	193			
GENERATED TERMS	768	INPUT SPACE	352	2000
EQUAL TERMS	564	OUTPUT SPACE	757	4740
CANCELLATIONS	11	NR. OF EXPR.	30	260
RECORDS WRITTEN	5263	ID. REGISTER	5	500
MULTIPLICATIONS	2784	FUNCT. REG.	17	750

SYMBOLS I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, ST=Z, AA=Z, B8=Z,
CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
=0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
GG=3, V=2, TT0, TT1, TT2, TT3.

```
 TT1 =

   + P(AA1)*P(A1)*P(B1)*P(3B1)

   * ( 112.*ALFA*W*PDP**2 - 64.*ALFA*W**2*PDP**2 - 336.*ALFA*W**3*PDP**2 + 704.*ALFA*W**4*PDP**2 - 512.*ALFA*W**5
   *PDP**2 + 128.*ALFA*W**6*PDP**2 - 32.*ALFA*PDP**2 + 144.*ALFA**2*W*PDP**2 + 32.*ALFA**2*W**2*PDP**2
   - 496.*ALFA**2*W**3*PDP**2 + 624.*ALFA**2*W**4*PDP**2 - 320.*ALFA**2*W**5*PDP**2 + 64.*ALFA**2*W**6*PDP**2
    - 48.*ALFA**2*PDP**2 - 90.*W**2*PDP**2 + 42.*W**3*PDP**2 + 174.*W**4*PDP**2 - 210.*W**5*PDP**2 + 68.*W**6
   *PDP**2 + 16.*PDP**2 )


   + P(AA1)*P(A1)*D(B1,BB1)

   * ( - 44.*ALFA*W*PDP**3 + 12.*ALFA*W**2*PDP**3 + 140.*ALFA*W**3*PDP**3 - 232.*ALFA*W**4*PDP**3 + 144.*ALFA
   *W**5*PDP**3 - 32.*ALFA*W**6*PDP**3 + 12.*ALFA*PDP**3 - 46.*ALFA**2*W*PDP**3 - 16.*ALFA**2*W**2*PDP**3
   + 162.*ALFA**2*W**3*PDP**3 - 138.*ALFA**2*W**4*PDP**3 + 38.*ALFA**2*W**5*PDP**3 - 16.*ALFA**2*W**6*PDP**3
   + 16.*ALFA**2*PDP**3 + 3./2.*W*PDP**3 + 8.*W**2*PDP**3 - 9./2.*W**3*PDP**3 - 37.*W**4*PDP**3 + 48.*W**5*PDP**3


    - 16.*W**6*PDP**3 )
```

```
 - 16.*W**6*PDP**3 )

+ P(AA1)*D(A1,B1)*P(BB1)
* ( - 52.*ALFA*W*PDP**3 - 36.*ALFA*W**2*PDP**3 + 208.*ALFA*W**3*PDP**3 - 208.*ALFA*W**4*PDP**3 + 64.*ALFA*W**5
*PDP**3 + 24.*ALFA*PDP**3 - 48.*ALFA**2*W*PDP**3 - 64.*ALFA**2*W**2*PDP**3 + 184.*ALFA**2*W**3*PDP**3
- 128.*ALFA**2*W**4*PDP**3 + 32.*ALFA**2*W**5*PDP**3 + 24.*ALFA**2*PDP**3 - 16.*W*PDP**3 + 25.*W**2*PDP**3
 + 48.*W**3*PDP**3 - 87.*W**4*PDP**3 + 34.*W**5*PDP**3 - 4.*PDP**3 )

+ P(AA1)*D(A1,BB1)*P(B1)
* ( - 44.*ALFA*W*PDP**3 + 12.*ALFA*W**2*PDP**3 + 140.*ALFA*W**3*PDP**3 - 232.*ALFA*W**4*PDP**3 + 144.*ALFA
*W**5*PDP**3 - 32.*ALFA*W**6*PDP**3 + 12.*ALFA*PDP**3 - 46.*ALFA**2*W*PDP**3 - 16.*ALFA**2*W**2*PDP**3
+ 162.*ALFA**2*W**3*PDP**3 - 138.*ALFA**2*W**4*PDP**3 + 88.*ALFA**2*W**5*PDP**3 - 16.*ALFA**2*W**6*PDP**3
+ 16.*ALFA**2*PDP**3 + 3./2.*W*PDP**3 + 8.*W**2*PDP**3 - 9./2.*W**3*PDP**3 - 37.*W**4*PDP**3 + 48.*W**5*PDP**3
 - 16.*W**6*PDP**3 )

+ D(AA1,A1)*P(B1)*P(BB1)
* ( - 44.*ALFA*W*PDP**3 + 12.*ALFA*W**2*PDP**3 + 140.*ALFA*W**3*PDP**3 - 232.*ALFA*W**4*PDP**3 + 144.*ALFA
*W**5*PDP**3 - 32.*ALFA*W**6*PDP**3 + 12.*ALFA*PDP**3 - 46.*ALFA**2*W*PDP**3 - 16.*ALFA**2*W**2*PDP**3
+ 162.*ALFA**2*W**3*PDP**3 - 138.*ALFA**2*W**4*PDP**3 + 88.*ALFA**2*W**5*PDP**3 - 16.*ALFA**2*W**6*PDP**3
+ 16.*ALFA**2*PDP**3 + 3./2.*W*PDP**3 + 8.*W**2*PDP**3 - 9./2.*W**3*PDP**3 - 37.*W**4*PDP**3 + 48.*W**5*PDP**3
 - 16.*W**6*PDP**3 )

+ D(AA1,A1)*D(B1,BB1)
* ( 44.*ALFA*W*PDP**4 - 12.*ALFA*W**2*PDP**4 - 140.*ALFA*W**3*PDP**4 + 232.*ALFA*W**4*PDP**4 - 144.*ALFA*W**5
*PDP**4 + 32.*ALFA*W**6*PDP**4 - 12.*ALFA*PDP**4 + 46.*ALFA**2*W*PDP**4 + 16.*ALFA**2*W**2*PDP**4 - 162.*ALFA**2
*W**3*PDP**4 + 138.*ALFA**2*W**4*PDP**4 - 88.*ALFA**2*W**5*PDP**4 + 16.*ALFA**2*W**6*PDP**4 - 16.*ALFA**2*PDP**4
 - 3./2.*W*PDP**4 - 3.*W**2*PDP**4 + 9./2.*W**3*PDP**4 + 37.*W**4*PDP**4 - 48.*W**5*PDP**4 + 16.*W**6*PDP**4)


+ D(AA1,B1)*P(A1)*P(BB1)
* ( - 44.*ALFA*W*PDP**3 + 12.*ALFA*W**2*PDP**3 + 140.*ALFA*W**3*PDP**3 - 232.*ALFA*W**4*PDP**3 + 144.*ALFA
*W**5*PDP**3 - 32.*ALFA*W**6*PDP**3 + 12.*ALFA*PDP**3 - 46.*ALFA**2*W*PDP**3 - 16.*ALFA**2*W**2*PDP**3
```

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
+ 162.*ALFA**2*W**3*PDP**3 - 288.*ALFA**2*W**4*PDP**3 + 96.*ALFA**2*W**5*PDP**3 - 16.*ALFA**2*W**6*PDP**3
+ 16.*ALFA**2*PDP**3 + 3./2.*W*PDP**3 + 8.*W**2*PDP**3 - 9./2.*W**3*PDP**3 - 37.*W**4*PDP**3 + 48.*W**5*PDP**3
 - 16.*W**6*PDP**3 )

+ D(AA1,B1)*D(A1,BB1)
* ( 44.*ALFA*W*PDP**4 - 12.*ALFA*W**2*PDP**4 - 140.*ALFA*W**3*PDP**4 + 232.*ALFA*W**4*PDP**4 - 144.*ALFA*W**5
*PDP**4 + 32.*ALFA*W**6*PDP**4 - 12.*ALFA*PDP**4 + 46.*ALFA**2*W*PDP**4 + 16.*ALFA**2*W**2*PDP**4 - 162.*ALFA**2
*W**3*PDP**4 + 188.*ALFA**2*W**4*PDP**4 - 88.*ALFA**2*W**5*PDP**4 + 16.*ALFA**2*W**6*PDP**4 - 16.*ALFA**2*PDP**4
 - 3./2.*W*PDP**4 - 8.*W**2*PDP**4 + 9./2.*W**3*PDP**4 + 37.*W**4*PDP**4 - 48.*W**5*PDP**4 + 16.*W**6*PDP**4)


+ D(AA1,BB1)*P(A1)*P(B1)
* ( - 52.*ALFA*W*PDP**3 - 36.*ALFA*W**2*PDP**3 + 208.*ALFA*W**3*PDP**3 - 208.*ALFA*W**4*PDP**3 + 64.*ALFA*W**5
*PDP**3 + 24.*ALFA*PDP**3 - 48.*ALFA**2*W*PDP**3 - 64.*ALFA**2*W**2*PDP**3 + 184.*ALFA**2*W**3*PDP**3
- 128.*ALFA**2*W**4*PDP**3 + 32.*ALFA**2*W**5*PDP**3 + 24.*ALFA**2*PDP**3 - 16.*W*PDP**3 + 25.*W**2*PDP**3
 + 48.*W**3*PDP**3 - 87.*W**4*PDP**3 + 34.*W**5*PDP**3 - 4.*PDP**3 )

+ D(AA1,BB1)*D(A1,B1)
* ( 48.*ALFA*W*PDP**4 + 68.*ALFA*W**2*PDP**4 - 200.*ALFA*W**3*PDP**4 + 144.*ALFA*W**4*PDP**4 - 32.*ALFA*W**5
*PDP**4 - 28.*ALFA*PDP**4 + 42.*ALFA**2*W*PDP**4 + 90.*ALFA**2*W**2*PDP**4 - 164.*ALFA**2*W**3*PDP**4
+ 88.*ALFA**2*W**4*PDP**4 - 16.*ALFA**2*W**5*PDP**4 - 28.*ALFA**2*PDP**4 + 21./2.*W*PDP**4 - 4.*W**2*PDP**4
 - 79./2.*W**3*PDP**4 + 49.*W**4*PDP**4 - 16.*W**5*PDP**4 )  +0.
```

BEGIN [130.14 SECONDS

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
BEGIN     1110.14  SECONDS

                    NAMES TT1
                    COMMON CGF1,PCGF1,SWI1
                    N 8
                    Z PTT1=P(A1)*TT1
                    Z PPTT1=P(A1)*P(AA1)*TT1
          L 2       ID D1=1+ALFA
          L 2       AL D2=2+ALFA
                    *NEXT

SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.          =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
               =0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
               GG=3, V=2, TT0, TT1, TT2, TT3, CGF1, PCGF1, SWI1.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	.92			
TERMS IN OUTPUT	60			
GENERATED TERMS	386	INPUT SPACE	353	2000
EQUAL TERMS	266	OUTPUT SPACE	449	4740
CANCELLATIONS	60	NR. OF EXPR.	32	260
RECORDS WRITTEN	5270	ID. REGISTER	5	500
MULTIPLICATIONS	1932	FUNCT. REG.	4	750

```
 PTT1 =

   + P(AA1)*P(B1)*P(BB1)

   * ( - 28.*ALFA*W*PDP**3 - 76.*ALFA*W**2*PDP**3 + 152.*ALFA*W**3*PDP**3 + 32.*ALFA*W**4*PDP**3 - 160.*ALFA*W**5

   *PDP**3 + 64.*ALFA*W**6*PDP**3 + 16.*ALFA*PDP**3 + 4.*ALFA**2*W*PDP**3 - 64.*ALFA**2*W**2*PDP**3 + 12.*ALFA**2

   *W**3*PDP**3 + 120.*ALFA**2*W**4*PDP**3 - 112.*ALFA**2*W**5*PDP**3 + 32.*ALFA**2*W**6*PDP**3 + 8.*ALFA**2*PDP**3

    - 13.*W*PDP**3 - 49.*W**2*PDP**3 + 81.*W**3*PDP**3 + 13.*W**4*PDP**3 - 80.*W**5*PDP**3 + 36.*W**6*PDP**3

   + 12.*PDP**3 )


   + D(AA1,BB1)*P(B1)

   * ( - 4.*ALFA*W*PDP**4 + 32.*ALFA*W**2*PDP**4 + 8.*ALFA*W**3*PDP**4 - 64.*ALFA*W**4*PDP**4 + 32.*ALFA*W**5
```

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
*PDP**4 - 4.*ALFA*PDP**4 - 6.*ALFA**2*W*PDP**4 + 26.*ALFA**2*W**2*PDP**4 + 20.*ALFA**2*W**3*PDP**4 - 40.*ALFA**2
*W**4*PDP**4 + 16.*ALFA**2*W**5*PDP**4 - 4.*ALFA**2*PDP**4 - 11./2.*W*PDP**4 + 21.*W**2*PDP**4 + 17./2.*W**3
*PDP**4 - 38.*W**4*PDP**4 + 18.*W**5*PDP**4 - 4.*PDP**4 )


PPTT1 =
  + P(B1)*P(BB1)
  * ( - 32.*ALFA*W*PDP**4 - 44.*ALFA*W**2*PDP**4 + 160.*ALFA*W**3*PDP**4 - 32.*ALFA*W**4*PDP**4 - 128.*ALFA*W**5
  *PDP**4 + 64.*ALFA*W**6*PDP**4 + 12.*ALFA*PDP**4 - 2.*ALFA**2*W*PDP**4 - 38.*ALFA**2*W**2*PDP**4 + 32.*ALFA**2
  *W**3*PDP**4 + 80.*ALFA**2*W**4*PDP**4 - 96.*ALFA**2*W**5*PDP**4 + 32.*ALFA**2*W**6*PDP**4 + 4.*ALFA**2*PDP**4
   - 37./2.*W*PDP**4 - 28.*W**2*PDP**4 + 179./2.*W**3*PDP**4 - 25.*W**4*PDP**4 - 62.*W**5*PDP**4 + 36.*W**6*PDP**4
   + 8.*PDP**4 )  +0.

                C CONNECTED GREEN'S FUNCTION
                N R
                Z CGF1=GG(NU,SI,A1,B1)*TT1*GG(AA1,BB1,MU,RO)
        L 4     ID Z=2*W
        L 4     AL W1=W-1
                DELETE TT1
                *NEXT
```

```
SYMBOLS     I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
            I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
            I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
            I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
            I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
            I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
            I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
            I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
            KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z. A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPP=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.       =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
            =0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
            GG=3, V=2, TT0, TT1, TT2, TT3, CGF1, PCGF1, SWI1.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	22.78			
TERMS IN OUTPUT	581			
GENERATED TERMS	3292	INPUT SPACE	430	2000
EQUAL TERMS	7291	OUTPUT SPACE	3587	4740
CANCELLATIONS	320	NR. OF EXPR.	33	260
RECORDS WRITTEN	3270	ID. REGISTER	7	500
MULTIPLICATIONS	35781	FUNCT. REG.	32	750

CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

CANCELLATIONS	320	NR. OF EXPR.	33	260
RECORDS WRITTEN	5270	ID. REGISTER	5	500
MULTIPLICATIONS	35782	FUNCT. REG.	32	750

			USED	MAXIMUM
RUNNING TIME (SEC)	43.31			
TERMS IN OUTPUT	435			
GENERATED TERMS	15633	INPUT SPACE	401	2000
EQUAL TERMS	14600	OUTPUT SPACE	4043	4740
CANCELLATIONS	598	NR. OF EXPR.	33	260
RECORDS WRITTEN	5270	ID. REGISTER	5	500
MULTIPLICATIONS	69744	FUNCT. REG.	32	750

SYMBOLS I=I, ALFA, D1, D2, D10, D1P0, D20, D2P0, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, PG, PI.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0, =0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4, GG=3, V=2, TT0, TT1, TT2, TT3, CGF1, PCGF1, SW11.

CGF1 =

+ P(MU)*P(NU)*P(RO)*P(SI)

* (16. - 32.*ALFA - 32.*ALFA*D1 + 80.*ALFA*D1*W + 64.*ALFA*D1*W**2 - 304.*ALFA*D1*W**3 + 256.*ALFA*D1*W**4

- 64.*ALFA*D1*W**5 + 112.*ALFA*W - 64.*ALFA*W**2 - 336.*ALFA*W**3 + 704.*ALFA*W**4 - 512.*ALFA*W**5

+ 128.*ALFA*W**6 - 48.*ALFA**2 + 144.*ALFA**2*W + 32.*ALFA**2*W**2 - 496.*ALFA**2*W**3 + 624.*ALFA**2*W**4

- 320.*ALFA**2*W**5 + 64.*ALFA**2*W**6 - 16.*D1 + 48.*D1*W + 16.*D1*W**2 - 176.*D1*W**3 + 192.*D1*W**4

- 64.*D1*W**5 - 90.*W**2 + 42.*W**3 + 174.*W**4 - 210.*W**5 + 68.*W**6)

+ P(MU)*P(NU)*D(RO,SI)

* (- 44.*ALFA*W*PDP + 12.*ALFA*W**2*PDP + 140.*ALFA*W**3*PDP - 232.*ALFA*W**4*PDP + 144.*ALFA*W**5*PDP

- 32.*ALFA*W**6*PDP + 22.*ALFA*PDP - 46.*ALFA**2*W*PDP - 16.*ALFA**2*W**2*PDP + 162.*ALFA**2*W**3*PDP

- 198.*ALFA**2*W**4*PDP + 88.*ALFA**2*W**5*PDP - 16.*ALFA**2*W**6*PDP + 16.*ALFA**2*PDP + 3./2.*W*PDP

+ 8.*W**2*PDP - 9./2.*W**3*PDP - 37.*W**4*PDP + 48.*W**5*PDP - 16.*W**6*PDP)

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

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+ P(MU)*D(NU,RO)*P(SI)
* ( - 44.*ALFA*W*PDP + 12.*ALFA*W**2*PDP + 140.*ALFA*W**3*PDP - 232.*ALFA*W**4*PDP + 144.*ALFA*W**5*PDP
- 32.*ALFA*W**6*PDP + 12.*ALFA*PDP - 46.*ALFA**2*W*PDP - 16.*ALFA**2*W**2*PDP + 162.*ALFA**2*W**3*PDP
- 188.*ALFA**2*W**4*PDP + 88.*ALFA**2*W**5*PDP - 16.*ALFA**2*W**6*PDP + 16.*ALFA**2*PDP + 3./2.*W*PDP
+ 8.*W**2*PDP - 9./2.*W**3*PDP - 37.*W**4*PDP + 48.*W**5*PDP - 16.*W**6*PDP )

+ P(MU)*D(NU,SI)*P(RO)
* ( - 28.*ALFA*D1*D2*W*PDP - 4.*ALFA*D1*D2*W**2*PDP + 104.*ALFA*D1*D2*W**3*PDP - 112.*ALFA*D1*D2*W**4*PDP
+ 32.*ALFA*D1*D2*W**5*PDP + 8.*ALFA*D1*D2*PDP - 40.*ALFA*D1*W*PDP - 104.*ALFA*D1*W**2*PDP + 200.*ALFA*D1*W**3
*PDP + 16.*ALFA*D1*W**4*PDP - 160.*ALFA*D1*W**5*PDP + 64.*ALFA*D1*W**6*PDP + 24.*ALFA*D1*PDP + 28.*ALFA*D1**2
*W*PDP + 4.*ALFA*D1**2*W**2*PDP - 104.*ALFA*D1**2*W**3*PDP + 112.*ALFA*D1**2*W**4*PDP - 32.*ALFA*D1**2*W**5
*PDP - 8.*ALFA*D1**2*PDP + 8.*ALFA*D2*W*PDP + 60.*ALFA*D2*W**2*PDP - 76.*ALFA*D2*W**3*PDP - 96.*ALFA*D2*W**4
*PDP + 176.*ALFA*D2*W**5*PDP - 64.*ALFA*D2*W**6*PDP - 8.*ALFA*D2*PDP - 52.*ALFA*W*PDP - 36.*ALFA*W**2*PDP
+ 208.*ALFA*W**3*PDP - 208.*ALFA*W**4*PDP + 64.*ALFA*W**5*PDP + 24.*ALFA*PDP + 4.*ALFA**2*D1*W*PDP - 64.*ALFA**2
*D1*W**2*PDP + 12.*ALFA**2*D1*W**3*PDP + 120.*ALFA**2*D1*W**4*PDP - 112.*ALFA**2*D1*W**5*PDP + 32.*ALFA**2
*D1*W**6*PDP + 8.*ALFA**2*D1*PDP - 4.*ALFA**2*D2*W*PDP + 64.*ALFA**2*D2*W**2*PDP - 12.*ALFA**2*D2*W**3*PDP
 - 120.*ALFA**2*D2*W**4*PDP + 112.*ALFA**2*D2*W**5*PDP - 32.*ALFA**2*D2*W**6*PDP - 8.*ALFA**2*D2*PDP
- 48.*ALFA**2*W*PDP - 64.*ALFA**2*W**2*PDP + 184.*ALFA**2*W**3*PDP - 128.*ALFA**2*W**4*PDP + 32.*ALFA**2*W**5
*PDP + 24.*ALFA**2*PDP - 16.*D1*D2*W*PDP + 4.*D1*D2*W**2*PDP + 56.*D1*D2*W**3*PDP - 80.*D1*D2*W**4*PDP
+ 32.*D1*D2*W**5*PDP + 4.*D1*D2*PDP - 21.*D1*W*PDP - 61.*D1*W**2*PDP + 113.*D1*W**3*PDP - 3.*D1*W**4*PDP
- 80.*D1*W**5*PDP + 36.*D1*W**6*PDP + 16.*D1*PDP + 16.*D1**2*W*PDP - 4.*D1**2*W**2*PDP - 56.*D1**2*W**3*PDP
 + 80.*D1**2*W**4*PDP - 32.*D1**2*W**5*PDP - 4.*D1**2*PDP + D2*W*PDP + 45.*D2*W**2*PDP - 37.*D2*W**3*PDP
- 61.*D2*W**4*PDP + 96.*D2*W**5*PDP - 36.*D2*W**6*PDP - 8.*D2*PDP - 16.*W*PDP + 25.*W**2*PDP + 48.*W**3*PDP
 - 87.*W**4*PDP + 34.*W**5*PDP - 4.*PDP )

+ D(MU,NU)*P(RO)*P(SI)
* ( - 44.*ALFA*W*PDP + 12.*ALFA*W**2*PDP + 140.*ALFA*W**3*PDP - 232.*ALFA*W**4*PDP + 144.*ALFA*W**5*PDP
- 32.*ALFA*W**6*PDP + 12.*ALFA*PDP - 46.*ALFA**2*W*PDP - 16.*ALFA**2*W**2*PDP + 162.*ALFA**2*W**3*PDP
- 188.*ALFA**2*W**4*PDP + 88.*ALFA**2*W**5*PDP - 16.*ALFA**2*W**6*PDP + 16.*ALFA**2*PDP + 3./2.*W*PDP
+ 8.*W**2*PDP - 9./2.*W**3*PDP - 37.*W**4*PDP + 48.*W**5*PDP - 16.*W**6*PDP )

+ D(MU,NU)*D(RO,SI)

* ( 44.*ALFA*W*PDP**2 - 12.*ALFA*W**2*PDP**2 - 140.*ALFA*W**3*PDP**2 + 232.*ALFA*W**4*PDP**2 - 144.*ALFA*W**
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CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

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* ( 44.*ALFA*W*PDP**2 - 12.*ALFA*W**2*PDP**2 - 140.*ALFA*W**3*PDP**2 + 232.*ALFA*W**4*PDP**2 - 144.*ALFA*W**5
*PDP**2 + 32.*ALFA*W**6*PDP**2 - 12.*ALFA*PDP**2 + 46.*ALFA**2*W*PDP**2 + 16.*ALFA**2*W**2*PDP**2 - 162.*ALFA**2
*W**3*PDP**2 + 100.*ALFA**2*W**4*PDP**2 - 88.*ALFA**2*W**5*PDP**2 + 16.*ALFA**2*W**6*PDP**2 - 16.*ALFA**2*PDP**2
 - 3./2.*W*PDP**2 - 8.*W**2*PDP**2 + 9./2.*W**3*PDP**2 + 37.*W**4*PDP**2 - 48.*W**5*PDP**2 + 16.*W**6*PDP**2)


+ D(MU,RD)*P(MU)*P(SI)
* ( - 28.*ALFA*D1*D2*W*PDP - 4.*ALFA*D1*D2*W**2*PDP + 104.*ALFA*D1*D2*W**3*PDP - 112.*ALFA*D1*D2*W**4*PDP
+ 32.*ALFA*D1*D2*W**5*PDP + 8.*ALFA*D1*D2*PDP - 40.*ALFA*D1*W*PDP - 104.*ALFA*D1*W**2*PDP + 200.*ALFA*D1*W**3
*PDP + 16.*ALFA*D1*W**4*PDP - 160.*ALFA*D1*W**5*PDP + 64.*ALFA*D1*W**6*PDP + 24.*ALFA*D1*PDP + 28.*ALFA*D1**2
*W*PDP + 4.*ALFA*D1**2*W**2*PDP - 104.*ALFA*D1**2*W**3*PDP + 112.*ALFA*D1**2*W**4*PDP - 32.*ALFA*D1**2*W**5
*PDP - 8.*ALFA*D1**2*PDP + 8.*ALFA*D2*W*PDP + 60.*ALFA*D2*W**2*PDP - 76.*ALFA*D2*W**3*PDP - 96.*ALFA*D2*W**4
*PDP + 176.*ALFA*D2*W**5*PDP - 64.*ALFA*D2*W**6*PDP - 8.*ALFA*D2*PDP - 52.*ALFA*W*PDP - 36.*ALFA*W**2*PDP
+ 208.*ALFA*W**3*PDP - 208.*ALFA*W**4*PDP + 64.*ALFA*W**5*PDP + 24.*ALFA*PDP + 4.*ALFA**2*D1*W*PDP - 64.*ALFA**2
*D1*W**2*PDP + 12.*ALFA**2*D1*W**3*PDP + 120.*ALFA**2*D1*W**4*PDP - 112.*ALFA**2*D1*W**5*PDP + 32.*ALFA**2
*D1*W**6*PDP + 8.*ALFA**2*D1*PDP - 4.*ALFA**2*D2*W*PDP + 64.*ALFA**2*D2*W**2*PDP - 12.*ALFA**2*D2*W**3*PDP
 - 120.*ALFA**2*D2*W**4*PDP + 112.*ALFA**2*D2*W**5*PDP - 32.*ALFA**2*D2*W**6*PDP - 8.*ALFA**2*D2*PDP
 - 48.*ALFA**2*W*PDP - 64.*ALFA**2*W**2*PDP + 184.*ALFA**2*W**3*PDP - 128.*ALFA**2*W**4*PDP + 32.*ALFA**2*W**5
*PDP + 24.*ALFA**2*PDP - 36.*D1*D2*W*PDP + 4.*D1*D2*W**2*PDP + 56.*D1*D2*W**3*PDP - 80.*D1*D2*W**4*PDP
+ 32.*D1*D2*W**5*PDP + 4.*D1*D2*PDP - 21.*D1*W*PDP - 61.*D1*W**2*PDP + 113.*D1*W**3*PDP - 3.*D1*W**4*PDP
 - 80.*D1*W**5*PDP + 36.*D1*W**6*PDP + 16.*D1*PDP + 16.*D1**2*W*PDP - 4.*D1**2*W**2*PDP - 56.*D1**2*W**3*PDP
 + 80.*D1**2*W**4*PDP - 32.*D1**2*W**5*PDP - 4.*D1**2*PDP + D2*W*PDP + 45.*D2*W**2*PDP - 37.*D2*W**3*PDP
 - 61.*D2*W**4*PDP + 96.*D2*W**5*PDP - 36.*D2*W**6*PDP - 8.*D2*PDP - 16.*W*PDP + 25.*W**2*PDP + 48.*W**3*PDP
 - 87.*W**4*PDP + 34.*W**5*PDP - 4.*PDP )

+ D(MU,RD)*D(MU,SI)
* ( 36.*ALFA*D1*D2*W*PDP**2 + 84.*ALFA*D1*D2*W**2*PDP**2 - 216.*ALFA*D1*D2*W**3*PDP**2 - 48.*ALFA*D1*D2*W**4
*PDP**2 + 288.*ALFA*D1*D2*W**5*PDP**2 - 128.*ALFA*D1*D2*W**6*PDP**2 - 16.*ALFA*D1*D2*PDP**2 - 8.*ALFA*D1*W
*PDP**2 + 64.*ALFA*D1*W**2*PDP**2 + 16.*ALFA*D1*W**3*PDP**2 - 128.*ALFA*D1*W**4*PDP**2 + 64.*ALFA*D1*W**5*PDP**2
 - 8.*ALFA*D1*PDP**2 - 32.*ALFA*D1**2*W*PDP**2 - 44.*ALFA*D1**2*W**2*PDP**2 + 160.*ALFA*D1**2*W**3*PDP**2
 - 32.*ALFA*D1**2*W**4*PDP**2 - 128.*ALFA*D1**2*W**5*PDP**2 + 64.*ALFA*D1**2*W**6*PDP**2 + 12.*ALFA*D1**2*PDP**2
 + 20.*ALFA*D2*W*PDP**2 - 36.*ALFA*D2*W**2*PDP**2 - 64.*ALFA*D2*W**3*PDP**2 + 144.*ALFA*D2*W**4*PDP**2

 - 64.*ALFA*D2*W**5*PDP**2 - 4.*ALFA*D2**2*W*PDP**2 - 40.*ALFA*D2**2*W**2*PDP**2 + 56.*ALFA*D2**2*W**3*PDP**2
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CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

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- 64.*ALFA*D2*W**5*PDP**2 - 4.*ALFA*D2**2*W*PDP**2 - 40.*ALFA*D2**2*W**2*PDP**2 + 56.*ALFA*D2**2*W**3*PDP**2
 + 80.*ALFA*D2**2*W**4*PDP**2 - 160.*ALFA*D2**2*W**5*PDP**2 + 64.*ALFA*D2**2*W**6*PDP**2 + 4.*ALFA*D2**2*PDP**2
 + 48.*ALFA*W*PDP**2 + 68.*ALFA*W**2*PDP**2 - 200.*ALFA*W**3*PDP**2 + 144.*ALFA*W**4*PDP**2 - 32.*ALFA*W**5
*PDP**2 - 28.*ALFA*PDP**2 + 4.*ALFA**2*D1*D2*W*PDP**2 + 76.*ALFA**2*D1*D2*W**2*PDP**2 - 64.*ALFA**2*D1*D2*W**3
*PDP**2 - 160.*ALFA**2*D1*D2*W**4*PDP**2 + 192.*ALFA**2*D1*D2*W**5*PDP**2 - 64.*ALFA**2*D1*D2*W**6*PDP**2
- 8.*ALFA**2*D1*D2*PDP**2 - 12.*ALFA**2*D1*W*PDP**2 + 52.*ALFA**2*D1*W**2*PDP**2 + 40.*ALFA**2*D1*W**3*PDP**2
 - 80.*ALFA**2*D1*W**4*PDP**2 + 32.*ALFA**2*D1*W**5*PDP**2 - 8.*ALFA**2*D1*PDP**2 - 2.*ALFA**2*D1**2*W*PDP**2
 - 38.*ALFA**2*D1**2*W**2*PDP**2 + 32.*ALFA**2*D1**2*W**3*PDP**2 + 80.*ALFA**2*D1**2*W**4*PDP**2 - 96.*ALFA**2
*D1**2*W**5*PDP**2 + 32.*ALFA**2*D1**2*W**6*PDP**2 + 4.*ALFA**2*D1**2*PDP**2 + 12.*ALFA**2*D2*W*PDP**2
- 52.*ALFA**2*D2*W**2*PDP**2 - 40.*ALFA**2*D2*W**3*PDP**2 + 80.*ALFA**2*D2*W**4*PDP**2 - 32.*ALFA**2*D2*W**5
*PDP**2 + 8.*ALFA**2*D2*PDP**2 - 2.*ALFA**2*D2**2*W*PDP**2 - 38.*ALFA**2*D2**2*W**2*PDP**2 + 32.*ALFA**2*D2**2
*W**3*PDP**2 + 80.*ALFA**2*D2**2*W**4*PDP**2 - 96.*ALFA**2*D2**2*W**5*PDP**2 + 32.*ALFA**2*D2**2*W**6*PDP**2
 + 4.*ALFA**2*D2**2*PDP**2 + 42.*ALFA**2*W*PDP**2 + 90.*ALFA**2*W**2*PDP**2 - 164.*ALFA**2*W**3*PDP**2
+ 88.*ALFA**2*W**4*PDP**2 - 16.*ALFA**2*W**5*PDP**2 - 28.*ALFA**2*PDP**2 + 21.*D1*D2*W*PDP**2 + 60.*D1*D2*W**2
*PDP**2 - 123.*D1*D2*W**3*PDP**2 - 30.*D1*D2*W**4*PDP**2 + 156.*D1*D2*W**5*PDP**2 - 72.*D1*D2*W**6*PDP**2
- 12.*D1*D2*PDP**2 - 11.*D1*W*PDP**2 + 42.*D1*W**2*PDP**2 + 17.*D1*W**3*PDP**2 - 76.*D1*W**4*PDP**2
+ 36.*D1*W**5*PDP**2 - 8.*D1*PDP**2 - 37./2.*D1**2*W*PDP**2 - 28.*D1**2*W**2*PDP**2 + 179./2.*D1**2*W**3*PDP**2
 - 25.*D1**2*W**4*PDP**2 - 62.*D1**2*W**5*PDP**2 + 36.*D1**2*W**6*PDP**2 + 8.*D1**2*PDP**2 + 19.*D2*W*PDP**2
 - 30.*D2*W**2*PDP**2 - 49.*D2*W**3*PDP**2 + 92.*D2*W**4*PDP**2 - 36.*D2*W**5*PDP**2 + 4.*D2*PDP**2
- 5./2.*D2**2*W*PDP**2 - 32.*D2**2*W**2*PDP**2 + 67./2.*D2**2*W**3*PDP**2 + 55.*D2**2*W**4*PDP**2 - 94.*D2**2
*W**5*PDP**2 + 36.*D2**2*W**6*PDP**2 + 4.*D2**2*PDP**2 + 21./2.*W*PDP**2 - 4.*W**2*PDP**2 - 79./2.*W**3*PDP**2
 + 49.*W**4*PDP**2 - 16.*W**5*PDP**2 )

+ D(MU,SI)*P(NU)*P(RO)
* ( - 44.*ALFA*W*PDP + 12.*ALFA*W**2*PDP + 140.*ALFA*W**3*PDP - 232.*ALFA*W**4*PDP + 144.*ALFA*W**5*PDP
- 32.*ALFA*W**6*PDP + 12.*ALFA*PDP - 46.*ALFA**2*W*PDP - 16.*ALFA**2*W**2*PDP + 162.*ALFA**2*W**3*PDP
- 188.*ALFA**2*W**4*PDP + 88.*ALFA**2*W**5*PDP - 16.*ALFA**2*W**6*PDP + 16.*ALFA**2*PDP + 3./2.*W*PDP
+ 8.*W**2*PDP - 9./2.*W**3*PDP - 37.*W**4*PDP + 48.*W**5*PDP - 16.*W**6*PDP )

+ D(MU,SI)*D(NU,RO)
* ( 44.*ALFA*W*PDP**2 - 12.*ALFA*W**2*PDP**2 - 140.*ALFA*W**3*PDP**2 + 232.*ALFA*W**4*PDP**2 - 144.*ALFA*W**5
*PDP**2 + 32.*ALFA*W**6*PDP**2 - 12.*ALFA*PDP**2 + 46.*ALFA**2*W*PDP**2 + 16.*ALFA**2*W**2*PDP**2 - 162.*ALFA**2
*W**3*PDP**2 + 188.*ALFA**2*W**4*PDP**2 - 88.*ALFA**2*W**5*PDP**2 + 16.*ALFA**2*W**6*PDP**2 - 16.*ALFA**2*PDP**2
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*W**3*PDP**2 + 180.*ALFA**2*W**4*PDP**2 - 88.*ALFA**2*W**5*PDP**2 + 16.*ALFA**2*W**6*PDP**2 - 16.*ALFA**2*PDP**2
 - 3./2.*W*PDP**2 - 8.*W**2*PDP**2 + 9./2.*W**3*PDP**2 + 37.*W**4*PDP**2 - 48.*W**5*PDP**2 + 16.*W**6*PDP**2)
  +0.

                C SLAVNOV-WARD IDENTITY
                N R
                Z PCGF1=P(NU)*CGF1
                Z SWI1=P(MU)*P(NU)*CGF1
        L 2     ID D1=1+ALFA
        L 2     AL D2=2+ALFA
                DELETE CGF1
                *NEXT

SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.           =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
                =0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
                GG=3, V=2, TT0, =0, TT2, TT3, CGF1, PCGF1, SWI1.

RUNNING TIME (SEC)      47.73                           USED    MAXIMUM
TERMS IN OUTPUT           24
GENERATED TERMS         1798        INPUT SPACE          360       2000
EQUAL TERMS             1524        OUTPUT SPACE        1026       4740
CANCELLATIONS            250        NR. OF EXPR.          31        260
RECORDS WRITTEN         5279        ID. REGISTER           5        500
MULTIPLICATIONS         6324        FUNCT. REG.           19        750


SYMBOLS         I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
                I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
                I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
                I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
                I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
                I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
                I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
                I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
                KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.
```

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```
VECTORS        Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.          =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,
               =0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
               GG=3, V=2, TT0, =0, TT2, TT3, CGF1, PCGF1, SWI1.

 PCGF1 =

   + P(MU)*P(RO)*P(SI)

   * ( 12.*ALFA*W*PDP + 4.*ALFA*W**2*PDP - 44.*ALFA*W**3*PDP + 48.*ALFA*W**4*PDP - 16.*ALFA*W**5*PDP - 4.*ALFA

   *PDP + 20.*ALFA**2*W*PDP + 16.*ALFA**2*W**2*PDP - 76.*ALFA**2*W**3*PDP + 64.*ALFA**2*W**4*PDP - 16.*ALFA**2

   *W**5*PDP - 8.*ALFA**2*PDP )


   + D(MU,RO)*P(SI)

   * ( - 12.*ALFA*W*PDP**2 - 4.*ALFA*W**2*PDP**2 + 44.*ALFA*W**3*PDP**2 - 48.*ALFA*W**4*PDP**2 + 16.*ALFA*W**5

   *PDP**2 + 4.*ALFA*PDP**2 - 20.*ALFA**2*W*PDP**2 - 16.*ALFA**2*W**2*PDP**2 + 76.*ALFA**2*W**3*PDP**2

   - 64.*ALFA**2*W**4*PDP**2 + 16.*ALFA**2*W**5*PDP**2 + 8.*ALFA**2*PDP**2 )



 SWI1 = 0.  +0.

                N R
                Z PCGF1=PCGF1
                Z SWI1=SWI1
        L 2     ID ALFA=0
                DELETE PCGF1,SWI1
                *BEGIN

SYMBOLS        I=I, ALFA, D1, D2, D1Q, D1PQ, D2Q, D2PQ, W, W1, Z, K, I1T11,
               I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12,
               I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21,
               I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21,
               I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22,
               I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122,
               I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322,
               I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522,
               KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GU, P0, P1.

EXPR.          =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0, =0, =0,

               =0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
```

=0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4,
GG=3, V=2, TT0, =0, TT2, TT3, =0, PCGF1, SWI1.

			USED	MAXIMUM
RUNNING TIME (SEC)	48.16			
TERMS IN OUTPUT	0			
GENERATED TERMS	0	INPUT SPACE	341	2000
EQUAL TERMS	0	OUTPUT SPACE	0	4740
CANCELLATIONS	0	NP. OF EXPR.	31	260
RECORDS WRITTEN	5285	ID. REGISTER	3	500
MULTIPLICATIONS	98	FUNCT. REG.	15	750

SYMBOLS I=I, ALFA, D1, D2, D10, D1PQ, D20, D2PQ, W, W1, Z, K, I1T11, I1T12, I1T22, I2T11, I2T12, I2T21, I2T22, I3T11, I3T12, I3T22, I4T11, I4T12, I4T21, I4T22, I5T11, I5T12, I5T21, I5T22, I6T11, I6T12, I6T21, I6T22, I7T11, I7T12, I7T21, I7T22, I8T11, I8T12, I8T21, I8T22, I9T11, I9T12, I9T22, I1011, I1012, I1021, I1022, I1111, I1112, I1121, I1122, I1211, I1212, I1221, I1222, I1311, I1312, I1321, I1322, I1411, I1412, I1421, I1422, I1511, I1512, I1521, I1522, KK.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, S0=Z, ST=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, LA=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GU, PQ, P1.

EXPR. =0, =0, =0, =0, =0, =0, =0, VERT3, =0, =0, =0. =0, =0, =0, =0, =0, LOOP, GHOST, VV3, VV4, VG3, VG4, PP3, PP4, GG=3, V=2, TT0, =0, TT2, TT3, =0, PCGF1, SWI1.

PCGF1 = 0.

SWI1 = 0. +0.

APPENDIX VI

THE ONE-LOOP GRAVITON CONTRIBUTION TO THE GRAVITON SELF-ENERGY

$\alpha = -\frac{1}{2}$

Einstein's Parametrization

SCHOONSCHIP , VERSION OF APRIL 1, 1977

TIME .35 SECONDS


```
C COUNTER/MERCURY
COMMON R1,R2,R3,R4,R5,R6,LAG
S D1,D2,D3,D10,D1PQ,D20,D2PQ,M,Z,K,
  I1T11,I2T11,I3T11,I4T11,I5T11,I6T11,I7T11,I8T11,I9T11
I N1=Z,N2=Z,N5=Z,N6=Z,N8=Z,N7=Z,N9=Z,N13=Z,N14=Z,N15=Z,N16=Z,N17=Z,
 N19=Z,N20=Z,N21=Z,N3=Z,N4=Z,N10=Z,N11=Z,N12=Z,LA=Z,TA=Z,
 MU=Z,NU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=Z,L6=Z,
 L7=Z,L8=Z,L9=Z,RU=Z,SI=Z,AA=Z,BB=Z,CC=Z,AA1=Z,AA2=Z,AA3=Z,
 A1=Z,A2=Z,A3=Z,B1=Z,B2=Z,B3=Z,J,BB1=Z,BB2=Z,BB3=Z,C1=Z,
 C2=Z,C3=Z,C4=Z,E1=Z,E2=Z,E3=Z,S1=Z,S2=Z,S3=Z,S4=Z
F GM1,GM,GU1,GU,P0,P1,P2,RX
*FIX
```

SYMBOLS I=I, D1, D2, D3, D10, D1PQ, D20, D2PQ, M, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RU=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. R1, R2, R3, R4, R5, R6, LAG.

BEGIN 57 SECONDS

```
BEGIN          .57  SECONDS

                    N R
                    Z R1=D(MU,NU)*RR(RD,MU,RD,NU)
                    Z R3=RR(RD,MU,RD,NU)
                    Z R5=D(LA,C1)*RR(C1,MU,RD,NU)
               L 1  ID RR(LA+,MU+,RD+,NU+)=(GM1(LA,MU,RD,NU)-GM1(LA,MU,NU,RD)
                     )*K**-1
               L 3  ID,GM1(A+,B+,L+,KA+)=
                     +1./4.*K*D(A,C)*(P2(B,C,L,KA)+P2(C,B,L,KA)
                                     +P2(C,L,B,KA)+P2(L,C,B,KA)
                                     -P2(B,L,C,KA)-P2(L,B,C,KA))
               L 5  ID,GM(A+,B+,C+)*GM(AA+,BB+,CC+)=1./16.*K**2
                     *GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                               +P1(L1,C,B)+P1(C,L1,B)
                               -P1(B,C,L1)-P1(C,B,L1))
                     *GU(AA,L2)*(P1(BB,L2,CC)+P1(L2,BB,CC)
                                +P1(L2,CC,BB)+P1(CC,L2,BB)
                                -P1(BB,CC,L2)-P1(CC,BB,L2))
               L 7  ID,GM(A+,B+,C+)=1./4.*K*GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                                                     +P1(L1,C,B)+P1(C,L1,B)
                                                     -P1(B,C,L1)-P1(C,B,L1))
               L 9  ID,GU1(A+,B+,C+)=-1./2.*K*(P1(A,B,C)+P1(B,A,C))
                     +1./4.*K**2*(P1(A,L3,C)*P0(L3,B)+P1(A,L3,C)*P0(B,L3)
                                 +P1(L3,A,C)*P0(L3,B)+P1(L3,A,C)*P0(B,L3)
                                 +P0(A,L3)*P1(L3,B,C)+P0(A,L3)*P1(B,L3,C)
                                 +P0(L3,A)*P1(L3,B,C)+P0(L3,A)*P1(B,L3,C))
                     -1./8.*K**3*(P1(A,L3,C)*P0(L3,L4)*P0(L4,B)
                                 +P1(A,L3,C)*P0(L3,L4)*P0(B,L4)
                                 +P1(A,L3,C)*P0(L4,L3)*P0(L4,B)
                                 +P1(A,L3,C)*P0(L4,L3)*P0(B,L4)
                                 +P1(L3,A,C)*P0(L3,L4)*P0(L4,B)
                                 +P1(L3,A,C)*P0(L3,L4)*P0(B,L4)
                                 +P1(L3,A,C)*P0(L4,L3)*P0(L4,B)
                                 +P1(L3,A,C)*P0(L4,L3)*P0(B,L4)
                                 +P0(A,L3)*P1(L3,L4,C)*P0(L4,B)
                                 +P0(A,L3)*P1(L3,L4,C)*P0(B,L4)
                                 +P0(A,L3)*P1(L4,L3,C)*P0(L4,B)
                                 +P0(A,L3)*P1(L4,L3,C)*P0(B,L4)
                                 +P0(L3,A)*P1(L3,L4,C)*P0(L4,B)
                                 +P0(L3,A)*P1(L3,L4,C)*P0(B,L4)
                                 +P0(L3,A)*P1(L4,L3,C)*P0(L4,B)
                                 +P0(L3,A)*P1(L4,L3,C)*P0(B,L4)
                                 +P0(A,L3)*P0(L3,L4)*P1(L4,B,C)
                                 +P0(A,L3)*P0(L3,L4)*P1(B,L4,C)
                                 +P0(A,L3)*P0(L4,L3)*P1(L4,B,C)
                                 +P0(A,L3)*P0(L4,L3)*P1(B,L4,C)
                                 +P0(L3,A)*P0(L3,L4)*P1(L4,B,C)
                                 +P0(L3,A)*P0(L3,L4)*P1(B,L4,C)
                                 +P0(L3,A)*P0(L4,L3)*P1(L4,B,C)
                                 +P0(L3,A)*P0(L4,L3)*P1(B,L4,C))
               L11   ID,K=0
               L12   ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(P0(A,B)+P0(B,A))
                     +1./4.*K**2*(P0(A,L3)*P0(L3,B)+P0(A,L3)*P0(B,L3)
                                 +P0(L3,A)*P0(L3,B)+P0(L3,A)*P0(B,L3))
                     -1./8.*K**3*(P0(A,L3)*P0(L3,L4)*P0(L4,B)
                                 +P0(A,L3)*P0(L3,L4)*P0(B,L4)
                                 +P0(A,L3)*P0(L4,L3)*P0(L4,B)
                                 +P0(A,L3)*P0(L4,L3)*P0(B,L4)
                                 +P0(L3,A)*P0(L3,L4)*P0(L4,B)
                                 +P0(L3,A)*P0(L3,L4)*P0(B,L4)
                                 +P0(L3,A)*P0(L4,L3)*P0(L4,B)
                                 +P0(L3,A)*P0(L4,L3)*P0(B,L4)))
                    *(D(AA,BB)-1./2.*K*(P0(AA,BB)+P0(BB,AA))
```

```
                +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                            +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                            +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                            +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                            +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                            +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                            +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                            +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                            +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
        L15     ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                            +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                            +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                            +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                            +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                            +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                            +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                            +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                            +PO(L3,A)*PO(L4,L3)*PO(B,L4))
        L17     ID,K=0
                *NEXT

SYMBOLS         I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N9=Z, N7=Z, N0=Z, N12=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UR6, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX, RR.

EXPR.           R1, R2, R3, R4, R5, R6, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	1.23			2000
TERMS IN OUTPUT	33			
GENERATED TERMS	36	INPUT SPACE	811	4740
EQUAL TERMS	3	OUTPUT SPACE	199	260
CANCELLATIONS	0	NR. OF EXPR.	40	500
RECORDS WRITTEN	0	ID. REGISTER	35	750
MULTIPLICATIONS	105	FUNCT. REG.	6	

```
R1 =

  + 1./2.*P2(NU,NU,R0,R0)


  - 1./4.*P2(NU,C,C,NU)


  - 1./2.*P2(NU,R0,NU,R0)


  + 1./4.*P2(NU,P0,R0,NU)
```


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```
     - 1./4.*P2(C,NU,C,NU)

     + 1./4.*P2(C,C,NU,NU)

     - 1./2.*P2(RD,NU,NU,RD)

     + 1./4.*P2(RD,NU,RD,NU)

     + 1./4.*P2(RD,RD,NU,NU)


R3 =
     + 1./4.*P2(NU,NU,RD,RD)

     - 1./4.*P2(NU,C,C,NU)

     - 1./4.*P2(NU,RD,NU,RD)

     + 1./4.*P2(NU,RD,RD,NU)

     + 1./4.*P2(NU,NU,RD,RD)

     - 1./4.*P2(NU,RD,NU,RD)

     - 1./4.*P2(C,NU,C,NU)

     + 1./4.*P2(C,C,NU,NU)

     - 1./4.*P2(RD,NU,NU,RD)

     + 1./4.*P2(RD,NU,RD,NU)
```




```
   - 1./4.*P2(RO,MU,MU,RO)

   + 1./4.*P2(RO,RO,MU,MU)


R5 =
   - 1./4.*P2(LA,MU,NU,RO)

   + 1./4.*P2(LA,MU,RO,NU)

   - 1./4.*P2(LA,NU,MU,RO)

   + 1./4.*P2(LA,RO,MU,NU)

   - 1./4.*P2(MU,LA,NU,RO)

   + 1./4.*P2(MU,LA,RO,NU)

   + 1./4.*P2(MU,NU,LA,RO)

   - 1./4.*P2(MU,RO,LA,NU)

   - 1./4.*P2(NU,LA,MU,RO)

   + 1./4.*P2(NU,MU,LA,RO)

   + 1./4.*P2(RO,LA,MU,NU)

   - 1./4.*P2(RO,MU,LA,NU)  +0.

                  N R
                  Σ R2=D(N1,N2)*RR(N3,N1,N3,N2)
```

```
      Z R4=D(LA,NU)*D(TA,NU)*RR(N3,LA,N3,TA)
      Z R6=D(MU,C2)*D(RO,C3)*D(NU,C4)*RR(LA,C2,C3,C4)
L 1   ID RR(N3+,N1+,N5+,N2+)=(GM1(N3,N1,N5,N2)-GM1(N3,N1,N2,N5)
       )*K**-1
L 3   ID,GM1(N5+,N6+,N7+,N9+)=
       +1./4.*K*D(N5,N8)*(P2(N6,N8,N7,N9)+P2(N8,N6,N7,N9)
                         +P2(N8,N7,N6,N9)+P2(N7,N8,N6,N9)
                         -P2(N6,N7,N8,N9)-P2(N7,N6,N8,N9))
L 5   ID,GM(N5+,N6+,N8+)*GM(N10+,N11+,N12+)=1./16.*K**2
       *GU(N5,N13)*(P1(N6,N13,N8)+P1(N13,N6,N8)
                   +P1(N13,N8,N6)+P1(N8,N13,N6)
                   -P1(N6,N8,N13)-P1(N8,N6,N13))
       *GU(N10,N14)*(P1(N11,N14,N12)+P1(N14,N11,N12)
                    +P1(N14,N12,N11)+P1(N12,N14,N11)
                    -P1(N11,N12,N14)-P1(N12,N11,N14))
L 7   ID,GM(N5+,N6+,N8+)=1./4.*K*GU(N5,N13)*(P1(N6,N13,N8)+P1(N13,N6,N6)
                                             +P1(N13,N8,N6)+P1(N8,N13,N6)
                                             -P1(N5,N8,N13)-P1(N6,N6,N13))
L 9   ID,GU1(N5+,N6+,N8+)=-1./2.*K*(P1(N5,N6,N8)+P1(N6,N5,N8))
       +1./4.*K**2*(P1(N5,N15,N8)*P0(N15,N6)+P1(N5,N15,N8)*P0(N6,N15)
                   +P1(N15,N5,N8)*P0(N15,N6)+P1(N15,N5,N8)*P0(N6,N15)
                   +P0(N5,N15)*P1(N15,N6,N8)+P0(N5,N15)*P1(N6,N15,N8)
                   +P0(N15,N5)*P1(N15,N6,N8)+P0(N15,N5)*P1(N6,N15,N8))
       -1./8.*K**3*(P1(N5,N15,N8)*P0(N15,N16)*P0(N16,N6)
                   +P1(N5,N15,N8)*P0(N15,N16)*P0(N6,N16)
                   +P1(N5,N15,N8)*P0(N16,N15)*P0(N16,N6)
                   +P1(N5,N15,N8)*P0(N16,N15)*P0(N6,N16)
                   +P1(N15,N5,N8)*P0(N15,N16)*P0(N16,N6)
                   +P1(N15,N5,N8)*P0(N15,N16)*P0(N6,N16)
                   +P1(N15,N5,N8)*P0(N16,N15)*P0(N16,N6)
                   +P1(N15,N5,N8)*P0(N16,N15)*P0(N6,N16)
                   +P0(N5,N15)*P1(N15,N16,N8)*P0(N16,N6)
                   +P0(N5,N15)*P1(N15,N16,N8)*P0(N6,N16)
                   +P0(N5,N15)*P1(N16,N15,N8)*P0(N16,N6)
                   +P0(N5,N15)*P1(N16,N15,N8)*P0(N6,N16)
                   +P0(N15,N5)*P1(N15,N16,N8)*P0(N16,N6)
                   +P0(N15,N5)*P1(N15,N16,N8)*P0(N6,N16)
                   +P0(N15,N5)*P1(N16,N15,N8)*P0(N16,N6)
                   +P0(N15,N5)*P1(N16,N15,N8)*P0(N6,N16)
                   +P0(N5,N15)*P0(N15,N16)*P1(N16,N6,N8)
                   +P0(N5,N15)*P0(N15,N16)*P1(N6,N16,N8)
                   +P0(N5,N15)*P0(N16,N15)*P1(N16,N6,N8)
                   +P0(N5,N15)*P0(N16,N15)*P1(N6,N16,N8)
                   +P0(N15,N5)*P0(N15,N16)*P1(N16,N6,N8)
                   +P0(N15,N5)*P0(N15,N16)*P1(N6,N16,N8)
                   +P0(N15,N5)*P0(N16,N15)*P1(N16,N6,N8)
                   +P0(N15,N5)*P0(N16,N15)*P1(N6,N16,N8))
L11   ID,K=0
L12   ID,GU(N5+,N6+)*GU(N10+,N11+)=(D(N5,N6)-1./2.*K*(P0(N5,N6)+P0(N6,N5))
       +1./4.*K**2*(P0(N5,N15)*P0(N15,N6)+P0(N5,N15)*P0(N6,N15)
                   +P0(N15,N5)*P0(N15,N6)+P0(N15,N5)*P0(N6,N15))
       -1./8.*K**3*(P0(N5,N15)*P0(N15,N16)*P0(N16,N6)
                   +P0(N5,N15)*P0(N15,N16)*P0(N6,N16)
                   +P0(N5,N15)*P0(N16,N15)*P0(N16,N6)
                   +P0(N5,N15)*P0(N16,N15)*P0(N6,N16)
                   +P0(N15,N5)*P0(N15,N16)*P0(N16,N6)
                   +P0(N15,N5)*P0(N15,N16)*P0(N6,N16)
                   +P0(N15,N5)*P0(N16,N15)*P0(N16,N6)
                   +P0(N15,N5)*P0(N16,N15)*P0(N6,N16)))
                  *(D(N10,N11)-1./2.*K*(P0(N10,N11)+P0(N11,N10))
       +1./4.*K**2*(P0(N10,N17)*P0(N17,N11)+P0(N10,N17)*P0(N11,N17)
                   +P0(N17,N10)*P0(N17,N11)+P0(N17,N10)*P0(N11,N17))
       -1./8.*K**3*(P0(N10,N17)*P0(N17,N18)*P0(N18,N11)
                   +P0(N10,N17)*P0(N17,N18)*P0(N11,N18)
```

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```
                              +PO(N10,N17)*PO(N18,N17)*PO(N18,N11)
                              +PO(N10,N17)*PO(N18,N17)*PO(N11,N18)
                              +PO(N17,N10)*PO(N17,N19)*PO(N18,N11)
                              +PO(N17,N10)*PO(N17,N18)*PO(N11,N18)
                              +PO(N17,N10)*PO(N18,N17)*PO(N18,N11)
                              +PO(N17,N18)*PO(N18,N17)*PO(N11,N18)))
        L15       ID,GU(N5+,N6+)=D(N5,N6)-1./2.*K*(PO(N5,N6)+PO(N6,N5))
                   +1./4.*K**2*(PO(N5,N15)*PO(N15,N6)+PO(N5,N15)*PO(N6,N15)
                              +PO(N15,N5)*PO(N15,N6)+PO(N15,N5)*PO(N6,N15))
                   -1./8.*K**3*(PO(N5,N15)*PO(N15,N16)*PO(N16,N6)
                              +PO(N5,N15)*PO(N15,N16)*PO(N6,N16)
                              +PO(N5,N15)*PO(N16,N15)*PO(N16,N6)
                              +PO(N5,N15)*PO(N16,N15)*PO(N6,N16)
                              +PO(N15,N5)*PO(N15,N16)*PO(N16,N6)
                              +PO(N15,N5)*PO(N15,N16)*PO(N6,N16)
                              +PO(N15,N5)*PO(N16,N15)*PO(N16,N6)
                              +PO(N15,N5)*PO(N16,N15)*PO(N6,N16))
        L17       ID,K=0
                  *NEXT
```

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```
SYMBOLS     I=I, D1, D2, D3, D19, D1PO, D29, D2PO, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N9=Z, N7=Z, N8=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UGG, DD=U, D8,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PC, P1, P2,
            RX, RR.

EXPR.       R1, R2, R3, R4, R5, R6, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	2.70			
TERMS IN OUTPUT	33			
GENERATED TERMS	36	INPUT SPACE	818	2000
EQUAL TERMS	3	OUTPUT SPACE	199	4740
CANCELLATIONS	0	NR. OF EXPR.	52	260
RECORDS WRITTEN	6	ID. REGISTER	35	500
MULTIPLICATIONS	105	FUNCT. REG.	6	750

```
R2 =

  + 1./2.*P2(N2,N2,N3,N3)


  - 1./4.*P2(N2,N8,N8,N2)


  - 1./2.*P2(N2,N3,N2,N3)


  + 1./4.*P2(N2,N3,N3,N2)
```

```
     - 1./4.*P2(N8,N2,N8,N2)

     + 1./4.*P2(N8,N8,N2,N2)

     - 1./2.*P2(N3,N2,N2,N3)

     + 1./4.*P2(N3,N2,N3,N2)

     + 1./4.*P2(N3,N3,N2,N2)


R4 =
     + 1./4.*P2(N8,N8,NU,NU)

     - 1./4.*P2(N8,NU,N8,NU)

     + 1./4.*P2(N3,N3,NU,NU)

     + 1./4.*P2(N3,NU,N3,NU)

     - 1./4.*P2(N3,NU,NU,N3)

     - 1./4.*P2(N3,NU,NU,N3)

     - 1./4.*P2(NU,N8,N8,NU)

     + 1./4.*P2(NU,N3,N3,NU)

     - 1./4.*P2(NU,N3,NU,N3)

     + 1./4.*P2(NU,NU,N3,N3)
```

```
     - 1./4.*P2(NU,N3,MU,N3)

     + 1./4.*P2(MU,MU,N3,N3)
```



```
R6 =
     - 1./4.*P2(LA,MU,NU,RO)

     + 1./4.*P2(LA,MU,RO,NU)

     - 1./4.*P2(LA,NU,MU,RO)

     + 1./4.*P2(LA,RO,NU,NU)

     - 1./4.*P2(MU,LA,NU,RO)

     + 1./4.*P2(MU,LA,RO,NU)

     + 1./4.*P2(MU,NU,LA,RO)

     - 1./4.*P2(MU,RO,LA,NU)

     - 1./4.*P2(NU,LA,MU,RO)

     + 1./4.*P2(NU,MU,LA,RO)

     + 1./4.*P2(RO,LA,MU,NU)

     - 1./4.*P2(RO,MU,LA,NU)   +0.

                    N R
     Z LAG=(1.+.5*K*P0(N20,N20)+K**2*(P0(N20,N20)*P0(N21,N21)/8.
      -1./16.*(P0(N20,N21)*P0(N20,N21)+P0(N20,N21)*P0(N21,N20)
      +P0(N21,N20)*P0(N20,N21)+P0(N21,N20)*P0(N21,N20))))
      *(D1*R1*R2+D2*R3*R4+D3*R5*R6)
```

```
L 5         ID,K=0
            NPRINT LAG
            DELETE R1,R2,R3,R4,R5,R6
            *BEGIN

SYMBOLS     I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX, RR.

EXPR.       R1, R2, R3, R4, R5, R6, LAG.
```

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			USED	MAXIMUM
RUNNING TIME (SEC)	10.01			
TERMS IN OUTPUT	369			
GENERATED TERMS	369	INPUT SPACE	313	2000
EQUAL TERMS	0	OUTPUT SPACE	2534	4740
CANCELLATIONS	0	NR. OF EXPR.	34	260
RECORDS WRITTEN	12	ID. REGISTER	3	500
MULTIPLICATIONS	17002	FUNCT. REG.	36	750

```
SYMBOLS     I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX, RR.

EXPR.       P1, R2, R3, R4, R5, P6, LAG.
```

BEGIN 10.87 SECONDS

```
NAMES LAG
COMMON V1,V2,INVP
S Z,KK
V Q1,Q2,Q3,P
*FIX
```

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SYMBOLS I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, LAG, V1, V2, INVP.

```
BEGIN       10.97  SECONDS

                N R
                Z V1=LAG
        L 2     ID,ADISO,P2(L1+,L2+,L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                 D(L1,A1)*D(L2,B1)*Q1(L3)*Q1(L4)*D(L5,A2)*D(L6,B2)*Q2(L7)*Q2(L8)
                *NEXT

SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, URG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, LAG, V1, V2, TNVP.

RUNNING TIME (SEC)      1.68                        USED     MAXIMUM
TERMS IN OUTPUT           36
GENERATED TERMS          369        INPUT SPACE      291        2000
EQUAL TERMS              311        OUTPUT SPACE     265        4740
CANCELLATIONS             22        NR. OF EXPR.      23         260
RECORDS WRITTEN           22        ID. REGISTER      14         500
MULTIPLICATIONS         2504        FUNCT. REG.       23         750

 V1 =

   + Q1(A1)*Q1(A2)*Q2(B1)*Q2(B2)

   * ( 1./8.*D2 )


   + Q1(A1)*Q1(A2)*D(B1,B2)

   * ( - 1./8.*D2*Q2DQ2 )


   + Q1(A1)*Q2(A2)*Q1(B1)*Q2(B2)

   * ( D1 )


   + Q1(A1)*Q2(A2)*Q2(B1)*Q1(B2)

   * ( 1./8.*D2 )
```

```
     + Q1(A1)*Q2(A2)*D(B1,B2)
     * ( 1./8.*D2*Q1DQ2 )

     + Q1(A1)*D(A2,B1)*Q1(B2)
     * ( - 1./8.*D2*Q2DQ2 )

     + Q1(A1)*D(A2,B1)*Q2(B2)
     * ( 1./8.*D2*Q1DQ2 )

     + Q1(A1)*D(A2,B2)*Q1(B1)
     * ( - D1*Q2DQ2 )

     + Q1(A1)*D(A2,B2)*Q2(B1)
     * ( - 1./4.*D2*Q1DQ2 )

     + Q2(A1)*Q1(A2)*Q1(B1)*Q2(B2)
     * ( 1./8.*D2 )

     + Q2(A1)*Q1(A2)*Q2(B1)*Q1(B2)
     * ( D3 )

     + Q2(A1)*Q1(A2)*D(B1,B2)
     * ( - 1./2.*D3*Q1DQ2 )

     + Q2(A1)*Q2(A2)*Q1(B1)*Q1(B2)
     * ( 1./8.*D2 )

     + Q2(A1)*Q2(A2)*D(B1,B2)
     * ( - 1./8.*D2*Q1DQ1 )

     + Q2(A1)*D(A2,B1)*Q1(B2)
     * ( - 1./2.*D3*Q1DQ2 )
```

```
     + D(A1,B1)*Q2(A2)*Q2(B2)
     * ( - D1*Q1DQ1 )

     + D(A1,B1)*D(A2,B2)
     * ( D1*Q1DQ1*Q2DQ2 + 1./4.*D3*Q1DQ2**2 )

     + D(A1,B2)*Q1(A2)*Q1(B1)
     * ( - 1./8.*D2*Q2DQ2 )

     + D(A1,B2)*Q1(A2)*Q2(B1)
     * ( - 1./2.*D3*Q1DQ2 )

     + D(A1,B2)*Q2(A2)*Q1(B1)
     * ( 1./8.*D2*Q1DQ2 )

     + D(A1,B2)*Q2(A2)*Q2(B1)
     * ( - 1./8.*D2*Q1DQ1 )

     + D(A1,B2)*D(A2,B1)
     * ( 1./8.*D2*Q1DQ1*Q2DQ2 + 1./2.*D3*Q1DQ2**2 )  +0.

                    N R
                    Z V2=LAG
          L 2       ID,ADISO,P2(L1+,L2+,L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                     D(L1,A2)*D(L2,B2)*Q2(L3)*Q2(L4)*D(L5,A1)*D(L6,B1)*Q1(L7)*Q1(L8)
                    DELETE LAG
                    *NEXT

SYMBOLS        I=I, D1, D2, D3, D2Q, D1PQ, D2Q, D2PQ, W, Z. K, I1T11,
               I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
               KK.

INDICES        N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
               N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
               N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
               KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
               R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
               A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
               C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3, P.
```




```
FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, LAG, V1, V2, INVP.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	3.49			
TERMS IN OUTPUT	36			
GENERATED TERMS	369	INPUT SPACE	279	2000
EQUAL TERMS	311	OUTPUT SPACE	265	4740
CANCELLATIONS	22	NR. OF EXPR.	22	260
RECORDS WRITTEN	24	ID. REGISTER	14	500
MULTIPLICATIONS	1046	FUNCT. REG.	23	750

```
SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N1
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9
                R0=Z, SI=Z, AA=Z, B0=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, LAG, V1, V2, INVP.
```

```
V2 =

  + Q1(A1)*Q1(A2)*Q2(B1)*Q2(B2)

  * ( 1./8.*D2 )


  + Q1(A1)*Q1(A2)*D(B1,B2)

  * ( - 1./8.*D2*Q2DQ2 )


  + Q1(A1)*Q2(A2)*Q1(B1)*Q2(B2)

  * ( D1 )


  + Q1(A1)*Q2(A2)*Q2(B1)*Q1(B2)

  * ( 1./8.*D2 )


  + Q1(A1)*Q2(A2)*D(B1,B2)

  * ( 1./8.*D2*Q1DQ2 )
```

```
     + Q1(A1)*D(A2,B1)*Q1(B2)
     * ( - 1./8.*D2*Q2D02 )

     + Q1(A1)*D(A2,B1)*Q2(B2)
     * ( 1./8.*D2*Q1D02 )

     + Q1(A1)*D(A2,B2)*Q1(B1)
     * ( - D1*Q2D02 )

     + Q1(A1)*D(A2,B2)*Q2(B1)
     * ( - 1./4.*D2*Q1D02 )

     + Q2(A1)*Q1(A2)*Q1(B1)*Q2(B2)
     * ( 1./8.*D2 )

     + Q2(A1)*Q1(A2)*Q2(B1)*Q1(B2)
     * ( D3 )

     + Q2(A1)*Q1(A2)*D(B1,B2)
     * ( - 1./2.*D3*Q1D02 )

     + Q2(A1)*Q2(A2)*Q1(B1)*Q1(B2)
     * ( 1./8.*D2 )

     + Q2(A1)*Q2(A2)*D(B1,B2)
     * ( - 1./8.*D2*Q1D01 )

     + Q2(A1)*D(A2,B1)*Q1(B2)
     * ( - 1./2.*D3*Q1D02 )

     + Q2(A1)*D(A2,B1)*Q2(B2)
```

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```
     * ( - 1./8.*D2*Q1DQ1 )

     + Q2(A1)*D(A2,B2)*Q1(B1)
     * ( - 1./4.*D2*Q1DQ2 )

     + Q2(A1)*D(A2,B2)*Q2(B1)
     * ( 1./4.*D2*Q1DQ1 )

     + D(A1,A2)*Q1(B1)*Q1(B2)
     * ( - 1./8.*D2*Q2DQ2 )

     + D(A1,A2)*Q1(B1)*Q2(B2)
     * ( 1./8.*D2*Q1DQ2 )

     + D(A1,A2)*Q2(B1)*Q1(B2)
     * ( - 1./2.*D3*Q1DQ2 )

     + D(A1,A2)*Q2(B1)*Q2(B2)
     * ( - 1./8.*D2*Q1DQ1 )

     + D(A1,A2)*D(B1,B2)
     * ( 1./8.*D2*Q1DQ1*Q2DQ2 + 1./2.*D3*Q1DQ2**2 )

     + D(A1,B1)*Q1(A2)*Q1(B2)
     * ( 1./4.*D2*Q2DQ2 )

     + D(A1,B1)*Q1(A2)*Q2(B2)
     * ( - 1./4.*D2*Q1DQ2 )

     + D(A1,B1)*Q2(A2)*Q1(B2)
     * ( - 1./4.*D2*Q1DQ2 )
```

```
      + D(A1,B1)*Q2(A2)*Q2(B2)
      * ( - D1*Q1DQ1 )

      + D(A1,B1)*D(A2,B2)
      * ( D1*Q1DQ1*Q2DQ2 + 1./4.*D2*Q1DQ2**2 )

      + D(A1,B2)*Q1(A2)*Q2(B1)
      * ( - 1./8.*D2*Q2DQ2 )

      + D(A1,B2)*Q1(A2)*Q2(B1)
      * ( - 1./2.*D3*Q1DQ2 )

      + D(A1,B2)*Q2(A2)*Q1(B1)
      * ( 1./8.*D2*Q1DQ2 )

      + D(A1,B2)*Q2(A2)*Q2(B1)
      * ( - 1./8.*D2*Q1DQ1 )

      + D(A1,B2)*D(A2,B1)
      * ( 1./8.*D2*Q1DQ1*Q2DQ2 + 1./2.*D3*Q1DQ2**2 )  +Q.

                  N R
                  Z INVP=V1+V2
            L 2   ID,Q1(MU+)=P(MU)
            L 3   ID,2,DUTPR,Q1(MU+)=P(MU)
            L 5   ID,Q2(MU+)=-P(MU)
            L 6   ID,2,DUTPR,Q2(MU+)=-P(MU)
            L 8   ID Z=2*W
                  NPRINT INVP
                  DELETE V1,V2
                  *BEGIN

SYMBOLS     I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, Y, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            PQ=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.
```

VECTORS Q1, Q2, Q3, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, V1, V2, INVP.

			USED	MAXIMUM
RUNNING TIME (SEC)	4.50			
TERMS IN OUTPUT	21			
GENERATED TERMS	72	INPUT SPACE	233	2000
EQUAL TERMS	45	OUTPUT SPACE	124	4740
CANCELLATIONS	6	NR. OF EXPR.	20	260
RECORDS WRITTEN	29	ID. REGISTER	15	500
MULTIPLICATIONS	782	FUNCT. REG.	19	750

SYMBOLS I=I, D1, D2, D3, D1Q, D1P0, D2Q, D2P0, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, V1, V2, INVP.

```
      C WORKS OUT PH1**3 PART OF R AND G**.5*R
      COMMON R,RR,LAG
      *FIX
```

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```
SYMBOLS     I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            BD=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2,
            BX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, TNVP, P, BR, LAG.
```


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```
BEGIN       15.68  SECONDS

            N R
            Z RR(MU,NU)=(GM1(RO,MU,RO,NU)-GM1(RO,MU,NU,RO)+GM(RO,SI,NU)
             *GM(SI,MU,RO)-GM(SI,MU,NU)*GM(RO,SI,RO))*K**-3
L 2         ID,GM1(A+,B+,L+,KA+)=1./4.*K*GU1(A,C,KA)*(P1(B,C,L)+P1(C,B,L)
                                                      +P1(C,L,B)+P1(L,C,B)
                                                      -P1(B,L,C)-P1(L,B,C))
             +1./4.*K*GU(A,C)*(P2(B,C,L,KA)+P2(C,B,L,KA)
                              +P2(C,L,B,KA)+P2(L,C,B,KA)
                              -P2(B,L,C,KA)-P2(L,B,C,KA))
L 4         ID,GM(A+,B+,C+)*GM(AA+,BB+,CC+)=1./16.*K**2
             *GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                       +P1(L1,C,B)+P1(C,L1,B)
                       -P1(B,C,L1)-P1(C,B,L1))
             *GU(AA,L2)*(P1(BB,L2,CC)+P1(L2,BB,CC)
                        +P1(L2,CC,BB)+P1(CC,L2,BB)
                        -P1(BB,CC,L2)-P1(CC,BB,L2))
L 6         ID,GM(A+,B+,C+)=1./4.*K*GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                                             +P1(L1,C,B)+P1(C,L1,B)
                                             -P1(B,C,L1)-P1(C,B,L1))
L 8         ID,GU1(A+,B+,C+)=-1./2.*K*(P1(A,B,C)+P1(B,A,C))
             +1./4.*K**2*(P1(A,L3,C)*P0(L3,B)+P1(A,L3,C)*P0(B,L3)
                         +P1(L3,A,C)*P0(L3,B)+P1(L3,A,C)*P0(B,L3)
                         +P0(A,L3)*P1(L3,B,C)+P0(A,L3)*P1(B,L3,C)
                         +P0(L3,A)*P1(L3,B,C)+P0(L3,A)*P1(B,L3,C))
             -1./8.*K**3*(P1(A,L3,C)*P0(L3,L4)*P0(L4,B)
                         +P1(A,L3,C)*P0(L3,L4)*P0(B,L4)
                         +P1(A,L3,C)*P0(L4,L3)*P0(L4,B)
                         +P1(A,L3,C)*P0(L4,L3)*P0(B,L4)
                         +P1(L3,A,C)*P0(L3,L4)*P0(L4,B)
                         +P1(L3,A,C)*P0(L3,L4)*P0(B,L4)
                         +P1(L3,A,C)*P0(L4,L3)*P0(L4,B)
                         +P1(L3,A,C)*P0(L4,L3)*P0(B,L4)
                         +P0(A,L3)*P1(L3,L4,C)*P0(L4,B)
                         +P0(A,L3)*P1(L3,L4,C)*P0(B,L4)
                         +P0(A,L3)*P1(L4,L3,C)*P0(L4,B)
                         +P0(A,L3)*P1(L4,L3,C)*P0(B,L4)
                         +P0(L3,A)*P1(L3,L4,C)*P0(L4,B)
                         +P0(L3,A)*P1(L3,L4,C)*P0(B,L4)
                         +P0(L3,A)*P1(L4,L3,C)*P0(L4,B)
                         +P0(L3,A)*P1(L4,L3,C)*P0(B,L4)
                         +P0(A,L3)*P0(L3,L4)*P1(L4,B,C)
                         +P0(A,L3)*P0(L3,L4)*P1(B,L4,C)
                         +P0(A,L3)*P0(L4,L3)*P1(L4,B,C)
                         +P0(A,L3)*P0(L4,L3)*P1(B,L4,C)
                         +P0(L3,A)*P0(L3,L4)*P1(L4,B,C)
                         +P0(L3,A)*P0(L3,L4)*P1(B,L4,C)
                         +P0(L3,A)*P0(L4,L3)*P1(L4,B,C)
                         +P0(L3,A)*P0(L4,L3)*P1(B,L4,C))
L10         ID,K=0
L11         ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(P0(A,B)+P0(B,A))
             +1./4.*K**2*(P0(A,L3)*P0(L3,B)+P0(A,L3)*P0(B,L3)
                         +P0(L3,A)*P0(L3,B)+P0(L3,A)*P0(B,L3))
             -1./8.*K**3*(P0(A,L3)*P0(L3,L4)*P0(L4,B)
                         +P0(A,L3)*P0(L3,L4)*P0(B,L4)
                         +P0(A,L3)*P0(L4,L3)*P0(L4,B)
                         +P0(A,L3)*P0(L4,L3)*P0(B,L4)
                         +P0(L3,A)*P0(L3,L4)*P0(L4,B)
                         +P0(L3,A)*P0(L3,L4)*P0(B,L4)
                         +P0(L3,A)*P0(L4,L3)*P0(L4,B)
                         +P0(L3,A)*P0(L4,L3)*P0(B,L4)))
                        *(D(AA,BB)-1./2.*K*(P0(AA,BB)+P0(BB,AA))
```

```
                +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                            +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                            +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                            +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                            +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                            +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                            +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                            +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                            +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
L14             ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                 +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                            +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                 -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                            +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                            +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                            +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                            +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                            +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                            +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                            +PO(L3,A)*PO(L4,L3)*PO(B,L4))
L16             ID,K=0
                NPRINT RR
                *NEXT

SYMBOLS         I=I, D1, D2, D3, D10, D1PO, D20, D2PO, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N0=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       0, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, PO, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, 0, RR, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	46.25			
TERMS IN OUTPUT	564			
GENERATED TERMS	564	INPUT SPACE	910	2000
EQUAL TERMS	0	OUTPUT SPACE	4360	4740
CANCELLATIONS	0	NR. OF EXPR.	52	260
RECORDS WRITTEN	32	ID. REGISTER	33	500
MULTIPLICATIONS	100929	FUNCT. REG.	35	750

```
N R
Z R=RR(MU,NU)*(D(MU,NU)-1./2.*K*(PO(MU,NU)+PO(NU,MU))
 +1./4.*K**2*(PO(MU,L7)*PO(L7,NU)+PO(NU,L7)*PO(NU,L7)
            +PO(L7,MU)*PO(L7,NU)+PO(L7,MU)*PO(NU,L7))
 -1./8.*K**3*(PO(MU,L7)*PO(L7,L8)*PO(L8,NU)
            +PO(MU,L7)*PO(L7,L8)*PO(NU,L8)
            +PO(MU,L7)*PO(L8,L7)*PO(L8,NU)
            +PO(MU,L7)*PO(L8,L7)*PO(NU,L8)
            +PO(L7,MU)*PO(L7,L8)*PO(L8,NU)
            +PO(L7,MU)*PO(L7,L8)*PO(NU,L8)
            +PO(L7,MU)*PO(L8,L7)*PO(L8,NU)

            +PO(L7,MU)*PO(L8,L7)*PO(NU,L8)))
```




```
                                        +PO(L7,MU)*PO(L8,L7)*PO(MU,L8)))
        L 4         ID,K=0
                    NPRINT R
                    *NEXT

SYMBOLS             I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
                    I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                    KK.

INDICES             N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                    N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                    N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                    KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                    RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                    A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                    C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS             Q1, Q2, Q3, P.

FUNCTIONS           D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                    DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                    RX.

EXPR.               =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, P, RR, LAG.

RUNNING TIME (SEC)      70.77                          USED    MAXIMUM
TERMS IN OUTPUT           743
GENERATED TERMS           876     INPUT SPACE          353       2000
EQUAL TERMS               133     OUTPUT SPACE        4740       4740
CANCELLATIONS               0     NR. OF EXPR.          28        260
RECORDS WRITTEN            46     ID. REGISTER           3        500
MULTIPLICATIONS         32401     FUNCT. REG.           28        750


SYMBOLS             I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
                    I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                    KK.

INDICES             N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                    N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                    N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                    KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                    RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                    A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                    C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS             Q1, Q2, Q3, P.

FUNCTIONS           D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                    DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                    RX.

EXPR.               =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, R, RR, LAG.

RUNNING TIME (SEC)      71.23                          USED    MAXIMUM
TERMS IN OUTPUT           735
GENERATED TERMS           876     INPUT SPACE          353       2000
EQUAL TERMS               141     OUTPUT SPACE        1010       7126
CANCELLATIONS               0     NR. OF EXPR.          28        260
RECORDS WRITTEN            59     ID. REGISTER           3        500
MULTIPLICATIONS         32401     FUNCT. REG.           28        750

                    N R
                    Z LAG=2.*R*(1.+.5*K*P0(L8,L8)+K**2*(P0(L8,L8)*P0(L9,L9)/8.
                     -1./16.*(P0(L8,L9)*P0(L8,L9)+P0(L8,L9)*P0(L9,L8)
```

```
                +P0(L9,L8)*P0(L8,L9)+P0(L9,L8)*P0(L9,L8)))
                +K**3*(P0(L8,L8)*P0(L9,L9)*P0(L10,L10)/48
                -1./32.*P0(L8,L8)*(P0(L9,L10)*P0(L9,L10)
                                  +P0(L9,L10)*P0(L10,L9)
                                  +P0(L10,L9)*P0(L9,L10)
                                  +P0(L10,L9)*P0(L10,L9))
                +1./48.*(P0(L8,L9)*P0(L9,L10)*P0(L10,L8)
                        +P0(L8,L9)*P0(L9,L10)*P0(L8,L10)
                        +P0(L8,L9)*P0(L10,L9)*P0(L10,L8)
                        +P0(L8,L9)*P0(L10,L9)*P0(L8,L10)
                        +P0(L9,L8)*P0(L9,L10)*P0(L10,L8)
                        +P0(L9,L8)*P0(L9,L10)*P0(L8,L10)
                        +P0(L9,L8)*P0(L10,L9)*P0(L10,L8)
                        +P0(L9,L8)*P0(L10,L9)*P0(L8,L10))))
        L 5     ID,K=0
                NPRINT LAG
                DELETE R,RR
                *BEGIN

SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z,
                L10.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, URG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, P, RR, LAG.

RUNNING TIME (SEC)      114.39
TERMS IN OUTPUT             903
GENERATED TERMS             903
EQUAL TERMS                   0
CANCELLATIONS                 0
RECORDS WRITTEN              67
MULTIPLICATIONS           56420

                                        USED    MAXIMUM
INPUT SPACE                411          2000
OUTPUT SPACE              4741          4740
NR. OF EXPR.                31           260
ID. REGISTER                 3           500
FUNCT. REG.                 33           750

SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z,
                L10.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, URG, DD=U, DB,
```




DT, DS=0, DX, DK, DP, DF=0, GM1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, R, RR, LAG.

			USED	MAXIMUM
RUNNING TIME (SEC)	115.44			
TERMS IN OUTPUT	903			
GENERATED TERMS	903	INPUT SPACE	411	2000
EQUAL TERMS	0	OUTPUT SPACE	2344	7126
CANCELLATIONS	0	NR. OF EXPR.	31	260
RECORDS WRITTEN	83	ID. REGISTER	3	500
MULTIPLICATIONS	36428	FUNCT. REG.	33	750

231

BEGIN 131.87 SECONDS

```
NAMES LAG
COMMON X1,X2,X3,X4,X5,X6,VERT3
S Z,KK
V Q1,Q2,Q3
*FIX
```

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SYMBOLS I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, TMVP, =0, =0, LAG, X1, X2, X3, X4, X5, X6, VERT3.

```
BEGIN     131.98  SECONDS

                N R
                C  WORKS OUT THE 3-GRAVITON VERTEX
                N R
                Z LAG=LAG
          L 2   ID,K**(J+)=KK**(-J)
          L 3   ID,KK=0
                NPRINT LAG
                *NEXT

SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, M, Z, X, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N12=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PG, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
                X1, X2, X3, X4, X5, X6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	5.10			
TERMS IN OUTPUT	771			2000
GENERATED TERMS	771	INPUT SPACE	250	4740
EQUAL TERMS	0	OUTPUT SPACE	4737	260
CANCELLATIONS	0	NR. OF EXPR.	25	500
RECORDS WRITTEN	92	ID. REGISTER	6	750
MULTIPLICATIONS	4912	FUNCT. REG.	14	

			USED	MAXIMUM
RUNNING TIME (SEC)	5.71			
TERMS IN OUTPUT	771			2000
GENERATED TERMS	771	INPUT SPACE	288	7126
EQUAL TERMS	0	OUTPUT SPACE	1433	260
CANCELLATIONS	0	NR. OF EXPR.	25	500
RECORDS WRITTEN	107	ID. REGISTER	6	750
MULTIPLICATIONS	4912	FUNCT. REG.	14	

```
                N R
                Z X1=LAG
          L 2   ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)*
                 D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*D(L5,A3)*D(L6,B3)*
                 Q3(L7)*Q3(L8)
          L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*
                 D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                 D(L7,A3)*D(L8,B3)
                NPRINT X1
                *NEXT

SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, M, Z, X, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.
```

```
INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            BO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            PX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
            X1, X2, X3, X4, X5, X6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	10.23			
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	315	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	23	260
RECORDS WRITTEN	111	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            BO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            PX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
            X1, X2, X3, X4, X5, X6, VERT3.
                 N R
                 Z X2=LAG
          L 2    ID,ADISO,P0(L2+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                  D(L1,A1)*D(L2,B2)*D(L3,A3)*D(L4,B3)*D(L5,A2)*D(L6,B2)*
                  Q2(L7)*Q2(L8)
          L 3    ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                  D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                  D(L7,A2)*D(L8,B2)
                 NPRINT X2
                 *NEXT

SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
```

```
N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
            X1, X2, X3, X4, X5, X6, VERT3.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	14.49			
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	315	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	24	260
RECORDS WRITTEN	115	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
            X1, X2, X3, X4, X5, X6, VERT3.
                N R
                Z X3=LAG
          L 2   ID,ADIS0,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                 D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*D(L5,A3)*D(L6,B3)*
                 Q3(L7)*Q3(L8)
          L 3   ID,ADIS0,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                 D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                 D(L7,A3)*D(L8,B3)
                NPRINT X3
                *NEXT

SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,


            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
```

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A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
            X1, X2, X3, X4, X5, X6, VERT3.
```

RUNNING TIME (SEC)	10.73		USED	MAXIMUM
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	315	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	25	260
RECORDS WRITTEN	119	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
            X1, X2, X3, X4, X5, X6, VERT3.
                N R
                Z X4=LAG
          L 2   ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                 D(L1,A2)*D(L2,B2)*D(L3,A3)*D(L4,B3)*D(L5,A1)*D(L6,B1)*
                 Q1(L7)*Q1(L8)
          L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                 D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                 D(L7,A1)*D(L8,B1)
                NPRINT X4
                *NEXT

SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.
```

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VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
               RX.

EXPR.          =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
               X1, X2, X3, X4, X5, X6, VERT3.
```

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			USED	MAXIMUM
RUNNING TIME (SEC)	22.95			
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	315	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	26	260
RECORDS WRITTEN	123	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS        I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
               I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
               KK.

INDICES        N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
               N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
               N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
               KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
               RD=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
               A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
               C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
               RX.

EXPR.          =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
               X1, X2, X3, X4, X5, X6, VERT3.
                    N R
                    Z X5=LAG
          L 2       ID,ADISD,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*D(L3,A1)*D(L4,B1)*D(L5,A2)*D(L6,B2)*
                     Q2(L7)*Q2(L8)
          L 3       ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                     D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                     D(L7,A2)*D(L8,B2)
                    NPRINT X5
                    *NEXT

SYMBOLS        I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
               I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
               KK.

INDICES        N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
               N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
               N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
               KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
               RD=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
               A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
               C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
```

```
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
                X1, X2, X3, X4, X5, X6, VERT3.
```

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			USED	MAXIMUM
RUNNING TIME (SEC)	27.20			
TERMS IN OUTPUT	144			
GENERATED TERMS	771	INPUT SPACE	815	2000
EQUAL TERMS	541	OUTPUT SPACE	1551	4740
CANCELLATIONS	86	NR. OF EXPR.	27	260
RECORDS WRITTEN	127	ID. REGISTER	31	500
MULTIPLICATIONS	3856	FUNCT. REG.	25	750

```
SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
                X1, X2, X3, X4, X5, X6, VERT3.
                     N R
                     Z X6=LAG
              L 2    ID,ADISD,P0(L1+,L2+)*P0(L3+,L4+)*P2(L5+,L6+,L7+,L8+)=
                      D(L1,A3)*D(L2,B3)*D(L3,A2)*D(L4,B2)*D(L5,A1)*D(L6,B1)*
                      Q1(L7)*Q1(L8)
              L 3    ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)=
                      D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                      D(L7,A1)*D(L8,B1)
                     NPRINT X6
                     *NEXT

SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                P0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.
```

```
EXPR.          =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
               X1, X2, X3, X4, X5, X6, VERT3.

                                                        USED    MAXIMUM
RUNNING TIME (SEC)      31.42
TERMS IN OUTPUT           144
GENERATED TERMS           771          INPUT SPACE      315       2000
EQUAL TERMS               541          OUTPUT SPACE    1551       4740
CANCELLATIONS              66          NR. OF EXPR.      28        260
RECORDS WRITTEN           131          ID. REGISTER      11        500
MULTIPLICATIONS          3856          FUNCT. REG.       25        750
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```
SYMBOLS        I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
               I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
               KK.

INDICES        N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
               N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N19=Z,
               N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
               KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
               BO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
               A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
               C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2,
               RX.

EXPR.          =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
               X1, X2, X3, X4, X5, X6, VERT3.
                    N R
                    Z VERT3=X1+X2+X3+X4+X5+X6
                    NPRINT VERT3
                    DELETE LAG,X1,X2,X3,X4,X5,X6
                    *BEGIN

SYMBOLS        I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
               I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
               KK.

INDICES        N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
               N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N19=Z,
               N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
               KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
               BO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
               A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
               C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS        Q1, Q2, Q3, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2,
               RX.

EXPR.          =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG,
               X1, X2, X3, X4, X5, X6, VERT3.

                                                        USED    MAXIMUM
RUNNING TIME (SEC)      34.64
TERMS IN OUTPUT           495
GENERATED TERMS           864          INPUT SPACE      242       2000
EQUAL TERMS               369          OUTPUT SPACE    3166       4740
CANCELLATIONS               0          NR. OF EXPR.      27        260
```

RECORDS WRITTEN	185	ID. REGISTER	1	300
MULTIPLICATIONS	2590	FUNCT. REG.	18	750

SYMBOLS I=I, D1, D2, D3, D10, D1PQ, D20, D2PQ, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z. 240

VECTORS Q1, Q2, Q3, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM2, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, LAG, X1, X2, X3, X4, X5, X6, VERT3.

BEGIN 167.05 SECONDS

```
BEGIN     167.33  SECONDS

                  N R
                  Z VV1=VERT3
                  Z VG1=VG(A1,B1,A2,A3)
          L 3     ID Q1(MU+)=P(MU)
          L 4     ID Q2(MU+)=-Q(MU)
          L 4     AL Q3(MU+)=Q(MU)-P(MU)
          L 5     ID,2,DOTPR,Q1(MU+)=P(MU)
          L 7     ID,2,DOTPR,Q2(MU+)=-Q(MU)
          L 9     ID,2,DOTPR,Q3(MU+)=Q(MU)-P(MU)
          L11     ID K1(MU+)=P(MU)
          L12     ID K2(MU+)=-Q(MU)
          L12     AL K3(MU+)=Q(MU)-P(MU)
          L13     ID,2,DOTPR,K1(MU+)=P(MU)
          L15     ID,2,DOTPR,K2(MU+)=-Q(MU)
          L17     ID,2,DOTPR,K3(MU+)=Q(MU)-P(MU)
                  NPRINT VV1,VG1,PP
                  *NEXT

SYMBOLS           I=I, D1, D2, D3, D1Q, D1P2, D2Q, D2P0, W, Z, K, I1T11,
                  I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                  KK.

INDICES           N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N12=Z, N14=Z,
                  N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                  N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                  KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                  R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                  A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                  C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS           Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS         D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                  DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PC, P1, P2,
                  RX.

EXPR.             =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                  =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST,
                  GG=2, VG=2.

RUNNING TIME (SEC)        6.90                          USED    MAXIMUM
TERMS IN OUTPUT            202
GENERATED TERMS            914        INPUT SPACE        430       2000
EQUAL TERMS                529        OUTPUT SPACE      2326       4740
CANCELLATIONS              193        NR. OF EXPR.        40        260
RECORDS WRITTEN            147        ID. REGISTER        37        500
MULTIPLICATIONS           5837        FUNCT. REG.          8        750

                  N R
                  Z VV2=VERT3*D(A1,AA1)*D(B1,BB1)*D(A2,AA2)*D(B2,BB2)
                                *D(A3,AA3)*D(B3,BB3)
                  Z VG2=VG(AA1,BB1,AA2,AA3)
          L 3     ID Q1(MU+)=-P(MU)
          L 3     AL Q2(MU+)=Q(MU)
          L 3     AL Q3(MU+)=-Q(MU)+P(MU)
          L 4     ID,2,DOTPR,Q1(MU+)=-P(MU)
          L 6     ID,2,DOTPR,Q2(MU+)=Q(MU)
          L 8     ID,2,DOTPR,Q3(MU+)=-Q(MU)+P(MU)
          L10     ID K1(MU+)=-P(MU)
          L10     AL K3(MU+)=Q(MU)
          L11     ID,2,DOTPR,K1(MU+)=-P(MU)
```

```
      NAMES VERT3
      C CONTRIBUTIONS TO THE GRAVITON SELF-ENERGY
      COMMON VV1,VV2,VG1,VG2,LOOP,GHOST
      V P,Q,K1,K2,K3
      X GG(A1,B1,A2,B2)=1./2.*(D(A1,A2)*D(B1,B2)
                              +D(A1,B2)*D(B1,A2)
                              -D(A1,B1)*D(A2,B2))

      X VG(RO,SI,L,MU)=
                    1./2.*(K1DK3*D(RO,MU)*D(L,SI)+K1DK3*D(RO,L)*D(MU,ST)
                          +K3DK3*D(RO,MU)*D(L,SI)+K3DK3*D(RO,L)*D(MU,ST)
                          +K1(RO)*K3(L)*D(MU,SI)+K1(SI)*K3(L)*D(RO,MU)
                          +K1(MU)*K3(RO)*D(L,SI)+K1(MU)*K3(SI)*D(RO,L)
                          +K1(RO)*K1(MU)*D(L,SI)+K1(SI)*K1(MU)*D(RO,L)
                          -K1(L)*K3(RO)*D(MU,SI)-K1(L)*K3(SI)*D(RO,MU)
                          -K1(MU)*K3(L)*D(RO,SI)-K1(L)*K1(MU)*D(RO,SI))

      *FIX
```

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SYMBOLS I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST, GG=2, VG=2.

```
L13         ID,2,DOTPR,K3(MU+)=Q(MU)
            NPRINT VV2,VG2,PP
            *NEXT

SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N0=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            PX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
            =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST,
            GG=2, VG=2.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	12.45			
TERMS IN OUTPUT	205			
GENERATED TERMS	899	INPUT SPACE	419	2000
EQUAL TERMS	510	OUTPUT SPACE	2302	4740
CANCELLATIONS	184	NR. OF EXPR.	40	260
RECORDS WRITTEN	153	ID. REGISTER	31	500
MULTIPLICATIONS	4993	FUNCT. REG.	18	750

```
SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N0=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            R0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
            =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST,
            GG=2, VG=2.
                N R
                Z LOOP=VV1*GG(A2,B2,AA2,BB2)*D10
                Z GHOST=VG1*D(A2,AA3)*D(A3,AA2)*D10*D1P0*VG2
                NPRINT LOOP,GHOST
                *NEXT

SYMBOLS     I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
```

KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

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VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
=0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST,
GG=2, VG=2.

RUNNING TIME (SEC)	15.04		USED	MAXIMUM
TERMS IN OUTPUT	276			
GENERATED TERMS	727	INPUT SPACE	250	2000
EQUAL TERMS	431	OUTPUT SPACE	1753	4740
CANCELLATIONS	20	NR. OF EXPR.	32	260
RECORDS WRITTEN	159	ID. REGISTER	1	500
MULTIPLICATIONS	3027	FUNCT. REG.	34	750

SYMBOLS I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
=0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST,
GG=2, VG=2.

```
      N R
      Z LOOP=LOOP*GG(A3,B3,AA3,BB3)*D1P0
      NPRINT LOOP
      *NEXT
```

SYMBOLS I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,

```
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST,
                GG=2, VG=2.
```

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			USED	MAXIMUM
RUNNING TIME (SEC)	17.45			
TERMS IN OUTPUT	257			
GENERATED TERMS	672	INPUT SPACE	348	2000
EQUAL TERMS	415	OUTPUT SPACE	1545	4740
CANCELLATIONS	0	NR. OF EXPR.	33	260
RECORDS WRITTEN	166	ID. REGISTER	1	500
MULTIPLICATIONS	2465	FUNCT. REG.	30	750

```
SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST,
                GG=2, VG=2.
                     N R
                     Z LOOP=LOOP*VV2
                     NPRINT LOOP
                     DELETE VV1,VV2,VG1,VG2,VERT3,PP
                     *BEGIN

SYMBOLS         I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
```

DT, DS=U, DX, DK, DP, DF=U, GH1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LOOP, GHOST, GG=2, VG=2.

246

			USED	MAXIMUM
RUNNING TIME (SEC)	37.69			
TERMS IN OUTPUT	217			
GENERATED TERMS	9192	INPUT SPACE	333	2000
EQUAL TERMS	7507	OUTPUT SPACE	2904	4740
CANCELLATIONS	468	NR. OF EXPR.	34	260
RECORDS WRITTEN	197	ID. REGISTER	1	500
MULTIPLICATIONS	49153	FUNCT. REG.	37	750

			USED	MAXIMUM
RUNNING TIME (SEC)	57.42			
TERMS IN OUTPUT	267			
GENERATED TERMS	16384	INPUT SPACE	333	2000
EQUAL TERMS	15275	OUTPUT SPACE	4626	4740
CANCELLATIONS	842	NR. OF EXPR.	34	260
RECORDS WRITTEN	197	ID. REGISTER	1	500
MULTIPLICATIONS	98305	FUNCT. REG.	37	750

			USED	MAXIMUM
RUNNING TIME (SEC)	77.89			
TERMS IN OUTPUT	314			
GENERATED TERMS	24576	INPUT SPACE	333	2000
EQUAL TERMS	23331	OUTPUT SPACE	1624	4740
CANCELLATIONS	931	NR. OF EXPR.	34	260
RECORDS WRITTEN	197	ID. REGISTER	1	500
MULTIPLICATIONS	147457	FUNCT. REG.	37	750

			USED	MAXIMUM
RUNNING TIME (SEC)	98.06			
TERMS IN OUTPUT	319			
GENERATED TERMS	32768	INPUT SPACE	333	2000
EQUAL TERMS	31443	OUTPUT SPACE	1950	4740
CANCELLATIONS	1006	NR. OF EXPR.	34	260
RECORDS WRITTEN	197	ID. REGISTER	1	500
MULTIPLICATIONS	196609	FUNCT. REG.	37	750

			USED	MAXIMUM
RUNNING TIME (SEC)	118.02			
TERMS IN OUTPUT	375			
GENERATED TERMS	40960	INPUT SPACE	333	2000
EQUAL TERMS	39556	OUTPUT SPACE	2256	4740
CANCELLATIONS	1029	NR. OF EXPR.	34	260
RECORDS WRITTEN	197	ID. REGISTER	1	500
MULTIPLICATIONS	245761	FUNCT. REG.	37	750

			USED	MAXIMUM
RUNNING TIME (SEC)	138.86			
TERMS IN OUTPUT	402			
GENERATED TERMS	49087	INPUT SPACE	333	2000
EQUAL TERMS	47641	OUTPUT SPACE	2434	4740
CANCELLATIONS	1044	NR. OF EXPR.	34	260
RECORDS WRITTEN	197	ID. REGISTER	1	500
MULTIPLICATIONS	294523	FUNCT. REG.	37	750

SYMBOLS I=I, D1, D2, D3, D10, D1P0, D20, D2P0, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GNL, GM, GU1, GU, P0, P1, P2, PX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, TMVP, =0, =0, =0, =0, =0, =0, =0, =0, VERT3, VV1, VV2, VG1, VG2, LUDP, GHOST, GG=2, VG=2.

BEGIN 306.51 SECONDS

```
NAMES LOOP,GHOST
COMMON TT,PTT
*FIX
```

SYMBOLS I=I, D1, D2, D3, D1Q, D1P0, D2Q, D2P0, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N0=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, LOOP, GHOST, GG=2, VG=2, TT, PTT.

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BEGIN 306.63 SECONDS

```
BEGIN     306.63  SECONDS

                  C THIS SECTION DOES THE Q( INTERNAL MTM.) -INTEGRATIONS
                  N R
                  Z TT=1./2.*LOOP-GHOST
            L 2   ID Q(S1+)*Q(S2+)*Q(S3+)*Q(S4+)*D10*D1PQ                    249
                   =P(S1)*P(S2)*P(S3)*P(S4)*I7T11
                   +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
                   +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
                   *I8T11
                   +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                   *I9T11
            L 4   ID QDQ*Q(S3+)*Q(S4+)*D10*D1PQ
                   =D(S1,S2)*P(S1)*P(S2)*P(S3)*P(S4)*I7T11
                   +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
                   +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
                   *D(S1,S2)*I8T11
                   +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                   *D(S1,S2)*I9T11
            L 6   ID QDQ**2*D10*D1PQ
                   =D(S1,S2)*D(S3,S4)*P(S1)*P(S2)*P(S3)*P(S4)*I7T11
                   +(P(S1)*P(S2)*D(S3,S4)+P(S1)*P(S3)*D(S2,S4)+P(S1)*P(S4)*D(S2,S3)
                   +P(S2)*P(S3)*D(S1,S4)+P(S2)*P(S4)*D(S1,S3)+P(S3)*P(S4)*D(S1,S2))
                   *D(S1,S2)*D(S3,S4)*I8T11
                   +(D(S1,S2)*D(S3,S4)+D(S1,S3)*D(S2,S4)+D(S1,S4)*D(S2,S3))
                   *D(S1,S2)*D(S3,S4)*I9T11

            L 8   ID QDQ*PDQ*D10*D1PQ
                   =P(S3)*D(S1,S2)*(P(S1)*P(S2)*P(S3)*I5T11
                   +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T11)
           L11    ID PDQ*Q(S1+)*Q(S2+)*D10*D1PQ
                    =PDP*P(S1)*P(S2)*I5T11
                    +(2*P(S1)*P(S2)+PDP*D(S1,S2))*I6T11
           L13    ID PDQ**2*D10*D1PQ
                    =PDP*I3T11+PDP**2*I4T11
           L14    ID Q(S1+)*Q(S2+)*Q(S3+)*D10*D1PQ
                   =P(S1)*P(S2)*P(S3)*I5T11
                   +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T11
           L16    ID QDQ*Q(S1+)*D10*D1PQ
                   =D(S2,S3)*(P(S1)*P(S2)*P(S3)*I5T11
                   +(P(S1)*D(S2,S3)+P(S2)*D(S1,S3)+P(S3)*D(S1,S2))*I6T11)
           L19    ID PDQ*Q(S1+)*D10*D1PQ
                    =P(S1)*I3T11+PDP*P(S1)*I4T11
           L20    ID Q(S1+)*Q(S2+)*D10*D1PQ
                   =D(S1,S2)*I3T11+P(S1)*P(S2)*I4T11
           L21    ID QDQ*D10*D1PQ
                   =D(S1,S2)*(D(S1,S2)*I3T11+P(S1)*P(S2)*I4T11)
           L23    ID Q(S1+)*Q(S2+)*D10*D1PQ
                   =D(S1,S2)*I3T11+P(S1)*P(S2)*I4T11
           L24    ID QDQ*D10*D1PQ
                   =D(S1,S2)*(D(S1,S2)*I3T11+P(S1)*P(S2)*I4T11)
           L26    ID PDQ*D10*D1PQ
                    =PDP*I2T11
                  *YEP

SYMBOLS           I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
                  I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                  KK.

INDICES           N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                  N15=Z, N16=Z, N17=Z, N10=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                  N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                  KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                  BB=Z, CI=Z, AA=Z, DD=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                  A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
```

```
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, LOOP, GHOST, GG=2,
                VG=2, TT, PTT.
```

250

RUNNING TIME (SEC)	7.34		USED	MAXIMUM
TERMS IN OUTPUT	404			
GENERATED TERMS	1285	INPUT SPACE	797	2000
EQUAL TERMS	871	OUTPUT SPACE	1553	4740
CANCELLATIONS	10	NR. OF EXPR.	62	260
RECORDS WRITTEN	207	ID. REGISTER	127	500
MULTIPLICATIONS	5222	FUNCT. REG.	6	750

```
                N R
        L 1     ID Q(S1+)*D1Q*D1P0=P(S1)*I2T31
        L 2     ID D1Q*D1P0=I1T11
        L 3     ID Z=4
        L 3     AL W=2
                DELETE LOOP,GHOST,LHT
                *BEGIN

SYMBOLS         I=I, D1, D2, D3, D1Q, D1P0, D2Q, D2P0, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                P0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, LOOP, GHOST, GG=2,
                VG=2, TT, PTT.

TERMS OUT       404 ,TERMS IN       404
```

RUNNING TIME (SEC)	8.78		USED	MAXIMUM
TERMS IN OUTPUT	73			
GENERATED TERMS	404	INPUT SPACE	357	2000
EQUAL TERMS	324	OUTPUT SPACE	230	4740
CANCELLATIONS	7	NR. OF EXPR.	40	260
RECORDS WRITTEN	211	ID. REGISTER	17	500
MULTIPLICATIONS	2937	FUNCT. REG.	3	750

```
 TT =

   + P(AA1)*P(A1)*P(B1)*P(BB1)
```

```
* ( I1T11 - 2.*I2T11 + 3.*I4T11 - 2.*I6T11 + I7T11 )

+ P(AA1)*P(A1)*D(B1,BB1)
* ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP
 - 3.*I8T11 )

+ P(AA1)*D(A1,B1)*P(BB1)
* ( - 1./4.*I2T11*PDP + I3T11 + 1./4.*I4T11*PDP - 1./2.*I5T11*PDP - 2.*I6T11 + 1./2.*I7T11*PDP + 5.*I8T11 )

+ P(AA1)*D(A1,BB1)*P(B1)
* ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP
 - 3.*I8T11 )

+ D(AA1,A1)*P(B1)*P(BB1)
* ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP
 - 3.*I8T11 )

+ D(AA1,A1)*D(B1,BB1)
* ( 1./2.*I1T11*PDP**2 - 3./4.*I2T11*PDP**2 + I3T11*PDP + 3./4.*I4T11*PDP**2 + I6T11*PDP - I8T11*PDP
- 5.*I9T11 )

+ D(AA1,B1)*P(A1)*P(BB1)
* ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP
 - 3.*I8T11 )

+ D(AA1,B1)*D(A1,BB1)
* ( 1./2.*I1T11*PDP**2 - 3./4.*I2T11*PDP**2 + I3T11*PDP + 3./4.*I4T11*PDP**2 + I6T11*PDP - I8T11*PDP
- 5.*I9T11 )

+ D(AA1,BB1)*P(A1)*P(B1)
* ( - 3./4.*I2T11*PDP + 4.*I3T11 + 7./4.*I4T11*PDP - 3./2.*I5T11*PDP - 6.*I6T11 + 1./2.*I7T11*PDP + 5.*I8T11)
```

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CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
     + D(AA1,BB1)*D(A1,B1)
     * ( 3./4.*I2T11*PDP**2 - 5./4.*I3T11*PDP - I4T11*PDP**2 + 1./2.*I5T11*PDP**2 + 2.*I6T11*PDP - 1./4.*I7T11*PDP**2
      - 2.*I8T11*PDP + I9T11 )  +0.
```

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
BEGIN     315.62  SECONDS

              NAMES TT,INVP
              COMMON QQ0,QQ1,QQ2,PQQ,PPQQ
              *FIX

SYMBOLS       I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
              I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
              KK.

INDICES       N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
              N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
              N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
              KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
              RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
              A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
              C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
              PX.

EXPR.         =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
              =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2,
              TT, PTT, QQ0, QQ1, QQ2, PQQ, PPQQ.

BEGIN     315.75  SECONDS
```

DEGLI STUDI DI TRIESTE
CENTRO DI CALCOLO DELL'UNIVERSITÀ

```
BEGIN     315.75  SECONDS

                  N R
                  Z PTT=P(AL)*TT
          L 2     ID W=2
                  *NEXT

SYMBOLS       I=I, D1, D2, D3, D10, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
              I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
              KK.

INDICES       N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
              N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
              N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
              KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
              S0=Z, S1=Z, AA=Z, B8=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
              A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
              C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS       Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
              RX.

EXPR.         =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
              =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2,
              TT, PTT, Q00, Q01, Q02, PQQ, PPQQ.

RUNNING TIME (SEC)          .24                          USED    MAXIMUM
TERMS IN OUTPUT              30
GENERATED TERMS              73        INPUT SPACE        354       2000
EQUAL TERMS                  39        OUTPUT SPACE       115       4740
CANCELLATIONS                 4        NR. OF EXPR.        29        260
RECORDS WRITTEN             216        ID. REGISTER         3        500
MULTIPLICATIONS             366        FUNCT. REG.          4        750

 PTT =

   + P(AA1)*P(B1)*P(BB1)

   * ( - 1./4.*I2T11*PDP - 5./2.*I3T11 + 1./4.*I4T11*PDP - 1./2.*I5T11*PDP + 4.*I6T11 + 1./2.*I7T11*PDP

   - I8T11 )


   + P(AA1)*D(B1,BB1)

   * ( 1./4.*I2T11*PDP**2 - 3./4.*I3T11*PDP - 3./4.*I4T11*PDP**2 + I5T11*PDP**2 + 4.*I6T11*PDP - 1./2.*I7T11*PDP**2

    - 4.*I8T11*PDP - 5.*I9T11 )


   + D(AA1,B1)*P(BB1)

   * ( 1./4.*I2T11*PDP**2 - 3./4.*I3T11*PDP - 3./4.*I4T11*PDP**2 + I5T11*PDP**2 + 4.*I6T11*PDP - 1./2.*I7T11*PDP**2

    - 4.*I8T11*PDP - 5.*I9T11 )
```

```
   + D(AA1,BB1)*P(B1)

   * ( 11./4.*I8T11*PDP + 3./4.*I4T11*PDP**2 - 15T11*PDP**2 - 6.*I6T11*PDP + 1./4.*I7T11*PDP**2 + 3.*I8T11*PDP

    + I9T11 )  +0.


                    C CONNECTED GREEN'S FUNCTION
                    N P
                    Z QQ0=GG(MU,NU,A1,B1)*TT*GG(AA1,BB1,PQ,SI)
                    Z QQ1=GG(MU,MU,A1,B1)*TT*GG(AA1,BB1,PQ,SI)
                    Z QQ2=GG(MU,MU,A1,B1)*TT*GG(AA1,BB1,SI,SI)
          L 3       ID Z=4
          L 3       AL W=2
                    *NEXT

SYMBOLS         I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                PQ=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
                BX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2,
                TT, PTT, QQ0, QQ1, QQ2, PQQ, PPQQ.

RUNNING TIME (SEC)      5.71
TERMS IN OUTPUT           94
GENERATED TERMS         1971          INPUT SPACE          USED 495    MAXIMUM 2000
EQUAL TERMS             1785          OUTPUT SPACE         602         4740
CANCELLATIONS             92          NR. OF EXPR.          35          260
RECORDS WRITTEN          218          ID. REGISTER           5          500
MULTIPLICATIONS        11755          FUNCT. REG.           39          750

SYMBOLS         I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                PQ=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,


                BX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
```

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CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

```
FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,

              PX.

EXPR.         =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
              =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2,
              TT, PTT, QQQ, QQ1, QQ2, PQQ, PPQQ.

 QQQ =

   + P(MU)*P(NU)*P(RO)*P(SI)

   * ( I1T11 - 2.*I2T11 + 3.*I4T11 - 2.*I5T11 + I7T11 )


   + P(MU)*P(NU)*D(RO,SI)

   * ( 1./2.*I1T11*PDP - 1./4.*I2T11*PDP - 1./2.*I3T11 - 1./4.*I4T11*PDP + 1./2.*I5T11*PDP + 2.*I6T11 + I8T11)



   + P(MU)*D(NU,RO)*P(SI)

   * ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP

    - 3.*I8T11 )


   + P(MU)*D(NU,SI)*P(RO)

   * ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP

    - 3.*I8T11 )


   + D(MU,NU)*P(RO)*P(SI)

   * ( 1./2.*I1T11*PDP - 3./4.*I2T11*PDP + 5./2.*I3T11 + 5./4.*I4T11*PDP - 1./2.*I5T11*PDP - 4.*I6T11 + I8T11)



   + D(MU,MU)*D(RO,SI)

   * ( - 1./4.*I1T11*PDP**2 + 3./4.*I2T11*PDP**2 - 1./2.*I3T11*PDP - 3./4.*I4T11*PDP**2 + I9T11 )


   + D(MU,RO)*P(NU)*P(SI)

   * ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP

    - 3.*I8T11 )


   + D(MU,RO)*D(NU,SI)

   * ( 1./2.*I1T11*PDP**2 - 3./4.*I2T11*PDP**2 + I3T11*PDP + 3./4.*I4T11*PDP**2 + I6T11*PDP - I8T11*PDP
```


CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
  - 5.*I9T11 )

  + D(MU,SI)*P(NU)*P(RO)
  * ( - 1./2.*I1T11*PDP + I2T11*PDP - 7./4.*I3T11 - 3./2.*I4T11*PDP + I5T11*PDP + 3.*I6T11 - 1./2.*I7T11*PDP
   - 3.*I8T11 )

  + D(NU,SI)*D(NU,RO)
  * ( 1./2.*I1T11*PDP**2 - 3./4.*I2T11*PDP**2 + I3T11*PDP + 3./4.*I4T11*PDP**2 + I6T11*PDP - I8T11*PDP
  - 5.*I9T11 )


QQ1 =
  + P(RO)*P(SI)
  * ( I1T11*PDP - I2T11*PDP + 3.*I3T11 + 2.*I4T11*PDP - 4.*I6T11 - I7T11*PDP - 8.*I8T11 )

  + D(RO,SI)
  * ( 1./2.*I1T11*PDP**2 + 5./4.*I2T11*PDP**2 - 1./2.*I3T11*PDP - 7./4.*I4T11*PDP**2 + 1./2.*I5T11*PDP**2
  + 4.*I6T11*PDP - I8T11*PDP - 6.*I9T11 )


QQ2 =
    + 3.*I1T11*PDP**2 + 4.*I2T11*PDP**2 + I3T11*PDP - 5.*I4T11*PDP**2 + 2.*I5T11*PDP**2 + 12.*I6T11*PDP
   - I7T11*PDP**2 - 12.*I8T11*PDP - 24.*I9T11  +0.


                C SLAVNOV-WARD IDENTITY
                N R
                Z PQQ=(-2)*(P(MU)*QQQ-1./2.*P(NU)*QQ1)
        L 3     ID Z=4
                *NEXT

SYMBOLS     I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, M, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            99=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, EC=Z, E0=Z, S1=Z, S2=Z, S3=Z, S4=Z.


VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.
```


CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2, TT, PTT, QQQ, QQ1, QQ2, PQQ, PPQQ.

			USED	MAXIMUM
RUNNING TIME (SEC)	6.28			
TERMS IN OUTPUT	29			
GENERATED TERMS	85	INPUT SPACE	368	2000
EQUAL TERMS	50	OUTPUT SPACE	118	4740
CANCELLATIONS	6	NR. OF EXPR.	33	260
RECORDS WRITTEN	224	ID. REGISTER	3	500
MULTIPLICATIONS	260	FUNCT. REG.	23	750

SYMBOLS I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2, TT, PTT, QQQ, QQ1, QQ2, PQQ, PPQQ.

```
 PQQ =

   + P(NU)*P(RO)*P(SI)

   * ( 1./2.*I2T11*PDP + 5.*I3T11 - 1./2.*I4T11*PDP + I5T11*PDP - 8.*I6T11 - I7T11*PDP + 2.*I8T11 )


   + P(NU)*D(RO,SI)

   * ( 1./4.*I2T11*PDP**2 + 3./2.*I3T11*PDP + 1./4.*I4T11*PDP**2 - 1./2.*I5T11*PDP**2 - 3.*I8T11*PDP - 8.*I9T11)



   + D(NU,RO)*P(SI)

   * ( - 1./2.*I2T11*PDP**2 + 3./2.*I3T11*PDP + 3./2.*I4T11*PDP**2 - 2.*I5T11*PDP**2 - 8.*I6T11*PDP + I7T11*PDP**2

    + 8.*I8T11*PDP + 10.*I9T11 )
```

CENTRO DI CALCOLO DELL'UNIVERSITÀ DEGLI STUDI DI TRIESTE

```
+ D(NU,SI)*P(RO)
* ( - 1./2.*I2T11*PDP**2 + 3./2.*I3T11*PDP + 3./2.*I4T11*PDP**2 - 2.*I5T11*PDP**2 - 8.*I6T11*PDP + I7T11*PDP**2
 + 8.*I8T11*PDP + 10.*I9T11 )  +0.

                N R
                DELETE QQQ,QQ1,QQ2
                N R
                Z TT=TT
                Z INVP=INVP
                Z PTT=PTT
                Z PQQ=PQQ
        L 2     ID I2T11=I1T11/2.
        L 2     AL I3T11=-PDP*I1T11/12.
        L 2     AL I4T11=I1T11/3.
        L 2     AL I5T11=I1T11/4.
        L 2     AL I6T11=-PDP*I1T11/24.
        L 2     AL I7T11=I1T11/5.
        L 2     AL I8T11=-PDP*I1T11/40.
        L 2     AL I9T11=PDP**2*I1T11/240.
                *NEXT

SYMBOLS     I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
            A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
            C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS     Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
            RX.

EXPR.       =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
            =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2,
            TT, PTT, QQQ, QQ1, QQ2, PQQ, PPQQ.

RUNNING TIME (SEC)      7.08                          USED    MAXIMUM
TERMS IN OUTPUT          31
GENERATED TERMS         153        INPUT SPACE        410       2000
EQUAL TERMS             103        OUTPUT SPACE       282       4740
CANCELLATIONS            14        NR. OF EXPR.        42        260
RECORDS WRITTEN         226        ID. REGISTER        17        500
MULTIPLICATIONS         713        FUNCT. REG.         23        750

SYMBOLS     I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, K, I1T11,
            I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
            KK.

INDICES     N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
            N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
            N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,

            KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
            RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
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CENTRO DI CALCOLO DELL'UNIVERSITA DEGLI STUDI DI TRIESTE

```
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2,
                TT, PTT, QQQ, QQ1, QQ2, PQQ, PPQQ.

 TT =

   + P(AA1)*P(A1)*P(B1)*P(BB1)

   * ( 7./10.*I1T11 )


   + P(AA1)*P(A1)*D(B1,BB1)

   * ( - 61./240.*I1T11*PDP )


   + P(AA1)*D(A1,B1)*P(BB1)

   * ( - 23./120.*I1T11*PDP )


   + P(AA1)*D(A1,BB1)*P(B1)

   * ( - 61./240.*I1T11*PDP )


   + D(AA1,A1)*P(B1)*P(BB1)

   * ( - 61./240.*I1T11*PDP )


   + D(AA1,A1)*D(B1,BB1)

   * ( 61./240.*I1T11*PDP**2 )


   + D(AA1,B1)*P(A1)*P(BB1)

   * ( - 61./240.*I1T11*PDP )


   + D(AA1,B1)*D(A1,BB1)

   * ( 61./240.*I1T11*PDP**2 )
```

260

```
  + D(AA1,BB1)*P(A1)*P(B1)
  * ( - 23./120.*I1T11*PDP )

  + D(AA1,BB1)*D(A1,B1)
  * ( 23./120.*I1T11*PDP**2 )


INVP =
  + P(A1)*P(A2)*P(B1)*P(B2)
  * ( 2.*D1 + D2 + 2.*D3 )

  + P(A1)*P(A2)*D(B1,B2)
  * ( - 1./4.*D2*PDP - D3*PDP )

  + P(A1)*D(A2,B1)*P(B2)
  * ( - 1./4.*D2*PDP - D3*PDP )

  + P(A1)*D(A2,B2)*P(B1)
  * ( - 2.*D1*PDP - 1./2.*D2*PDP )

  + D(A1,A2)*P(B1)*P(B2)
  * ( - 1./4.*D2*PDP - D3*PDP )

  + D(A1,A2)*D(B1,B2)
  * ( 1./4.*D2*PDP**2 + D3*PDP**2 )

  + D(A1,B1)*P(A2)*P(B2)
  * ( - 2.*D1*PDP - 1./2.*D2*PDP )

  + D(A1,B1)*D(A2,B2)
  * ( 2.*D1*PDP**2 + 1./2.*D2*PDP**2 )
```

```
   + D(A1,B2)*P(A2)*P(B1)
   * ( - 1./4.*D2*PDP - D3*PDP )

   + D(A1,B2)*D(A2,B1)
   * ( 1./4.*D2*PDP**2 + D3*PDP**2 )

PTT = 0.

PQQ = 0.  +0.

                N R
                Z PTT=PTT
                Z PPTT=PPTT
                Z WI(2)=WI(2)
                Z PQQ=PQQ
        L 2     ID W=2
                DELETE PTT,PQQ
                *BEGIN

SYMBOLS         I=I, D1, D2, D3, D1Q, D1PQ, D2Q, D2PQ, W, Z, KK, I1T11,
                I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11,
                KK, PPTT.

INDICES         N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z,
                N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z,
                N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z,
                KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z,
                R0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z,
                A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z,
                C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS         Q1, Q2, Q3, P, Q, K1, K2, K3, WI.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GH1, GM, GU1, GU, P0, P1, P2,
                RX.

EXPR.           =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0,
                =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2,
                TT, PTT, =0, =0, =0, PQQ, PPQQ.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	7.49			
TERMS IN OUTPUT	2			
GENERATED TERMS	2	INPUT SPACE	336	2000
EQUAL TERMS	0	OUTPUT SPACE	11	4740
CANCELLATIONS	0	NR. OF EXPR.	31	260
RECORDS WRITTEN	231	ID. REGISTER	2	500
MULTIPLICATIONS	4	FUNCT. REG.	4	750

```
      PTT = 0.


      PPTT =   + PPTT

                                                                    263

      WI(2) =   + WI(2)


      PQQ = 0.  +0.
```

BEGIN 323.27 SECONDS

WRITE COMMON
*END

264

SYMBOLS I=I, D1, D2, D3, D10, D1PQ, D20, D2PQ, V, Z, K, I1T11, I2T11, I3T11, I4T11, I5T11, I6T11, I7T11, I8T11, I9T11, KK.

INDICES N1=Z, N2=Z, N5=Z, N6=Z, N8=Z, N7=Z, N9=Z, N13=Z, N14=Z, N15=Z, N16=Z, N17=Z, N18=Z, N20=Z, N21=Z, N3=Z, N4=Z, N10=Z, N11=Z, N12=Z, LA=Z, TA=Z, MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z, C1=Z, C2=Z, C3=Z, C4=Z, E1=Z, E2=Z, E3=Z, S1=Z, S2=Z, S3=Z, S4=Z.

VECTORS Q1, Q2, Q3, P, Q, K1, K2, K3.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UDG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2, RX.

EXPR. =0, =0, =0, =0, =0, =0, =0, =0, =0, INVP, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, GG=2, VG=2, TT, =0, =0, =0, =0, =0, PPQQ, PTT, P00.

			USED	MAXIMUM
RUNNING TIME (SEC)	.12			
TERMS IN OUTPUT	0			
GENERATED TERMS	0	INPUT SPACE	307	2000
EQUAL TERMS	0	OUTPUT SPACE	0	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	238	ID. REGISTER	1	500
MULTIPLICATIONS	0	FUNCT. REG.	0	750

END OF RUN. TIME 323.41 SECONDS

APPENDIX VII

MISCELLANEOUS

APPENDIX VII.A

THE GRAVITON PROPAGATOR FOR TWO GENERAL GAUGE PARAMETERS

Einstein's Parametrization

SCHOONSCHIP , VERSION OF APRIL 1, 1977

TIME .14 SECONDS

```
C WORKS OUT PHI**2 PART OF F AND G**.5*P
COMMON R,RR,LAG
S Z,K,D1,X1,X2
I MU=Z,NU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=Z,L6=Z,
 L7=Z,L8=Z,L9=Z,PO=Z,SI=Z,AA=Z,BB=Z,CC=Z,AA1=Z,AA2=Z,AA3=Z,
 A1=Z,A2=Z,A3=Z,B1=Z,B2=Z,B3=Z,J,BB1=Z,BB2=Z,BB3=Z
F GM1,GM,GU1,GU,P0,P1,P2
*FIX
```

SYMBOLS I=I, Z, K, D1, X1, X2.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. R, RR, LAG.

```
BEGIN          .24  SECONDS

                    N R
                    Z RR(MU,NU)=(GM1(RU,MU,RD,NU)-GM1(RD,MU,NU,RD)+GM(RD,SI,NU)
                     *GM(SI,MU,RD)-GM(SI,MU,NU)*GM(RD,SI,RD))*K**-2
               L 2  ID,GM1(A+,B+,L+,KA+)=1./4.*K*GU1(A,C,KA)*(P1(B,C,L)+P1(C,B,L)
                                                             +P1(C,L,B)+P1(L,C,B)
                                                             -P1(B,L,C)-P1(L,B,C))
                     +1./4.*K*GU(A,C)*(P2(B,C,L,KA)+P2(C,B,L,KA)
                                      +P2(C,L,B,KA)+P2(L,C,B,KA)
                                      -P2(B,L,C,KA)-P2(L,B,C,KA))
               L 4   ID,GM(A+,B+,C+)*GM(AA+,BB+,CC+)=1./16.*K**2
                     *GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                               +P1(L1,C,B)+P1(C,L1,B)
                               -P1(B,C,L1)-P1(C,B,L1))
                     *GU(AA,L2)*(P1(BB,L2,CC)+P1(L2,BB,CC)
                                +P1(L2,CC,BB)+P1(CC,L2,BB)
                                -P1(BB,CC,L2)-P1(CC,BB,L2))
               L 6   ID,GM(A+,B+,C+)=1./4.*K*GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                                                      +P1(L1,C,B)+P1(C,L1,B)
                                                      -P1(B,C,L1)-P1(C,B,L1))
               L 8   ID,GU1(A+,B+,C+)=-1./2.*K*(P1(A,B,C)+P1(B,A,C))
                     +1./4.*K**2*(P1(A,L3,C)*P0(L3,B)+P1(A,L3,C)*P0(B,L3)
                                 +P1(L3,A,C)*P0(L3,B)+P1(L3,A,C)*P0(B,L3)
                                 +P0(A,L3)*P1(L3,B,C)+P0(A,L3)*P1(B,L3,C)
                                 +P0(L3,A)*P1(L3,B,C)+P0(L3,A)*P1(B,L3,C))
                     -1./8.*K**3*(P1(A,L3,C)*P0(L3,L4)*P0(L4,B)
                                 +P1(A,L3,C)*P0(L3,L4)*P0(B,L4)
                                 +P1(A,L3,C)*P0(L4,L3)*P0(L4,B)
                                 +P1(A,L3,C)*P0(L4,L3)*P0(B,L4)
                                 +P1(L3,A,C)*P0(L3,L4)*P0(L4,B)
                                 +P1(L3,A,C)*P0(L3,L4)*P0(B,L4)
                                 +P1(L3,A,C)*P0(L4,L3)*P0(L4,B)
                                 +P1(L3,A,C)*P0(L4,L3)*P0(B,L4)
                                 +P0(A,L3)*P1(L3,L4,C)*P0(L4,B)
                                 +P0(A,L3)*P1(L3,L4,C)*P0(B,L4)
                                 +P0(A,L3)*P1(L4,L3,C)*P0(L4,B)
                                 +P0(A,L3)*P1(L4,L3,C)*P0(B,L4)
                                 +P0(L3,A)*P1(L3,L4,C)*P0(L4,B)
                                 +P0(L3,A)*P1(L3,L4,C)*P0(B,L4)
                                 +P0(L3,A)*P1(L4,L3,C)*P0(L4,B)
                                 +P0(L3,A)*P1(L4,L3,C)*P0(B,L4)
                                 +P0(A,L3)*P0(L3,L4)*P1(L4,B,C)
                                 +P0(A,L3)*P0(L3,L4)*P1(B,L4,C)
                                 +P0(A,L3)*P0(L4,L3)*P1(L4,B,C)
                                 +P0(A,L3)*P0(L4,L3)*P1(B,L4,C)
                                 +P0(L3,A)*P0(L3,L4)*P1(L4,B,C)
                                 +P0(L3,A)*P0(L3,L4)*P1(B,L4,C)
                                 +P0(L3,A)*P0(L4,L3)*P1(L4,B,C)
                                 +P0(L3,A)*P0(L4,L3)*P1(B,L4,C))
               L10   ID,K=0
               L11   ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(P0(A,B)+P0(B,A))
                     +1./4.*K**2*(P0(A,L3)*P0(L3,B)+P0(A,L3)*P0(B,L3)
                                 +P0(L3,A)*P0(L3,B)+P0(L3,A)*P0(B,L3))
                     -1./8.*K**3*(P0(A,L3)*P0(L3,L4)*P0(L4,B)
                                 +P0(A,L3)*P0(L3,L4)*P0(B,L4)
                                 +P0(A,L3)*P0(L4,L3)*P0(L4,B)
                                 +P0(A,L3)*P0(L4,L3)*P0(B,L4)
                                 +P0(L3,A)*P0(L3,L4)*P0(L4,B)
                                 +P0(L3,A)*P0(L3,L4)*P0(B,L4)
                                 +P0(L3,A)*P0(L4,L3)*P0(L4,B)
                                 +P0(L3,A)*P0(L4,L3)*P0(B,L4)))
                    *(D(AA,BB)-1./2.*K*(P0(AA,BB)+P0(BB,AA))
```

```
                +1./4.*K**2*(PO(AA,L1)*PO(L5,BB)*PO(AA,L5)*PO(BB,L1)
                            +PO(L5,AA)*PO(L5,BB)*PO(L5,AA)*PO(BB,L5))
                -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                            +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                            +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                            +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                            +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                            +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                            +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                            +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
     L14        ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                            +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                            +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                            +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                            +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                            +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                            +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                            +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                            +PO(L3,A)*PO(L4,L3)*PO(B,L4))
     L16        ID,K=0
                NPRINT RP
                *NEXT

SYMBOLS         I=I, Z, K, P1, X1, X2.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PP=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.           R, RR, LAG.

RUNNING TIME (SEC)      39.92                          USED    MAXIMUM
TERMS IN OUTPUT           132
GENERATED TERMS           132        INPUT SPACE        903       2000
EQUAL TERMS                 0        OUTPUT SPACE       913       4740
CANCELLATIONS               0        NR. OF EXPR.        52        260
RECORDS WRITTEN             0        ID. REGISTER        39        500
MULTIPLICATIONS        101361        FUNCT. REG.         35        750

                ) R
                Z R=RR(MU,NU)*(D(MU,NU)-1./2.*K*(PO(MU,NU)+PO(NU,MU))
                 +1./4.*K**2*(PO(MU,L7)*PO(L7,NU)+PO(MU,L7)*PO(NU,L7)
                            +PO(L7,MU)*PO(L7,NU)+PO(L7,MU)*PO(NU,L7))
                 -1./8.*K**3*(PO(MU,L7)*PO(L7,L8)*PO(L8,NU)
                            +PO(MU,L7)*PO(L7,L8)*PO(NU,L8)
                            +PO(MU,L7)*PO(L8,L7)*PO(L8,NU)
                            +PO(MU,L7)*PO(L8,L7)*PO(NU,L8)
                            +PO(L7,MU)*PO(L7,L8)*PO(L8,NU)
                            +PO(L7,MU)*PO(L7,L8)*PO(NU,L8)
                            +PO(L7,MU)*PO(L8,L7)*PO(L8,NU)
                            +PO(L7,MU)*PO(L8,L7)*PO(NU,L8)))
     L 4        ID,K=0
                NPRINT R
                *NEXT

SYMBOLS         I=I, Z, K, D1, X1, X2.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
```

```
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S2=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z.
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=1, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
```

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RUNNING TIME (SEC)	44.10		USED	MAXIMUM
TERMS IN OUTPUT	123			
GENERATED TERMS	156	INPUT SPACE	336	2000
EQUAL TERMS	33	OUTPUT SPACE	853	4740
CANCELLATIONS	0	NR. OF EXPR.	27	260
RECORDS WRITTEN	4	ID. REGISTER	3	500
MULTIPLICATIONS	7633	FUNCT. REG.	23	750

```
SYMBOLS         I=I, Z, K, D1, X1, X2.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=1, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
                     N R
                     Z LAG=2.*R*(1.+.5*K*P0(L8,L8)+K**2*(P0(L8,L8)*P0(L9,L9)/8.
                      -1./16.*(P0(L8,L9)*P0(L8,L9)+P0(L8,L9)*P0(L9,L8)
                      +P0(L9,L8)*P0(L8,L9)+P0(L9,L8)*P0(L9,L8))))
          L 5        ID,K=0
                     NPRINT LAG
                     *NEXT

SYMBOLS         I=I, Z, K, D1, X1, X2.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
```

RUNNING TIME (SEC)	46.22		USED	MAXIMUM
TERMS IN OUTPUT	132			
GENERATED TERMS	132	INPUT SPACE	308	2000
EQUAL TERMS	0	OUTPUT SPACE	916	4740
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	8	ID. REGISTER	3	500
MULTIPLICATIONS	3682	FUNCT. REG.	22	750

```
SYMBOLS         I=I, Z, K, D1, X1, X2.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z.
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.
```

```
FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C. UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           R, RR, LAG.
                     DELETE R,RR
                     *BEGIN

SYMBOLS         I=I, Z, K, D1, X1, X2.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z. L3=Z.
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, DD=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z. B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C. UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM. GU1, GU, P0, P1. P2.

EXPR.           R, RR, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	46.34			
TERMS IN OUTPUT	0			
GENERATED TERMS	0	INPUT SPACE	175	2000
EQUAL TERMS	0	OUTPUT SPACE	0	4740
CANCELLATIONS	0	NR. OF EXPR.	19	250
RECORDS WRITTEN	12	ID. REGISTER	1	500
MULTIPLICATIONS	0	FUNCT. REG.	0	750

BEGIN 46.70 SECONDS

```
NAMES LAG
COMMON V1,V2,VV1,VV2,INPP,INPF,LPF,LAG1
S Z,KK,T1,T2,T3,T4,T5,T6,T7,T8,T9,T10,SA,SB,SC
V Q1,Q2,P
*FIX
```

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SYMBOLS I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, SA, SB, SC.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, PQ=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, CI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GH1, GH, GU1, GU, P0, P1, P2.

EXPR. =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.

SYMBOLS I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, SA, SB, SC.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.

			USED	MAXIMUM
RUNNING TIME (SEC)	.45			
TERMS IN OUTPUT	2			
GENERATED TERMS	9	INPUT SPACE	235	2000
EQUAL TERMS	7	OUTPUT SPACE	13	4740
CANCELLATIONS	0	NR. OF EXPR.	24	260
RECORDS WRITTEN	19	ID. REGISTER	3	500
MULTIPLICATIONS	46	FUNCT. REG.	13	750

SYMBOLS I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, SA, SB, SC.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.

```
N R
C WORKS OUT THE GRAVITON PROPAGATOR
Z LAG=LAG
```

```
L 2         ID,K**(J+)=KL**(-J)
L 3         ID,KK=0
            UPRINT LAG
            *NEXT
```



```
SYMBOLS     I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
            T8, T9, T10, SA, SB, SC.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, P.

FUNCTIONS   D, EPF=1, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, D0,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, VV1, VV2, IMPP, IMPF, LPF, LAG1.
```

RUNNING TIME (SEC)	.95		USED	MAXIMUM
TERMS IN OUTPUT	123			
GENERATED TERMS	123	INPUT SPACE	238	2000
EQUAL TERMS	0	OUTPUT SPACE	462	4743
CANCELLATIONS	0	NO. OF EXPR.	25	260
RECORDS WRITTEN	26	ID. REGISTER	6	500
MULTIPLICATIONS	424	FUNCT. REG.	20	750

```
SYMBOLS     I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
            T8, T9, T10, SA, SB, SC.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, P.

FUNCTIONS   D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, D0,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, VV1, VV2, IMPP, IMPF, LPF, LAG1.
            H R
            C GAUGE BREAKING TERM
            Z LAG=LAG-1./2.*D1**(-1)*(1./2.*(P1(MU,NU,MU)*P1(NU,MU,MU))
                        *1./2.*X1**2*(P1(P0,MU,P0)+P1(NU,P0,P0))
                        +1./2.*X1*X2*(P1(MU,NU,MU)+P1(NU,MU,MU))*P1(P0,P0,MU)
                        +1./2.*X1*X2*(P1(P0,NU,P0)+P1(NU,P0,P0))*P1(MU,MU,MU)
                        +X2**2*P1(MU,NU,NU)*P1(P0,P0,NU))


            UPRINT LAG
            *NEXT

SYMBOLS     I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
            T8, T9, T10, SA, SB, SC.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, P.
```

```
FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.
```

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			USED	MAXIMUM
RUNNING TIME (SEC)	1.55			
TERMS IN OUTPUT	134			
GENERATED TERMS	134	INPUT SPACE	291	2000
EQUAL TERMS	0	OUTPUT SPACE	943	4740
CANCELLATIONS	0	NR. OF EXPR.	31	250
RECORDS WRITTEN	33	ID. REGISTER	1	500
MULTIPLICATIONS	405	FUNCT. DEG.	19	750

```
SYMBOLS         I=I, Z, K, D1, X1, X2, LP, T1, T2, T3, T4, T5, T6, T7,
                T8, T9, T10, SA, SB, SC.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, DD=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.
```

```
                N R
                Z V1=LAG

        L 2     ID,ADISO,P0(L1+,L2+)*P2(L3+,L4+,L5+,L6+)=
                 D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*Q2(L5)*Q2(L6)
        L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)=
                 D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)
                NPRINT V1
                *NEXT

SYMBOLS         I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
                T8, T9, T10, SA, SB, SC.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, DD=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.
```

```
RUNNING TIME (SEC)          2.28                          USED    MAXIMUM
TERMS IN OUTPUT               31
GENERATED TERMS              134        INPUT SPACE        208        2000
EQUAL TERMS                   93        OUTPUT SPACE       214        4748
CANCELLATIONS                 10        NR. OF EXPR.        28         250
RECORDS WRITTEN               42        ID. REGISTER        23         500
MULTIPLICATIONS              672        FUNCT. REG.         22         750
```

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```
SYMBOLS       I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
              T8, T9, T10, SA, SB, SC.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS       Q1, Q2, P.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.         =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.
```

```
              N R
              Z V2=LAG

        L 2   ID,ADISO,P0(L1+,L2+)*P2(L3+,L4+,L5+,L6+)=
               D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*Q1(L5)*Q1(L6)
        L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)=
               D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)
              NPRINT V2
              *NEXT
```

```
SYMBOLS       I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
              T8, T9, T10, SA, SB, SC.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
              CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
              B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS       Q1, Q2, P.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
              DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.         =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.

RUNNING TIME (SEC)          2.04                          USED    MAXIMUM
TERMS IN OUTPUT               31
```

GENERATED TERMS	136	INPUT SPACE	230	2000
EQUAL TERMS	93	OUTPUT SPACE	214	4740
CANCELLATIONS	10	NR. OF EXPR.	30	260
RECORDS WRITTEN	46	ID. REGISTER	23	500
MULTIPLICATIONS	672	FUNCT. REG.	22	750

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SYMBOLS I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, SA, SB, SC.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.

```
N R
Z INPP=V1+V2

DELETE,LAG,LPF,LAG1,V1,V2,VV1,VV2
*NEXT
```

SYMBOLS I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, SA, SB, SC.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. =0, =0, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.

			USED	MAXIMUM
RUNNING TIME (SEC)	3.21			
TERMS IN OUTPUT	44			
GENERATED TERMS	62	INPUT SPACE	229	2000
EQUAL TERMS	18	OUTPUT SPACE	225	4740
CANCELLATIONS	0	NR. OF EXPR.	30	260
RECORDS WRITTEN	50	ID. REGISTER	1	500
MULTIPLICATIONS	190	FUNCT. REG.	18	750

```
SYMBOLS         I=I, Z, K, D1, X1, X2, LM, T1, T2, T3, T4, T5, T6, T7,
                T8, T9, T10, SA, SB, SC.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, B0=Z, S1=Z, SA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z.
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DP,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =Q, =Q, LAG, V1, V2, VV1, VV2, INPP, INPF, LPF, LAG1.

 INPP =

   + Q1(A1)*Q1(A2)*D(B1,B2)


   + Q1(A1)*Q2(A2)*D(B1,B2)

   * ( 1. - 1./4.*D1**(-1)*X1**2 )


   + Q1(A1)*D(A2,B1)*Q1(B2)


   + Q1(A1)*D(A2,B1)*Q2(B2)

   * ( 1. - 1./4.*D1**(-1)*X1**2 )


   - Q1(A1)*D(A2,B2)*Q1(B1)


   + Q1(A1)*D(A2,B2)*Q2(B1)

   * ( - 1. - 1./2.*D1**(-1)*X1*X2 )


   + 1./2.*Q2(A1)*Q1(A2)*D(B1,B2)


   + Q2(A1)*Q2(A2)*D(B1,B2)


   + 1./2.*Q2(A1)*D(A2,B1)*Q1(B2)


   + Q2(A1)*D(A2,B1)*Q2(B2)
```

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```
     + Q2(A1)*D(A2,B2)*Q1(B1)
     * ( - 1. - 1./2.*D1**(-1)*X1*X2 )

     - 2.*Q2(A1)*D(A2,B2)*Q2(B1)

     + D(A1,A2)*Q1(B1)*Q1(B2)

     + D(A1,A2)*Q1(B1)*Q2(B2)
     * ( 1. - 1./4.*D1**(-1)*X1**2 )

     + 1./2.*D(A1,A2)*Q2(B1)*Q1(B2)

     + D(A1,A2)*Q2(B1)*Q2(B2)

     + D(A1,A2)*D(B1,B2)
     * ( - Q1DQ1 - 3./2.*Q1DQ2 - Q2DQ2 )

     - 2.*D(A1,B1)*Q1(A2)*Q1(B2)

     + D(A1,B1)*Q1(A2)*Q2(B2)
     * ( - 1. - 1./2.*D1**(-1)*X1*X2 )

     + D(A1,B1)*Q2(A2)*Q1(B2)
     * ( - 1. - 1./2.*D1**(-1)*X1*X2 )

     - D(A1,B1)*Q2(A2)*Q2(B2)

     + D(A1,B1)*D(A2,B2)
     * ( - D1**(-1)*X2**2*Q1DQ2 + Q1DQ1 + Q1DQ2 + Q2DQ2 )

     + D(A1,B2)*Q1(A2)*Q1(B1)
```

```
   + 1./2.*D(A1,B1)*Q1(A2)*Q2(B2)

   + D(A1,B2)*Q2(A2)*Q1(B1)
   * ( 1. - 1./4.*D1**(-1)*X1**2 )

   + D(A1,B2)*Q2(A2)*Q2(B1)

   + D(A1,B2)*D(A2,B1)
   * ( - Q1DQ1 - 3./2.*Q1DQ2 - Q2DQ2 )
```



```
                  N R
                  Z INPP=INPP

         L 2      ID,Q1(NU+)=P(NU)
         L 3      ID,2,OUTPR,Q1(NU+)=P(NU)
         L 5      ID,Q2(NU+)=-P(NU)
         L 6      ID,2,OUTPR,Q2(NU+)=-P(NU)
                  *BEGIN

SYMBOLS        I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
               T8, T9, T10, SA, SB, SC.

INDICES        NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, P0=Z, S1=Z, AA=Z, BB=Z,
               CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
               B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, P.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UC=C, UBG, DD=U, D8,
               DT, DS=U, DX, DK, DP, DF=U, GU1, GM, GU2, GU, P0, P1, P2.

EXPR.          =0, =0, =0, =0, =0, =0, =0, INPP, INPF, =0, =0.

RUNNING TIME (SEC)      3.73                              USED    MAXIMUM
TERMS IN OUTPUT           18
GENERATED TERMS           44        INPUT SPACE          263      2000
EQUAL TERMS               20        OUTPUT SPACE         115      4740
CANCELLATIONS              6        NR. OF EXPR.          28       250
```

RECORDS WRITTEN	54	ID. REGISTER	32	512
MULTIPLICATIONS	310	FUNCT. REG.	10	750

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SYMBOLS I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, SA, SB, SC.

INDICES NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, M0=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=1, GI, G5=I, G6=C, G7, HG=C, UBG, DD=U, D3, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. =0, =0, =0, =0, =0, =0, =0, INPP, INPF, =0, =0.

```
 INPP =

   + P(A1)*P(A2)*D(B1,B2)

   * ( 1./2. + 1./4.*D1**(-1)*X1**2 )


   + P(A1)*D(A2,B1)*P(B2)

   * ( 1./2. + 1./4.*D1**(-1)*X1**2 )


   + P(A1)*D(A2,B2)*P(B1)

   * ( - 1. + D1**(-1)*X1*X2 )


   + D(A1,A2)*P(B1)*P(B2)

   * ( 1./2. + 1./4.*D1**(-1)*X1**2 )


   + D(A1,A2)*D(B1,B2)

   * ( - 1./2.*PDP )


   + D(A1,B1)*P(A2)*P(B2)

   * ( - 1. + D1**(-1)*X1*X2 )


   + D(A1,B1)*D(A2,B2)

   * ( D1**(-1)*X2**2*PDP + PDP )


   + D(A1,B2)*P(A2)*P(B1)
```

```
* ( 1./2. + 1./4.*D1**(-1)*X1**2 )

+ D(A1,B2)*D(A2,B1)
* ( - 1./2.*PDP )
```

```
NAMES INPP,INPF
X PP(A1,B1,AA1,BB1)=
    + P(AA1)*P(A1)*P(B1)*P(BB1)*T1
    + P(AA1)*P(A1)*D(B1,BB1)*T5
    + P(AA1)*D(A1,B1)*P(BB1)*T4
    + P(AA1)*D(A1,BB1)*P(B1)*T6
    + D(AA1,A1)*P(B1)*P(BB1)*T7
    + D(AA1,A1)*D(B1,BB1)*T3
    + D(AA1,B1)*P(A1)*P(BB1)*T8
    + D(AA1,B1)*D(A1,BB1)*T9
    + D(AA1,BB1)*P(A1)*P(B1)*T10
    + D(AA1,BB1)*D(A1,B1)*T2
X UH(A,B,PD,SI)=+SA*D(A,PD)*D(B,SI)
                +SB*D(A,SI)*D(B,PD)
                +SC*D(A,B)*D(PD,SI)
*FIX
```

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SYMBOLS I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, SA, SB, SC.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, LN=Z, LM=Z, PD=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z, B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, P.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2.

EXPR. =0, =0, =0, =0, =0, =0, =0, INPP, INPF, =0, =0, PP=1, UH=1.

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```
                N R
                Z UNIT=INPP*PP(A2,B2,AA1,BB1)

                DELETE INPP,INPF
                *BEGIN

SYMBOLS         I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
                T8, T9, T10, SA, SB, SC.

INDICES         NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, DPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, =0, =0, =0, =0, =0, INPP, INPF, =0, =0, PP=1, UN=1.

RUNNING TIME (SEC)      2.55                            USED    MAXIMUM
TERMS IN OUTPUT          100
GENERATED TERMS          180        INPUT SPACE          307       2000
EQUAL TERMS               56        OUTPUT SPACE         505       4740
CANCELLATIONS             24        NR. OF EXPR.          26        260
RECORDS WRITTEN           60        ID. REGISTER           1        500
MULTIPLICATIONS          902        FUNCT. REG.           25        750


SYMBOLS         I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
                T8, T9, T10, SA, SB, SC.

INDICES         NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, RO=Z, SI=Z, AA=Z, BB=Z,
                CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
                B3=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, P.

FUNCTIONS       D, DPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, =0, =0, =0, =0, =0, INPP, INPF, =0, =0, PP=1, UN=1.

 UNIT =

   + P(AA1)*P(A2)*P(B1)*P(BB2)

   * ( Z*D1**(-1)*X1*X2*T4 - Z*T4 + D1**(-1)*X1*X2*T1*PDP + D1**(-1)*X1*X2*T5 + D1**(-1)*X1*X2*T6 + D1**(-1)*X1
```

```
*X2*T7 + D1**(-1)*X1*X2*T8 + D1**(-1)*X1**2*T1*PDP + D1**(-1)*X1**2*T4 + 1./2.*D1**(-1)*X1**2*T5 + 1./2.*D1**(-1)
*X1**2*T6 + 1./2.*D1**(-1)*X1**2*T7 + 1./2.*D1**(-1)*X1**2*T8 + 2.*T4 )

2.  + P(AA1)*P(A1)*D(B1,BB1)
    * ( 1./4.*D1**(-1)*X1**2*T3 + 1./4.*D1**(-1)*X1**2*T5*PDP + 1./4.*D1**(-1)*X1**2*T6*PDP + 1./4.*D1**(-1)*X1**2
    *T9 + 1./2.*T3 + 1./2.*T9 )

    + P(AA1)*D(A1,B1)*P(BB1)
    * ( Z*D1**(-1)*X2**2*T4*PDP + Z*T4*PDP + D1**(-1)*X1*X2*T1*PDP**2 + D1**(-1)*X1*X2*T3 + D1**(-1)*X1*X2*T4*PDP
     + D1**(-1)*X1*X2*T5*PDP + D1**(-1)*X1*X2*T6*PDP + D1**(-1)*X1*X2*T7*PDP + D1**(-1)*X1*X2*T8*PDP + D1**(-1)
    *X1*X2*T9 + D1**(-1)*X2**2*T1*PDP**2 + D1**(-1)*X2**2*T5*PDP + D1**(-1)*X2**2*T6*PDP + D1**(-1)*X2**2*T7*PDP
     + D1**(-1)*X2**2*T8*PDP - T3 - 2.*T4*PDP - T9 )

2.  + P(AA1)*D(A1,BB1)*P(B1)
    * ( 1./4.*D1**(-1)*X1**2*T3 + 1./4.*D1**(-1)*X1**2*T5*PDP + 1./4.*D1**(-1)*X1**2*T6*PDP + 1./4.*D1**(-1)*X1**2
    *T9 + 1./2.*T3 + 1./2.*T9 )

2.  + D(AA1,A1)*P(B1)*P(BB1)
    * ( 1./4.*D1**(-1)*X1**2*T3 + 1./4.*D1**(-1)*X1**2*T7*PDP + 1./4.*D1**(-1)*X1**2*T8*PDP + 1./4.*D1**(-1)*X1**2
    *T9 + 1./2.*T3 + 1./2.*T9 )

1.  + D(AA1,A1)*D(B1,BB1)
    * ( - 1./2.*T3*PDP - 1./2.*T9*PDP )

2.  + D(AA1,B1)*P(A1)*P(BB1)
    * ( 1./4.*D1**(-1)*X1**2*T3 + 1./4.*D1**(-1)*X1**2*T7*PDP + 1./4.*D1**(-1)*X1**2*T8*PDP + 1./4.*D1**(-1)*X1**2
    *T9 + 1./2.*T3 + 1./2.*T9 )

1.  + D(AA1,B1)*D(A1,BB1)
    * ( - 1./2.*T3*PDP - 1./2.*T9*PDP )

4   + D(AA1,BB1)*P(A1)*P(B1)
```

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```
* ( Z*D1**(-1)*X1*X2*T2 - Z*T2 + D1**(-1)*X1*X2*T3 + D1**(-1)*X1*X2*T9 + D1**(-1)*X1*X2*T10*PDP + D1**(-1)
*X1**2*T2 + D1**(-1)*X1**2*T10*PDP + 2.*T2 - T3 - T9 )
```

3. `+ D(AA1,BB1)*D(A1,B1)`

```
* ( Z*D1**(-1)*X2**2*T2*PDP + Z*T2*PDP + D1**(-1)*X1*X2*T2*PDP + D1**(-1)*X1*X2*T10*PDP**2 + D1**(-1)*X2**2
*T3*PDP + D1**(-1)*X2**2*T9*PDP + D1**(-1)*X2**2*T10*PDP**2 - 2.*T2*PDP + T3*PDP + T9*PDP )
```

UNIVERSITÀ DI TRIESTE
CENTRO DI CALCOLO DELL'

```
BEGIN       53.68  SECONDS

            WRITE COMMON
            *END

SYMBOLS     I=I, Z, K, D1, X1, X2, KK, T1, T2, T3, T4, T5, T6, T7,
            T8, T9, T10, SA, SB, SC.

INDICES     NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, LP=Z, L9=Z, KU=Z, SI=Z, AA=Z, BB=Z,
            CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, B1=Z, B2=Z,
            B3=Z, J, BB2=Z, BB3=Z, BB3=Z.

VECTORS     Q1, Q2, P.

FUNCTIONS   D, EPF=I, G=I, GI, C5=I, G6=C, G7, HG=C, HHG, DD=U, D2,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, =0, =0, =C, =C, =0, =C, =0, =0, =0, DD=I, DU=I.

RUNNING TIME (SEC)          .10                          USED    MAXIMUM
TERMS IN OUTPUT               0
GENERATED TERMS               0        INPUT SPACE        256       3000
EQUAL TERMS                   0        OUTPUT SPACE         0       4240
CANCELLATIONS                 0        NP. OF EXPR.        20        200
RECORDS WRITTEN              64        IO. REGISTER         1          5
MULTIPLICATIONS               0        FUNCT. REG.          0        750

END OF RUN.   TIME      53.79  SECONDS
```

APPENDIX VII.B

THE 4-GRAVITON VERTEX FUNCTION

Einstein's Parametrization

SCHROEDINGER , VERSION OF APRIL 1, 1977

TIME .13 SECONDS

```
C WORKS OUT PSI**4 PART OF R AND G**.5*R
COMMON R,RR,LAG
S Z,K
I NU=Z,MU=Z,A=Z,B=Z,C=Z,L=Z,KA=Z,L1=Z,L2=Z,L3=Z,L4=Z,L5=Z,L6=Z,
 L7=Z,L8=Z,L9=Z,L10=Z,MU=Z,SI=Z,AA=Z,BB=Z,CC=Z,AA1=Z,AA2=Z,AA3=Z,
 A1=Z,A2=Z,A3=Z,A4=Z,B1=Z,B2=Z,B3=Z,B4=Z,J,BB1=Z,BB2=Z,BB3=Z
F GM1,GM,GU1,GU,P0,P1,P2
*FIX
```

SYMBOLS I=I, Z, K.

INDICES NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, R0=Z, SI=Z,
AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS D, DPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UPG, DD=U, DR,
DT, DS=U, DY, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. R, RR, LAG.

BEGIN .25 SECONDS

```
BEGIN          .25  SECONDS
                    I; R
                    Z RR(MU,NU)=(GM1(RQ,MU,RQ,NU)-GM1(RQ,MU,NU,RQ)+GM(RQ,SI,NU)
                     *GM(SI,MU,RQ)-GM(SI,MU,NU)*GM(RQ,SI,RQ))*K**-4
               L 2  ID,GM1(A+,B+,L+,KA+)=1./4.*K*GU1(A,C,KA)*(P1(B,C,L)+P1(C,B,L)
                                                             +P1(C,L,B)+P1(L,C,B)
                                                             -P1(B,L,C)-P1(L,B,C))
                     +1./4.*K*GU(A,C)*(P2(B,C,L,KA)+P2(C,B,L,KA)
                                      +P2(C,L,B,KA)+P2(L,C,B,KA)
                                      -P2(B,L,C,KA)-P2(L,B,C,KA))
               L 4   ID,GM(A+,B+,C+)*GM(AA+,BB+,CC+)=1./16.*K**2
                     *GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                               +P1(L1,C,B)+P1(C,L1,B)
                               -P1(B,C,L1)-P1(C,B,L1))
                     *GU(AA,L2)*(P1(BB,L2,CC)+P1(L2,BB,CC)
                                +P1(L2,CC,BB)+P1(CC,L2,BB)
                                -P1(BB,CC,L2)-P1(CC,BB,L2))
               L 6   ID,GM(A+,B+,C+)=1./4.*K*GU(A,L1)*(P1(B,L1,C)+P1(L1,B,C)
                                                      +P1(L1,C,B)+P1(C,L1,B)
                                                      -P1(B,C,L1)-P1(C,B,L1))
               L 8   ID,GU1(A+,B+,C+)=-1./2.*K*(P1(A,B,C)+P1(B,A,C))
                     +1./4.*K**2*(P1(A,L3,C)*P0(L3,B)+P1(A,L3,C)*P0(B,L3)
                                 +P1(L3,A,C)*P0(L3,B)+P1(L3,A,C)*P0(B,L3)
                                 +P0(A,L3)*P1(L3,B,C)+P0(A,L3)*P1(B,L3,C)
                                 +P0(L3,A)*P1(L3,B,C)+P0(L3,A)*P1(B,L3,C))
                     -1./8.*K**3*(P1(A,L3,C)*P0(L3,L4)*P0(L4,B)
                                 +P1(A,L3,C)*P0(L3,L4)*P0(B,L4)
                                 +P1(A,L3,C)*P0(L4,L3)*P0(L4,B)
                                 +P1(A,L3,C)*P0(L4,L3)*P0(B,L4)
                                 +P1(L3,A,C)*P0(L3,L4)*P0(L4,B)
                                 +P1(L3,A,C)*P0(L3,L4)*P0(B,L4)
                                 +P1(L3,A,C)*P0(L4,L3)*P0(L4,B)
                                 +P1(L3,A,C)*P0(L4,L3)*P0(B,L4)
                                 +P0(A,L3)*P1(L3,L4,C)*P0(L4,B)
                                 +P0(A,L3)*P1(L3,L4,C)*P0(B,L4)
                                 +P0(A,L3)*P1(L4,L3,C)*P0(L4,B)
                                 +P0(A,L3)*P1(L4,L3,C)*P0(B,L4)
                                 +P0(L3,A)*P1(L3,L4,C)*P0(L4,B)
                                 +P0(L3,A)*P1(L3,L4,C)*P0(B,L4)
                                 +P0(L3,A)*P1(L4,L3,C)*P0(L4,B)
                                 +P0(L3,A)*P1(L4,L3,C)*P0(B,L4)
                                 +P0(A,L3)*P0(L3,L4)*P1(L4,B,C)
                                 +P0(A,L3)*P0(L3,L4)*P1(B,L4,C)
                                 +P0(A,L3)*P0(L4,L3)*P1(L4,B,C)
                                 +P0(A,L3)*P0(L4,L3)*P1(B,L4,C)
                                 +P0(L3,A)*P0(L3,L4)*P1(L4,B,C)
                                 +P0(L3,A)*P0(L3,L4)*P1(B,L4,C)
                                 +P0(L3,A)*P0(L4,L3)*P1(L4,B,C)
                                 +P0(L3,A)*P0(L4,L3)*P1(B,L4,C))
               L10   ID,K=0
               L11   ID,GU(A+,B+)*GU(AA+,BB+)=(D(A,B)-1./2.*K*(P0(A,B)+P0(B,A))
                     +1./4.*K**2*(P0(A,L3)*P0(L3,B)+P0(A,L3)*P0(B,L3)
                                 +P0(L3,A)*P0(L3,B)+P0(L3,A)*P0(B,L3))
                     -1./8.*K**3*(P0(A,L3)*P0(L3,L4)*P0(L4,B)
                                 +P0(A,L3)*P0(L3,L4)*P0(B,L4)
                                 +P0(A,L3)*P0(L4,L3)*P0(L4,B)
                                 +P0(A,L3)*P0(L4,L3)*P0(B,L4)
                                 +P0(L3,A)*P0(L3,L4)*P0(L4,B)
                                 +P0(L3,A)*P0(L3,L4)*P0(B,L4)
                                 +P0(L3,A)*P0(L4,L3)*P0(L4,B)
                                 +P0(L3,A)*P0(L4,L3)*P0(B,L4)))
                                *(D(AA,BB)-1./2.*K*(P0(AA,BB)+P0(BB,AA))
```

```
                +1./4.*K**2*(PO(AA,L5)*PO(L5,BB)+PO(AA,L5)*PO(BB,L5)
                            +PO(L5,AA)*PO(L5,BB)+PO(L5,AA)*PO(BB,L5))
                -1./8.*K**3*(PO(AA,L5)*PO(L5,L6)*PO(L6,BB)
                            +PO(AA,L5)*PO(L5,L6)*PO(BB,L6)
                            +PO(AA,L5)*PO(L6,L5)*PO(L6,BB)
                            +PO(AA,L5)*PO(L6,L5)*PO(BB,L6)
                            +PO(L5,AA)*PO(L5,L6)*PO(L6,BB)
                            +PO(L5,AA)*PO(L5,L6)*PO(BB,L6)
                            +PO(L5,AA)*PO(L6,L5)*PO(L6,BB)
                            +PO(L5,AA)*PO(L6,L5)*PO(BB,L6)))
      L14       ID,GU(A+,B+)=D(A,B)-1./2.*K*(PO(A,B)+PO(B,A))
                +1./4.*K**2*(PO(A,L3)*PO(L3,B)+PO(A,L3)*PO(B,L3)
                            +PO(L3,A)*PO(L3,B)+PO(L3,A)*PO(B,L3))
                -1./8.*K**3*(PO(A,L3)*PO(L3,L4)*PO(L4,B)
                            +PO(A,L3)*PO(L3,L4)*PO(B,L4)
                            +PO(A,L3)*PO(L4,L3)*PO(L4,B)
                            +PO(A,L3)*PO(L4,L3)*PO(B,L4)
                            +PO(L3,A)*PO(L3,L4)*PO(L4,B)
                            +PO(L3,A)*PO(L3,L4)*PO(B,L4)
                            +PO(L3,A)*PO(L4,L3)*PO(L4,B)
                            +PO(L3,A)*PO(L4,L3)*PO(B,L4))
      L16       ID,K=0
                UPRINT,RR
                *NEXT

SYMBOLS         I=I, Z, K.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS       D, EPF=1, G=I, GI, G5=1, G6=C, G7, UG=C, UUG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, PO, P1, P2.

EXPR.           R, RR, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	45.73			
TERMS IN OUTPUT	1812			
GENERATED TERMS	1812	INPUT SPACE	903	2000
EQUAL TERMS	0	OUTPUT SPACE	4736	4740
CANCELLATIONS	0	NR. OF EXPR.	50	260
RECORDS WRITTEN	20	ID. REGISTER	33	500
MULTIPLICATIONS	99601	FUNCT. REG.	35	750

			USED	MAXIMUM
RUNNING TIME (SEC)	49.88			
TERMS IN OUTPUT	1812			
GENERATED TERMS	1812	INPUT SPACE	903	2000
EQUAL TERMS	0	OUTPUT SPACE	7124	7126
CANCELLATIONS	0	NR. OF EXPR.	56	260
RECORDS WRITTEN	37	ID. REGISTER	33	500
MULTIPLICATIONS	99601	FUNCT. REG.	35	750

			USED	MAXIMUM
RUNNING TIME (SEC)	52.75			
TERMS IN OUTPUT	1812			
GENERATED TERMS	1812	INPUT SPACE	903	2000
EQUAL TERMS	0	OUTPUT SPACE	2495	7126
CANCELLATIONS	0	NR. OF EXPR.	50	260
RECORDS WRITTEN	50	ID. REGISTER	33	500
MULTIPLICATIONS	99601	FUNCT. REG.	35	750

N R

```
      Z R=RR(MU,NU)*(D(MU,NU)-1./2.*K*(PO(MU,MU)+PO(NU,NU))
       +1./4.*K**2*(PO(MU,L7)*PO(L7,NU)+PO(NU,L7)*PO(NU,L7)
                   +PO(L7,MU)*PO(L7,NU)+PO(L7,MU)*PO(NU,L7))
       -1./8.*K**3*(PO(MU,L7)*PO(L7,L8)*PO(L8,NU)
                   +PO(MU,L7)*PO(L7,L8)*PO(L8,NU)
                   +PO(MU,L7)*PO(L8,L7)*PO(L8,NU)
                   +PO(NU,L7)*PO(L8,L7)*PO(NU,L8)
                   +PO(L7,MU)*PO(L7,L8)*PO(L8,NU)
                   +PO(L7,MU)*PO(L7,L8)*PO(NU,L8)
                   +PO(L7,NU)*PO(L8,L7)*PO(L8,NU)
                   +PO(L7,MU)*PO(L8,L7)*PO(NU,L8)))
L 4   ID,K=0
      HPRINT R
      *NEXT
```

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```
SYMBOLS     I=I, Z, K.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GH1, GH, GU1, GU, P0, P1, P2.

EXPR.       R, RR, LAG.

RUNNING TIME (SEC)      134.34                          USED    MAXIMUM
TERMS IN OUTPUT           3477
GENERATED TERMS           3564      INPUT SPACE          354       2000
EQUAL TERMS                 87      OUTPUT SPACE        4735       4740
CANCELLATIONS                0      NR. OF EXPR.          27        260
RECORDS WRITTEN            106      ID. REGISTER           3        500
MULTIPLICATIONS         103345      FUNCT. REG.           33        750


SYMBOLS     I=I, Z, K.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS   D, EPF=1, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GH1, GH, GU1, GU, P0, P1, P2.

EXPR.       R, RR, LAG.

RUNNING TIME (SEC)      145.66                          USED    MAXIMUM
TERMS IN OUTPUT           3381
GENERATED TERMS           3564      INPUT SPACE          354       2000
EQUAL TERMS                183      OUTPUT SPACE        7124       7124
CANCELLATIONS                0      NR. OF EXPR.          27        260
RECORDS WRITTEN            247      ID. REGISTER           3        500
MULTIPLICATIONS         103345      FUNCT. REG.           33        750


RUNNING TIME (SEC)      158.21                          USED    MAXIMUM
TERMS IN OUTPUT           3255
GENERATED TERMS           3564      INPUT SPACE          354       2000
EQUAL TERMS                309      OUTPUT SPACE        7125       7126
CANCELLATIONS                0      NR. OF EXPR.          27        260
RECORDS WRITTEN            180      ID. REGISTER           3        500
MULTIPLICATIONS         103345      FUNCT. REG.           33        750
```

			USED	MAXIMUM
RUNNING TIME (SEC)	162.55			
TERMS IN OUTPUT	3111			
GENERATED TERMS	3564	INPUT SPACE	354	2000
EQUAL TERMS	453	OUTPUT SPACE	5776	7124
CANCELLATIONS	0	NR. OF EXPR.	27	260
RECORDS WRITTEN	201	ID. REGISTER	3	500
MULTIPLICATIONS	103345	FUNCT. REG.	33	750

```
        H R
        Z LAG=2.*R*(1.+.5*K*PO(L8,L8)+K**2*(PO(L8,L8)*PO(L9,L9)/8.
         -1./16.*(PO(L8,L9)*PO(L8,L9)+PO(L8,L9)*PO(L9,L8)
          +PO(L9,L8)*PO(L8,L9)+PO(L9,L8)*PO(L9,L8)))
          +K**3*(PO(L8,L8)*PO(L9,L9)*PO(L10,L10)/48
          -1./32.*PO(L8,L8)*(PO(L9,L10)*PO(L9,L10)
                            +PO(L9,L10)*PO(L10,L9)
                            +PO(L10,L9)*PO(L9,L10)
                            +PO(L10,L9)*PO(L10,L9))
          +1./48.*(PO(L8,L9)*PO(L9,L10)*PO(L10,L9)
                  +PO(L8,L9)*PO(L9,L10)*PO(L8,L10)
                  +PO(L8,L9)*PO(L10,L9)*PO(L10,L8)
                  +PO(L8,L9)*PO(L10,L9)*PO(L8,L10)
                  +PO(L9,L8)*PO(L9,L10)*PO(L10,L8)
                  +PO(L9,L8)*PO(L9,L10)*PO(L8,L10)
                  +PO(L9,L8)*PO(L10,L9)*PO(L10,L8)
                  +PO(L9,L8)*PO(L10,L9)*PO(L8,L10))))
  L 5   ID,K=0
        NPRINT LAG
        *NEXT
```

SYMBOLS I=I, Z, K.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, R0=Z, SI=Z,
AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
DT, DS=U, DX, DK, DP, DF=U, GU1, GM, GU1, GU, P0, P1, P2.

EXPR. R, RR, LAG.

			USED	MAXIMUM
RUNNING TIME (SEC)	345.39			
TERMS IN OUTPUT	4578			
GENERATED TERMS	4578	INPUT SPACE	419	2000
EQUAL TERMS	0	OUTPUT SPACE	4735	4740
CANCELLATIONS	0	NR. OF EXPR.	30	260
RECORDS WRITTEN	275	ID. REGISTER	3	500
MULTIPLICATIONS	238082	FUNCT. REG.	39	750

SYMBOLS I=I, Z, K.

INDICES MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, R0=Z, SI=Z,
AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
DT, DS=U, DX, DK, DP, DF=U, GU1, GM, GU1, GU, P0, P1, P2.

EXPR. R, RR, LAG.

			USED	MAXIMUM
RUNNING TIME (SEC)	371.83			
TERMS IN OUTPUT	4578			
GENERATED TERMS	4578	INPUT SPACE	419	2000
EQUAL TERMS	0	OUTPUT SPACE	7127	7126
CANCELLATIONS	0	NR. OF EXPR.	30	260
RECORDS WRITTEN	333	ID. REGISTER	3	500
MULTIPLICATIONS	238081	FUNCT. REG.	39	750

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			USED	MAXIMUM
RUNNING TIME (SEC)	381.33			
TERMS IN OUTPUT	4578			
GENERATED TERMS	4578	INPUT SPACE	419	2000
EQUAL TERMS	0	OUTPUT SPACE	7125	7126
CANCELLATIONS	0	NR. OF EXPR.	30	260
RECORDS WRITTEN	385	ID. REGISTER	3	500
MULTIPLICATIONS	238081	FUNCT. REG.	39	750

			USED	MAXIMUM
RUNNING TIME (SEC)	397.84			
TERMS IN OUTPUT	4578			
GENERATED TERMS	4578	INPUT SPACE	419	2000
EQUAL TERMS	0	OUTPUT SPACE	7126	7126
CANCELLATIONS	0	NR. OF EXPR.	30	260
RECORDS WRITTEN	424	ID. REGISTER	3	500
MULTIPLICATIONS	238081	FUNCT. REG.	39	750

			USED	MAXIMUM
RUNNING TIME (SEC)	406.88			
TERMS IN OUTPUT	4578			
GENERATED TERMS	4578	INPUT SPACE	419	2000
EQUAL TERMS	0	OUTPUT SPACE	7125	7126
CANCELLATIONS	0	NR. OF EXPR.	30	260
RECORDS WRITTEN	450	ID. REGISTER	3	500
MULTIPLICATIONS	238081	FUNCT. REG.	39	750

			USED	MAXIMUM
RUNNING TIME (SEC)	410.52			
TERMS IN OUTPUT	4578			
GENERATED TERMS	4578	INPUT SPACE	419	2000
EQUAL TERMS	0	OUTPUT SPACE	3251	7126
CANCELLATIONS	0	NR. OF EXPR.	30	260
RECORDS WRITTEN	471	ID. REGISTER	3	500
MULTIPLICATIONS	238081	FUNCT. REG.	39	750

```
DELETE R,RR
*BEGIN

SYMBOLS     I=I, Z, K.

INDICES     NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RR=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       I, RR, LAG.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	411.68			
TERMS IN OUTPUT	0			
GENERATED TERMS	0	INPUT SPACE	175	2000
EQUAL TERMS	0	OUTPUT SPACE	0	4740
CANCELLATIONS	0	NR. OF EXPR.	19	260

RECORDS WRITTEN	403	ID. REGISTER	1	500
MULTIPLICATIONS	0	FUNCT. REG.	0	750

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```
BEGIN     413.36  SECONDS

          NAMES LAG
          COMMON V1,V2,V3,V4,V5,V6,V7,V8,V9,V10,V11,V12,V13,
                 V14,V15,V16,V17,V18,V19,V20,V21,V22,V23,V24,VERT4
          S Z,KK
          V Q1,Q2,Q3,Q4
          *FIX

SYMBOLS   I=I, Z, K, KK.

INDICES   MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
          L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
          AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
          A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS   Q1, Q2, Q3, Q4.

FUNCTIONS D, CPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UPG, PP=U, P9,
          DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.     =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
          V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
          V23, V24, VERT4.
```

```
BEGIN     413.47  SECONDS

                  M R
                  C WORKS OUT THE 4-GRAVITON VERTEX
                  Z LAG=LAG
          L 2     ID,K**(J+)=KK**(-J)
          L 3     ID,KK=0
                  NPRINT LAG
                  *NEXT

SYMBOLS       I=I, Z, K, KK.

INDICES       MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, MA=Z, L1=Z, L2=Z, L3=Z,
              L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
              AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
              A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS       Q1, Q2, Q3, Q4.

FUNCTIONS     D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
              DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.         =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
              V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
              V23, V24, VERT4.

RUNNING TIME (SEC)      29.97                          USED    MAXIMUM
TERMS IN OUTPUT          3675
GENERATED TERMS          3675      INPUT SPACE          258       2000
EQUAL TERMS                 0      OUTPUT SPACE        4737       4740
CANCELLATIONS               0      NR. OF EXPR.          26        260
RECORDS WRITTEN           632      ID. REGISTER           6        500
MULTIPLICATIONS         25600      FUNCT. REG.           18        750

RUNNING TIME (SEC)      48.22                          USED    MAXIMUM
TERMS IN OUTPUT          3675
GENERATED TERMS          3675      INPUT SPACE          258       2000
EQUAL TERMS                 0      OUTPUT SPACE        7121       7126
CANCELLATIONS               0      NR. OF EXPR.          26        260
RECORDS WRITTEN           679      ID. REGISTER           6        500
MULTIPLICATIONS         25600      FUNCT. REG.           18        750

RUNNING TIME (SEC)      50.94                          USED    MAXIMUM
TERMS IN OUTPUT          3675
GENERATED TERMS          3675      INPUT SPACE          258       2000
EQUAL TERMS                 0      OUTPUT SPACE        7121       7126
CANCELLATIONS               0      NR. OF EXPR.          26        260
RECORDS WRITTEN           719      ID. REGISTER           6        500
MULTIPLICATIONS         25600      FUNCT. REG.           18        750

RUNNING TIME (SEC)      68.67                          USED    MAXIMUM
TERMS IN OUTPUT          3675
GENERATED TERMS          3675      INPUT SPACE          258       2000
EQUAL TERMS                 0      OUTPUT SPACE        7121       7126
CANCELLATIONS               0      NR. OF EXPR.          26        260
RECORDS WRITTEN           746      ID. REGISTER           6        500
MULTIPLICATIONS         25600      FUNCT. REG.           18        750

RUNNING TIME (SEC)      72.27                          USED    MAXIMUM
```

TERMS IN OUTPUT	3675			
GENERATED TERMS	3675	INPUT SPACE	258	2000
EQUAL TERMS	0	OUTPUT SPACE	3305	7126
CANCELLATIONS	0	NR. OF EXPR.	26	260
RECORDS WRITTEN	768	ID. REGISTER	6	500
MULTIPLICATIONS	25600	FUNCT. REG.	18	750

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```
                N R
                Z V1=LAG
        L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+
                 D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*D(L5,A3)*D(L6,B3)*
                 D(L7,A4)*D(L8,B4)*Q4(L9)*Q4(L10)
        L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L9+)*P0(L9+,L10+
                 D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                 D(L7,A3)*D(L8,B3)*D(L9,A4)*D(L10,B4)
                NPRINT V1
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RU=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	101.62			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	22	260
RECORDS WRITTEN	798	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RU=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	103.93			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NR. OF EXPR.	22	260
RECORDS WRITTEN	809	ID. REGISTER	39	500

RECORDS WRITTEN	809	ID. REGISTER	39	500
MULTIPLICATIONS	10376	FUNCT. REG.	31	750

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```
                    N R
                    Z V2=LAG
          L 2       ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+
                     D(L1,A1)*D(L2,B1)*D(L3,A2)*D(L4,B2)*D(L5,A4)*D(L6,B4)*
                     D(L7,A3)*D(L8,B3)*Q3(L9)*Q3(L10)
          L 3       ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L1
                     D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                     D(L7,A4)*D(L8,B4)*D(L9,A3)*D(L10,B3)
                    NPRINT V2
                    *NEXT
```

```
SYMBOLS         I=I, Z, K, EK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RD=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UNG, DD=U, DP,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	132.09			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4749
CANCELLATIONS	320	NR. OF EXPR.	23	260
RECORDS WRITTEN	836	ID. REGISTER	39	500
MULTIPLICATIONS	10376	FUNCT. REG.	31	750

```
SYMBOLS         I=I, Z, K, EK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RD=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UNG, DD=U, DP,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	135.41			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	6696	7126
CANCELLATIONS	479	NR. OF EXPR.	23	260
RECORDS WRITTEN	847	ID. REGISTER	39	500
MULTIPLICATIONS	10376	FUNCT. REG.	31	750

```
                    N R
```

```
                Z V3=LAG
        L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A1)*D(L2,B1)*D(L3,A3)*D(L4,B3)*D(L5,A2)*D(L6,B2)*
                 D(L7,A4)*D(L8,B4)*Q4(L9)*Q4(L10)
        L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                 D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                 D(L7,A2)*D(L8,B2)*D(L9,A4)*D(L10,B4)
                UPRINT V3
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      164.49
TERMS IN OUTPUT           1696
GENERATED TERMS           3675
EQUAL TERMS               1559
CANCELLATIONS              220
RECORDS WRITTEN            874
MULTIPLICATIONS          18376

                                        USED    MAXIMUM
INPUT SPACE              333            2000
OUTPUT SPACE            4737            4740
NR. OF EXPR.              24             260
ID. REGISTER              39             500
FUNCT. REG.               31             750


SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      166.85
TERMS IN OUTPUT            840
GENERATED TERMS           3675
EQUAL TERMS               2356
CANCELLATIONS              479
RECORDS WRITTEN            865
MULTIPLICATIONS          18376

                                        USED    MAXIMUM
INPUT SPACE              333            2000
OUTPUT SPACE            4690            7126
NR. OF EXPR.              24             250
ID. REGISTER              39             500
FUNCT. REG.               31             750

                N R
                Z V4=LAG
        L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A1)*D(L2,B1)*D(L3,A4)*D(L4,B4)*D(L5,A2)*D(L6,B2)*
                 D(L7,A3)*D(L8,B3)*Q3(L9)*Q2(L10)
```

```
L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)
         D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A4)*D(L5,B4)*Q4(L6)*
         D(L7,A2)*D(L8,B2)*D(L9,A3)*D(L10,B3)
        HPRINT V4
        *NEXT
```

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```
SYMBOLS     I=I, Z, K, KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, R0=Z, S1=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, Q3, Q4.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
            V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
            V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	190.40			
TERMS IN OUTPUT	2896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	25	260
RECORDS WRITTEN	912	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS     I=I, Z, K, KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, R0=Z, S1=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, Q3, Q4.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
            V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
            V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	198.83			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NR. OF EXPR.	25	260
RECORDS WRITTEN	923	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
        N R
        Z V5=LAG
L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L1
         D(L1,A1)*D(L2,B1)*D(L3,A3)*D(L4,B3)*D(L5,A4)*D(L6,B4)*
         D(L7,A2)*D(L8,B2)*Q2(L9)*Q2(L10)
L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L1
         D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
         D(L7,A4)*D(L8,B4)*D(L9,A2)*D(L10,B2)
        HPRINT V5

        *NEXT
```

```
*NEXT

SYMBOLS      I=I, Z, K, KK.

INDICES      MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
             AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
             A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS      Q1, Q2, Q3, Q4.

FUNCTIONS    D, EPF=I, G=1, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
             DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.        =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
             V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
             V23, V24, VERT4.

RUNNING TIME (SEC)     228.40                          USED    MAXIMUM
TERMS IN OUTPUT           1890
GENERATED TERMS           3675      INPUT SPACE        333       2000
EQUAL TERMS               1559      OUTPUT SPACE      4737       4740
CANCELLATIONS              220      NR. OF EXPR.        26        260
RECORDS WRITTEN            950      ID. REGISTER        39        500
MULTIPLICATIONS          10376      FUNCT. REG.         31        750


SYMBOLS      I=I, Z, K, KK.

INDICES      MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
             AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
             A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS      Q1, Q2, Q3, Q4.

FUNCTIONS    D, EPF=I, G=1, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
             DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.        =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
             V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
             V23, V24, VERT4.

RUNNING TIME (SEC)     230.79                          USED    MAXIMUM
TERMS IN OUTPUT            840
GENERATED TERMS           3675      INPUT SPACE        333       2000
EQUAL TERMS               2356      OUTPUT SPACE      4690       7126
CANCELLATIONS              479      NR. OF EXPR.        26        260
RECORDS WRITTEN            961      ID. REGISTER        39        500
MULTIPLICATIONS          10376      FUNCT. REG.         31        750

             N R
             Z V6=LAG
        L 2  ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
              D(L1,A1)*D(L2,B1)*D(L3,A4)*D(L4,B4)*D(L5,A3)*D(L6,B3)*
              D(L7,A2)*D(L8,B2)*Q2(L9)*Q2(L10)
        L 3  ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
              D(L1,A1)*D(L2,B1)*Q1(L3)*D(L4,A4)*D(L5,B4)*Q4(L6)*
              D(L7,A3)*D(L8,B3)*D(L9,A2)*D(L10,B2)
             NPRINT V6
             *NEXT

SYMBOLS      I=I, Z, K, KK.
```

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```
INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, Q3, Q4.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
            V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
            V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	260.31			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	27	260
RECORDS WRITTEN	900	ID. REGISTER	30	500
MULTIPLICATIONS	10376	FUNCT. REG.	31	750

```
SYMBOLS     I=I, Z, K, KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, Q3, Q4.

FUNCTIONS   D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
            V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
            V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	262.69			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4590	7126
CANCELLATIONS	479	NR. OF EXPR.	27	260
RECORDS WRITTEN	999	ID. REGISTER	30	500
MULTIPLICATIONS	10376	FUNCT. REG.	31	750

```
            N R
            Z V7=LAG
      L 2   ID,ADISO,P0(L2+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
             D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*D(L5,A3)*D(L6,B3)*
             D(L7,A4)*D(L8,B4)*Q4(L9)*Q4(L10)
      L 3   ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
             D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
             D(L7,A3)*D(L8,B3)*D(L9,A4)*D(L10,B4)
            MPRINT V7
            *NEXT

SYMBOLS     I=I, Z, K, KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, Q3, Q4.
```

```
VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G1=I, G6=C, G7, UG=C, UBG, DD=U, D8,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

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			USED	MAXIMUM
RUNNING TIME (SEC)	291.75			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NP. OF EXPR.	28	260
RECORDS WRITTEN	1026	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS        I=I, Z, K, KK.

INDICES        PU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PO=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G1=I, G6=C, G7, UG=C, UBG, DD=U, D8,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	293.80			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NP. OF EXPR.	28	260
RECORDS WRITTEN	1037	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
               N R
               Z V8=LAG
        L 2    ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                D(L1,A2)*D(L2,B2)*D(L3,A1)*D(L4,B1)*D(L5,A4)*D(L6,B4)*
                D(L7,A3)*D(L8,B3)*Q3(L9)*Q3(L10)
        L 3    ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A1)*P(L5,B1)*Q1(L6)*
                D(L7,A4)*D(L8,B4)*D(L9,A3)*D(L10,B3)
               UPRINT V8
               *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PO=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G1=I, G6=C, G7, UG=C, UBG, DD=U, D8,

               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,
```

```
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      323.00                          USED    MAXIMUM
TERMS IN OUTPUT           3896
GENERATED TERMS           3675        INPUT SPACE        333       2000
EQUAL TERMS               2559        OUTPUT SPACE      4737       4740
CANCELLATIONS              220        NR. OF EXPR.        29        260
RECORDS WRITTEN           1064        ID. REGISTER        39        500
MULTIPLICATIONS          18376        FUNCT. REG.         31        750

SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, LR=Z, L9=Z, L10=Z, PU=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      325.19                          USED    MAXIMUM
TERMS IN OUTPUT            840
GENERATED TERMS           3675        INPUT SPACE        333       2000
EQUAL TERMS               2356        OUTPUT SPACE      4690       7125
CANCELLATIONS              479        NR. OF EXPR.        29        260
RECORDS WRITTEN           1075        ID. REGISTER        39        500
MULTIPLICATIONS          18376        FUNCT. REG.         31        750

                N R
                Z V9=LAG
        L 2     ID,ADISD,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A3)*D(L2,P3)*D(L3,A1)*D(L4,B1)*D(L5,A2)*D(L6,B2)*
                 D(L7,A4)*D(L8,B4)*Q4(L9)*Q4(L10)
        L 3     ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)*
                 D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                 D(L7,A2)*D(L8,B2)*D(L9,A4)*D(L10,B4)
                UPRINT V9
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, LR=Z, L9=Z, L10=Z, PU=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
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```
                V23, V24, VERT4.

RUNNING TIME (SEC)      354.47                              USED    MAXIMUM
TERMS IN OUTPUT           1896
GENERATED TERMS           3675          INPUT SPACE          333       2000
EQUAL TERMS               1559          OUTPUT SPACE        4737       4740
CANCELLATIONS              220          NR. OF EXPR.          30        260
RECORDS WRITTEN           1102          ID. REGISTER          39        500
MULTIPLICATIONS          10376          FUNCT. REG.           31        750


SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, GF=I, GG=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GU1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      356.47                              USED    MAXIMUM
TERMS IN OUTPUT           340
GENERATED TERMS           3675          INPUT SPACE          333       2000
EQUAL TERMS               2356          OUTPUT SPACE        4696       7126
CANCELLATIONS              479          NR. OF EXPR.          30        260
RECORDS WRITTEN           1113          ID. REGISTER          39        500
MULTIPLICATIONS          10376          FUNCT. REG.           31        750

                N R
                Z V10=LAG
          L 2   ID,ADISU,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A4)*D(L2,B4)*D(L3,A1)*D(L4,B1)*D(L5,A2)*D(L6,B2)*
                 D(L7,A3)*D(L8,B2)*Q3(L9)*Q3(L10)
          L 3   ID,ADISU,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                 D(L1,A4)*D(L2,B4)*Q4(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                 D(L7,A2)*D(L8,B2)*D(L9,A3)*D(L10,B3)
                HPRINT V10
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, GF=I, GG=C, G7, UG=C, UBG, DD=U, DR,
                DT, DS=U, DX, DK, DP, DF=U, GU1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      365.50                              USED    MAXIMUM
TERMS IN OUTPUT           1896
```

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GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	31	260
RECORDS WRITTEN	1140	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

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```
SYMBOLS        I=I, Z, K, KK.

INDICES        NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

RUNNING TIME (SEC)	387.56		USED	MAXIMUM
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2556	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NR. OF EXPR.	31	260
RECORDS WRITTEN	1151	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
               N R
               Z V12=LAG
        L 2    ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                D(L1,A3)*D(L2,B3)*D(L3,A1)*D(L4,B1)*D(L5,A4)*D(L6,B4)*
                D(L7,A2)*D(L8,B2)*Q2(L9)*Q2(L10)
        L 3    ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                D(L7,A4)*D(L8,B4)*D(L9,A2)*D(L10,B2)
               UPRINT V11
               *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

RUNNING TIME (SEC)	416.73		USED	MAXIMUM
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	32	260
RECORDS WRITTEN	1178	ID. REGISTER	39	500

```
RECORDS WRITTEN          1170        ID. REGISTER        30        500

MULTIPLICATIONS         10376        FUNCT. REG.         31        750

SYMBOLS        I=I, Z, K, KK.

INDICES        NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, R0=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPE=I, G=I, GI, GI=I, G6=C, G7, UG=C, UBG, DD=U, DP,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2,

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.

RUNNING TIME (SEC)      416.91                          USED    MAXIMUM
TERMS IN OUTPUT            840
GENERATED TERMS           2675        INPUT SPACE        333       2000
EQUAL TERMS               2356        OUTPUT SPACE      4690       7126
CANCELLATIONS              479        NR. OF EXPR.        32        260
RECORDS WRITTEN           1189        ID. REGISTER        30        500
MULTIPLICATIONS          10376        FUNCT. REG.         31        750

                  N R
                  Z V12=LAG
          L 2     ID,ADISU,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                   D(L1,A4)*D(L2,B4)*D(L3,A1)*D(L4,B1)*D(L5,A3)*D(L6,B3)*
                   D(L7,A2)*D(L8,B2)*Q2(L9)*Q2(L10)
          L 3      ID,ADISU,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                   D(L1,A4)*D(L2,B4)*Q4(L3)*D(L4,A1)*D(L5,B1)*Q1(L6)*
                   D(L7,A3)*D(L8,B3)*D(L9,A2)*D(L10,B2)
                  UPRINT V12
                  *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, R0=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPE=I, G=I, GI, GI=I, G6=C, G7, UG=C, UBG, DD=U, DP,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.

RUNNING TIME (SEC)      440.09                          USED    MAXIMUM
TERMS IN OUTPUT           1896
GENERATED TERMS           3675        INPUT SPACE        333       2000
EQUAL TERMS               1559        OUTPUT SPACE      4737       4740
CANCELLATIONS              220        NR. OF EXPR.        33        260
RECORDS WRITTEN           1216        ID. REGISTER        30        500
MULTIPLICATIONS          10376        FUNCT. REG.         31        750

SYMBOLS        I=I, Z, K, KK.
```

```
INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PU=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, GP=I, G6=C, G7, UG=C, UBG, DD=U, D2,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

				USED	MAXIMUM
RUNNING TIME (SEC)	459.27				
TERMS IN OUTPUT	840				
GENERATED TERMS	3675	INPUT SPACE		933	2000
EQUAL TERMS	2356	OUTPUT SPACE		4696	7126
CANCELLATIONS	479	NR. OF EXPR.		33	260
RECORDS WRITTEN	1227	ID. REGISTER		30	500
MULTIPLICATIONS	10376	FUNCT. REG.		31	750

```
               N R
               Z V13=LAG
          L 2  ID,ADISU,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                D(L1,A2)*D(L2,B2)*D(L3,A3)*D(L4,B3)*D(L5,A1)*D(L6,B1)*
                D(L7,A4)*D(L8,B4)*Q4(L9)*Q4(L10)
          L 3   ID,ADISU,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                D(L7,A1)*D(L8,B1)*D(L9,A4)*D(L10,B4)
               HPRINT V13
               *NEXT
```

```
SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PU=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, GP=I, G6=C, G7, UG=C, UBG, DD=U, D2,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

				USED	MAXIMUM
RUNNING TIME (SEC)	479.06				
TERMS IN OUTPUT	1896				
GENERATED TERMS	5675	INPUT SPACE		933	2000
EQUAL TERMS	1559	OUTPUT SPACE		4737	4746
CANCELLATIONS	220	NR. OF EXPR.		34	260
RECORDS WRITTEN	1254	ID. REGISTER		30	500
MULTIPLICATIONS	10376	FUNCT. REG.		31	750

```
SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PU=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
```

```
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, GS=I, GG=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM. GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      402.22                          USED    MAXIMUM
TERMS IN OUTPUT            840
GENERATED TERMS           3675        INPUT SPACE        333       2000
EQUAL TERMS               2356        OUTPUT SPACE      4690       7126
CANCELLATIONS              479        OP. OF EXPR.        34        260
RECORDS WRITTEN           1265        ID. REGISTER        30        500
MULTIPLICATIONS          10376        FUNCT. REG.         31        750

                H R
                Z V14=LAG
        L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A2)*D(L2,B2)*D(L3,A4)*D(L4,B4)*D(L5,A1)*D(L6,B1)*
                 D(L7,A3)*D(L8,B3)*Q3(L9)*Q3(L10)
        L 3     ID,ADISO,P2(L1+,L2+,L3+)*P2(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                 D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A4)*D(L5,B4)*Q4(L6)*
                 D(L7,A1)*D(L8,B1)*D(L9,A3)*D(L10,B3)
                UPRINT V14
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU1=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=1, G=I, GI, GS=I, GG=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM. GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      511.75                          USED    MAXIMUM
TERMS IN OUTPUT            1096
GENERATED TERMS           3675        INPUT SPACE        333       2000
EQUAL TERMS               1559        OUTPUT SPACE      4727       4749
CANCELLATIONS              320        OP. OF EXPR.        35        260
RECORDS WRITTEN           1292        ID. REGISTER        30        500
MULTIPLICATIONS          10376        FUNCT. REG.         31        750

SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU1=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.
```




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FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D3,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

308

			USED	MAXIMUM
RUNNING TIME (SEC)	514.20			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NR. OF EXPR.	35	260
RECORDS WRITTEN	1303	ID. REGISTER	30	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
                N R
                Z V15=LAG
        L 2     ID,ADISU,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A3)*D(L2,B3)*D(L3,A2)*D(L4,B2)*D(L5,A1)*D(L6,B1)*
                 D(L7,A4)*D(L8,B4)*Q4(L9)*Q4(L10)
        L 3     ID,ADISU,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                 D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                 D(L7,A1)*D(L8,B1)*D(L9,A4)*D(L10,B4)
                UPRINT V15
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PD=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D3,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	543.39			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	36	260
RECORDS WRITTEN	1330	ID. REGISTER	30	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PD=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D3,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
```

```
V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	545.71			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NR. OF EXPR.	36	260
RECORDS WRITTEN	1341	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
N R
Z V16=LAG
L 2     ID,A0IS0,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
         D(L1,A4)*D(L2,B4)*D(L3,A2)*D(L4,B2)*D(L5,A1)*D(L6,B1)*
         D(L7,A3)*D(L8,B3)*Q3(L9)*Q3(L10)
L 3     ID,A0IS0,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
         D(L1,A4)*D(L2,B4)*Q4(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
         D(L7,A1)*D(L8,B1)*D(L9,A3)*D(L10,B3)
HPRINT V16
*NEXT
```

```
SYMBOLS     I=I, Z, K, KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PO=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, Q3, Q4.

FUNCTIONS   D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
            V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
            V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	574.92			
TERMS IN OUTPUT	1096			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	37	260
RECORDS WRITTEN	1368	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS     I=I, Z, K, KK.

INDICES     MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
            L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PO=Z, SI=Z,
            AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
            A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS     Q1, Q2, Q3, Q4.

FUNCTIONS   D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
            DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.       =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
            V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
            V23, V24, VERT4.
```

RUNNING TIME (SEC)	577.25		USED	MAXIMUM

```
TERMS IN OUTPUT            840
GENERATED TERMS           3675          INPUT SPACE        333        2000
EQUAL TERMS               2356          OUTPUT SPACE      4690        7126
CANCELLATIONS              479          NR. OF EXPR.        37         260
RECORDS WRITTEN           1379          ID. REGISTER        30         500
MULTIPLICATIONS          18376          FUNCT. REG.         31         750
```

210

```
                  H R
                  Z V17=LAG
          L 2     ID,ADISD,PD(L1+,L2+)*PD(L3+,L4+)*PD(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                   D(L1,A2)*D(L2,B3)*D(L3,A4)*D(L4,B4)*D(L5,A1)*D(L6,B1)*
                   D(L7,A2)*D(L8,B2)*Q2(L9)*Q2(L10)
          L 3      ID,ADISD,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*PD(L7+,L8+)*PD(L9+,L10+)=
                   D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A4)*D(L5,B4)*Q4(L6)*
                   D(L7,A1)*D(L8,B1)*D(L9,A2)*D(L10,B2)
                  HPRINT V17
                  *NEXT
```

```
SYMBOLS        I=I, Z, K, LK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RU=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
               DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

```
RUNNING TIME (SEC)      606.80                          USED    MAXIMUM
TERMS IN OUTPUT            1896
GENERATED TERMS            3675          INPUT SPACE        333        2000
EQUAL TERMS                1559          OUTPUT SPACE      4737        4740
CANCELLATIONS               220          NR. OF EXPR.        37         260
RECORDS WRITTEN            1406          ID. REGISTER        30         500
MULTIPLICATIONS           18376          FUNCT. REG.         31         750
```

```
SYMBOLS        I=I, Z, K, LK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RU=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, D8,
               DT, DS=U, DX, DK, DP, DF=U, GN1, GN, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

```
RUNNING TIME (SEC)      609.27                          USED    MAXIMUM
TERMS IN OUTPUT            840
GENERATED TERMS           3675          INPUT SPACE        333        2000
EQUAL TERMS               2356          OUTPUT SPACE      4690        7126
CANCELLATIONS              479          NR. OF EXPR.        38         260
```

RECORDS WRITTEN	1417	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
                    U R
                    Z V18=LAG
          L 2       ID,ADISO,P0(L2+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)-
                     D(L1,A4)*D(L2,B4)*D(L3,A3)*D(L4,B3)*D(L5,A1)*D(L6,B1)*
                     D(L7,A2)*D(L8,B2)*Q2(L9)*Q2(L10)
          L 3       ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)-
                     D(L1,A4)*D(L2,B4)*Q4(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                     D(L7,A1)*D(L8,B1)*D(L9,A2)*D(L10,B2)
                    UPRINT V18
                    *NEXT
```

```
SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	638.52			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	39	260
RECORDS WRITTEN	1444	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	640.95			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NR. OF EXPR.	39	260
RECORDS WRITTEN	1455	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
                    U R
```




```
H R
Z V19=LAG
L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
         D(L1,A2)*D(L2,B2)*D(L3,A3)*D(L4,B3)*D(L5,A4)*D(L6,B4)*
         D(L7,A1)*D(L8,B1)*Q1(L9)*Q1(L10)
L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
         D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
         D(L7,A4)*D(L8,B4)*D(L9,A1)*D(L10,B1)
UPRINT V19
*NEXT

SYMBOLS      I=1, Z, K, KK.

INDICES      HU=Z, HU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PO=Z, SI=Z,
             AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
             A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS      Q1, Q2, Q3, Q4.

FUNCTIONS    D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
             DT, DS=U, DX, DK, DP, DF=U, GU1, GM, GU1, GU, P0, P1, P2.

EXPR.        =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11.
             V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
             V23, V24, VENT4.

RUNNING TIME (SEC)      669.99
TERMS IN OUTPUT           1896
GENERATED TERMS           3675          INPUT SPACE          333        2000
EQUAL TERMS               2559          OUTPUT SPACE        4737        4740
CANCELLATIONS              220          NR. OF EXPR.          40         260
RECORDS WRITTEN           1482          ID. REGISTER          39         500
MULTIPLICATIONS          18376          FUNCT. REG.           31         750

SYMBOLS      I=1, Z, K, KK.

INDICES      HU=Z, HU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, PO=Z, SI=Z,
             AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
             A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS      Q1, Q2, Q3, Q4.

FUNCTIONS    D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
             DT, DS=U, DX, DK, DP, DF=U, GU1, GM, GU1, GU, P0, P1, P2.

EXPR.        =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11.
             V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
             V23, V24, VENT4.

RUNNING TIME (SEC)      672.39
TERMS IN OUTPUT            840
GENERATED TERMS           3675          INPUT SPACE          333        2000
EQUAL TERMS               2356          OUTPUT SPACE        4690        7126
CANCELLATIONS              470          NR. OF EXPR.          40         260
RECORDS WRITTEN           1493          ID. REGISTER          39         500
MULTIPLICATIONS          18376          FUNCT. REG.           31         750

H R
Z V20=LAG
L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
         D(L1,A2)*D(L2,B2)*D(L3,A4)*D(L4,B4)*D(L5,A3)*D(L6,B3)*
         D(L7,A1)*D(L8,B1)*Q1(L9)*Q1(L10)
```

```
        L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                 D(L1,A2)*D(L2,B2)*Q2(L3)*D(L4,A4)*D(L5,B4)*Q4(L6)*
                 D(L7,A3)*D(L8,B3)*D(L9,A1)*D(L10,B1)
                HPRINT V20
                *NEXT
```

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```
SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=1, G6=C, G7, UG=C, UNG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GH1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	701.16			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NP. OF EXPR.	41	260
RECORDS WRITTEN	1520	ID. REGISTER	30	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=1, G6=C, G7, UG=C, UNG, DD=U, DB,
                DT, DS=U, DX, DK, DP, DF=U, GH1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	703.52			
TERMS IN OUTPUT	840			
GENERATED TERMS	3679	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NP. OF EXPR.	41	260
RECORDS WRITTEN	1531	ID. REGISTER	30	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
                N R
                Z V21=LAG
        L 2     ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A3)*D(L2,B3)*Q(L3,A2)*D(L4,B2)*D(L5,A4)*D(L6,B4)*
                 D(L7,A1)*D(L8,B1)*Q1(L9)*Q1(L10)
        L 3     ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                 D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                 D(L7,A4)*D(L8,B4)*D(L9,A1)*D(L10,B1)
                HPRINT V21

                *NEXT
```

```
                    *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=1, G=I, GI, G1=I, G6=C, G7, UG=C, UBG, DD=U, DP,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      732.54                          USED    MAXIMUM
TERMS IN OUTPUT           1896
GENERATED TERMS           3675        INPUT SPACE        333       2000
EQUAL TERMS               1559        OUTPUT SPACE      4737       4740
CANCELLATIONS              220        NR. OF EXPR.        42        260
RECORDS WRITTEN           1558        ID. REGISTER        39        500
MULTIPLICATIONS          18376        FUNCT. REG.         31        750


SYMBOLS         I=I, Z, K, KK.

INDICES         MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=1, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DP,
                DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      735.01                          USED    MAXIMUM
TERMS IN OUTPUT            840
GENERATED TERMS           3675        INPUT SPACE        333       2000
EQUAL TERMS               2356        OUTPUT SPACE      4690       7126
CANCELLATIONS              479        NR. OF EXPR.        42        260
RECORDS WRITTEN           1569        ID. REGISTER        39        500
MULTIPLICATIONS          18376        FUNCT. REG.         31        750

                U R
                Z V22=LAG
          L 2   ID,ADISU,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                 D(L1,A4)*D(L2,B4)*D(L3,A2)*D(L4,B2)*D(L5,A3)*D(L6,B3)*
                 D(L7,A1)*D(L8,B1)*Q1(L9)*Q1(L10)
          L 3   ID,ADISU,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                 D(L1,A4)*D(L2,B4)*Q4(L3)*D(L4,A2)*D(L5,B2)*Q2(L6)*
                 D(L7,A3)*D(L8,B3)*D(L9,A1)*D(L10,B1)
                UPRINT V22
                *NEXT

SYMBOLS         I=I, Z, K, KK.
```

```
INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, GF=I, G6=C, G7, UG=C, UBG, DD=U, DP,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.

RUNNING TIME (SEC)      764.04                          USED    MAXIMUM
TERMS IN OUTPUT           1896
GENERATED TERMS           3675      INPUT SPACE          333       2000
EQUAL TERMS               1559      OUTPUT SPACE        4737       4740
CANCELLATIONS              220      HR. OF EXPR.          43        260
RECORDS WRITTEN           1596      ID. REGISTER          39        500
MULTIPLICATIONS          10376      FUNCT. REG.           31        750


SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, GF=I, G6=C, G7, UG=C, UBG, DD=U, DP,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.

RUNNING TIME (SEC)      766.57                          USED    MAXIMUM
TERMS IN OUTPUT            840
GENERATED TERMS           3675      INPUT SPACE          333       2000
EQUAL TERMS               2356      OUTPUT SPACE        4699       7126
CANCELLATIONS              479      HR. OF EXPR.          43        260
RECORDS WRITTEN           1607      ID. REGISTER          39        500
MULTIPLICATIONS          10376      FUNCT. REG.           31        750

               H R
               Z V23=LAG
        L 2    ID,ADISO,P0(L2+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                D(L1,A3)*D(L2,B3)*D(L3,A4)*D(L4,B4)*D(L5,A2)*D(L6,B2)*
                D(L7,A1)*D(L8,B1)*Q1(L9)*Q1(L10)
        L 3    ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                D(L1,A3)*D(L2,B3)*Q3(L3)*D(L4,A4)*D(L5,B4)*Q4(L6)*
                D(L7,A2)*D(L8,B2)*D(L9,A1)*D(L10,B1)
               HPRINT V23
               *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.
```




```
VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

316

			USED	MAXIMUM
RUNNING TIME (SEC)	795.17			
TERMS IN OUTPUT	1896			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	1559	OUTPUT SPACE	4737	4740
CANCELLATIONS	220	NR. OF EXPR.	44	260
RECORDS WRITTEN	1634	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
               DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR.          =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
               V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
               V23, V24, VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	797.62			
TERMS IN OUTPUT	840			
GENERATED TERMS	3675	INPUT SPACE	333	2000
EQUAL TERMS	2356	OUTPUT SPACE	4690	7126
CANCELLATIONS	479	NR. OF EXPR.	44	260
RECORDS WRITTEN	1645	ID. REGISTER	39	500
MULTIPLICATIONS	18376	FUNCT. REG.	31	750

```
               N B
               Z V24=LAG
        L 2    ID,ADISO,P0(L1+,L2+)*P0(L3+,L4+)*P0(L5+,L6+)*P2(L7+,L8+,L9+,L10+)=
                D(L1,A4)*D(L2,B4)*D(L3,A3)*D(L4,B3)*D(L5,A2)*D(L6,B2)*
                D(L7,A1)*D(L8,B1)*Q1(L9)*Q1(L10)
        L 3    ID,ADISO,P1(L1+,L2+,L3+)*P1(L4+,L5+,L6+)*P0(L7+,L8+)*P0(L9+,L10+)=
                D(L1,A4)*D(L2,B4)*Q4(L3)*D(L4,A3)*D(L5,B3)*Q3(L6)*
                D(L7,A2)*D(L8,B2)*D(L9,A1)*D(L10,B1)
               NPRINT V24
               *NEXT

SYMBOLS        I=I, Z, K, KK.

INDICES        MU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
               L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z,
               AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
               A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS        Q1, Q2, Q3, Q4.

FUNCTIONS      D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB,
```

```
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      826.18                          USED    MAXIMUM
TERMS IN OUTPUT           1896
GENERATED TERMS           3675        INPUT SPACE        383       2000
EQUAL TERMS               1559        OUTPUT SPACE      4737       4740
CANCELLATIONS              220        NR. OF EXPR.        45        260
RECORDS WRITTEN           1672        ID. REGISTER        39        500
MULTIPLICATIONS          10376        FUNCT. REG.         31        750

SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z.
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UC=C, UBG, DD=U, D3.
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      828.79                          USED    MAXIMUM
TERMS IN OUTPUT           840
GENERATED TERMS           3675        INPUT SPACE        383       2000
EQUAL TERMS               2356        OUTPUT SPACE      4696       7126
CANCELLATIONS              479        NR. OF EXPR.        45        260
RECORDS WRITTEN           1683        ID. REGISTER        39        500
MULTIPLICATIONS          10376        FUNCT. REG.         31        750

                N R
                Z VERT4=V1+V2+V3+V4+V5+V6+V7+V8+V9+V10+V11+V12+V13+
                        V14+V15+V16+V17+V18+V19+V20+V21+V22+V23+V24
                NPRINT VERT4
                DELETE LAG,V1,V2,V3,V4,V5,V6,V7,V8,V9,V10,V11,V12,V13,V14,
                        V15,V16,V17,V18,V19,V20,V21,V22,V23,V24
                *NEXT

SYMBOLS         I=I, Z, K, KK.

INDICES         NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
                L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z.
                AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
                A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS         Q1, Q2, Q3, Q4.

FUNCTIONS       D, EPF=I, G=I, GI, G5=I, G6=C, G7, UC=C, UBG, DD=U, D3.
                DT, DS=U, DX, DK, DP, DF=U, GN1, GM, GU1, GU, P0, P1, P2.

EXPR.           =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11,
                V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22,
                V23, V24, VERT4.

RUNNING TIME (SEC)      869.56                          USED    MAXIMUM

TERMS IN OUTPUT          7292
```

317

RUNNING TIME (SEC)	869.56		USED	MAXIMUM
TERMS IN OUTPUT	7292			
GENERATED TERMS	8192	INPUT SPACE	295	2000
EQUAL TERMS	884	OUTPUT SPACE	4737	4740
CANCELLATIONS	16	NR. OF EXPR.	44	260
RECORDS WRITTEN	1785	ID. REGISTER	1	500
MULTIPLICATIONS	24586	FUNCT. REG.	20	750

318

RUNNING TIME (SEC)	910.29		USED	MAXIMUM
TERMS IN OUTPUT	15284			
GENERATED TERMS	16384	INPUT SPACE	295	2000
EQUAL TERMS	1084	OUTPUT SPACE	4737	4740
CANCELLATIONS	16	NR. OF EXPR.	44	260
RECORDS WRITTEN	1899	ID. REGISTER	1	500
MULTIPLICATIONS	40172	FUNCT. REG.	20	750

RUNNING TIME (SEC)	929.43		USED	MAXIMUM
TERMS IN OUTPUT	19060			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	1084	OUTPUT SPACE	4737	4740
CANCELLATIONS	16	NR. OF EXPR.	44	260
RECORDS WRITTEN	1954	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

SYMBOLS I=I, Z, K, KK.

INDICES NU=Z, NU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z, L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, RO=Z, SI=Z, AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z, A4=Z, B1=Z, B2=Z, B3=Z, B4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS Q1, Q2, Q3, Q4.

FUNCTIONS D, EPF=I, G=I, GI, G5=I, G6=C, G7, UG=C, UBG, DD=U, DB, DT, DS=U, DX, DK, DP, DF=U, GM1, GM, GU1, GU, P0, P1, P2.

EXPR. =0, =0, LAG, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22, V23, V24, VERT4.

RUNNING TIME (SEC)	1024.19		USED	MAXIMUM
TERMS IN OUTPUT	17391			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	2729	OUTPUT SPACE	7128	7126
CANCELLATIONS	40	NR. OF EXPR.	44	260
RECORDS WRITTEN	2194	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1095.31		USED	MAXIMUM
TERMS IN OUTPUT	15623			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	4457	OUTPUT SPACE	7126	7126
CANCELLATIONS	80	NR. OF EXPR.	44	260
RECORDS WRITTEN	2401	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1164.62		USED	MAXIMUM
TERMS IN OUTPUT	14101			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	5963	OUTPUT SPACE	7124	7126

CANCELLATIONS	96	NR. OF EXPR.	44	260
RECORDS WRITTEN	2572	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1210.97		USED	MAXIMUM
TERMS IN OUTPUT	13263			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	6801	OUTPUT SPACE	7121	7126
CANCELLATIONS	96	NR. OF EXPR.	44	260
RECORDS WRITTEN	2719	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1257.23		USED	MAXIMUM
TERMS IN OUTPUT	11698			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	8346	OUTPUT SPACE	7127	7126
CANCELLATIONS	116	NR. OF EXPR.	44	260
RECORDS WRITTEN	2831	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1288.91		USED	MAXIMUM
TERMS IN OUTPUT	10364			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	9668	OUTPUT SPACE	7127	7126
CANCELLATIONS	128	NR. OF EXPR.	44	260
RECORDS WRITTEN	2912	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1310.89		USED	MAXIMUM
TERMS IN OUTPUT	8902			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	11114	OUTPUT SPACE	7127	7126
CANCELLATIONS	144	NR. OF EXPR.	44	260
RECORDS WRITTEN	2959	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1321.13		USED	MAXIMUM
TERMS IN OUTPUT	7770			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	12246	OUTPUT SPACE	7123	7126
CANCELLATIONS	144	NR. OF EXPR.	44	260
RECORDS WRITTEN	2977	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

RUNNING TIME (SEC)	1323.44		USED	MAXIMUM
TERMS IN OUTPUT	7770			
GENERATED TERMS	20160	INPUT SPACE	295	2000
EQUAL TERMS	12246	OUTPUT SPACE	217	7126
CANCELLATIONS	144	NR. OF EXPR.	44	260
RECORDS WRITTEN	2995	ID. REGISTER	1	500
MULTIPLICATIONS	60504	FUNCT. REG.	20	750

```
N R
Z VERT4=VERT4
L 2     ID Q1(MU+)=-Q2(MU)-Q3(MU)-Q4(MU)
L 3     ID,2,OUTPR,Q1(MU+)=-Q2(MU)-Q3(MU)-Q4(MU)
        DELETE VERT4
        UPRINT VERT4
```

*BEGIN



BEGIN 2017.71 SECONDS

320

```
WRITE COMMON
*END

SYMBOLS      I=I, Z, K, KK.

INDICES      NU=Z, MU=Z, A=Z, B=Z, C=Z, L=Z, KA=Z, L1=Z, L2=Z, L3=Z,
             L4=Z, L5=Z, L6=Z, L7=Z, L8=Z, L9=Z, L10=Z, P0=Z, SI=Z,
             AA=Z, BB=Z, CC=Z, AA1=Z, AA2=Z, AA3=Z, A1=Z, A2=Z, A3=Z,
             A4=Z, B1=Z, B2=Z, B3=Z, P4=Z, J, BB1=Z, BB2=Z, BB3=Z.

VECTORS      Q1, Q2, Q3, Q4.

FUNCTIONS    D, EPF=I, G=I, G1, G5=I, G6=C, G7, UG=C, UBG, DD=U, DR,
             DT, DS=U, DX, DK, DP, DF=U, GH1, GH, GU1, GU, P0, P1, P2.

EXPR.        =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0,
             =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0, =0,
             VERT4.
```

			USED	MAXIMUM
RUNNING TIME (SEC)	.64			
TERMS IN OUTPUT	0			
GENERATED TERMS	0	INPUT SPACE	182	2000
EQUAL TERMS	0	OUTPUT SPACE	0	4740
CANCELLATIONS	0	NR. OF EXPR.	17	260
RECORDS WRITTEN	3731	ID. REGISTER	1	500
MULTIPLICATIONS	0	FUNCT. REG.	0	750

END OF RUN. TIME 2018.36 SECONDS

APPENDIX VII.C

PUBLISHED WORK

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Transverse Green's function in quantum gravity

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The study of the gravitational Slavnov-Ward identities shows that the total graviton propagator is transverse in the Landau gauge ($\alpha=0$). An off-shell, explicit computation of the one-loop graviton contribution to the graviton self-energy confirms this result for order κ^2.

In the last ten years the covariant approach to quantum gravity, flat-spacetime expansion, has been applied several times in an attempt to understand the structure of the counterterms required for the graviton loops.[1–5] Essentially, these calculations demonstrate the possibilities for *regularizing* the lowest-order contributions for the two-point graviton Green's function—a single graviton and fictitious loops—by employing the method of dimensional regularization. But also a conclusion was forwarded according to which the counterterms required to cancel the one-loop infinities in pure gravity cannot be made from the generally covariant objects $\sqrt{-g}R^2$, $\sqrt{-g}\ R_{\mu\nu}R^{\mu\nu}$, and $\sqrt{-g}R_{\alpha\mu\beta\nu}R^{\alpha\mu\beta\nu}$ working with the flat-spacetime expansion method, in the presence of Lorentz-covariant gauge-breaking expressions, where general covariance is the gravitational analog of gauge invariance.[1–5,8] The reason for these results is the dependence of the one-loop radiative corrections to the graviton Green's function on the gauge parameter α, and the impossibility of choosing α such that a transverse Green's function occurs.

Unfortunately the conclusion quoted above relies on a misunderstanding of the Slavnov-Ward identities and is in striking contradiction with the results obtained for pure gravity in the background-field formalism[16,17] in which case gauge-invariant counterterms can be realized.

In the absence of a convincing physical argument to explain such disagreement it is worth investigating the subject further. In principle, the general covariance of the Einstein gravitational Lagrangian suggests gauge-invariant counterterms. It is shown below that a consistent treatment of the problem confirms this expectation.

The starting point of this article is a general description of an off-shell calculation of the divergent one-loop graviton contribution to the graviton self-energy, in the context of the covariant quantization method, by using Lorentz-covariant gauge-breaking terms, and working with two distinct parametrizations for the graviton field, referred to as {1} and {2}. These results will serve to check the conclusion extracted from the gravitational Slavnov-Ward identities. A brief explanation of the notation used follows:

$$\{1\}\quad \mathcal{L}=\frac{1}{2\kappa^2}\left[\bar{g}^{\rho\sigma}\bar{g}_{\lambda\mu}\bar{g}_{\kappa\nu}-\frac{1}{n-2}\bar{g}^{\rho\sigma}\bar{g}_{\mu\kappa}\bar{g}_{\lambda\nu}-2\delta^{\sigma}_{\kappa}\delta^{\rho}_{\lambda}\bar{g}_{\mu\nu}\right]\bar{g}^{\mu\kappa}{}_{,\rho}\bar{g}^{\lambda\nu}{}_{,\sigma} \tag{1}$$

is Goldberg's version of the Einstein Lagrangian extended to n dimensions,[1,10] where $\bar{g}^{\mu\nu}$ and $\bar{g}_{\mu\nu}$ are defined by $\bar{g}^{\mu\nu}=(-g)^{1/2}g^{\mu\nu}$, $\bar{g}_{\mu\nu}=(-g)^{-1/2}g_{\mu\nu}$. Here, $g_{\mu\nu}$ is the metric tensor, $g=\det g_{\mu\nu}$, and $g^{\mu\nu}g_{\nu\lambda}=\delta^{\mu}_{\lambda}$. In the system of units $\hbar=c=1$, the relation between the gravitational coupling constant κ and the Newton constant G is $\kappa^2=16\pi G$. The graviton field, here called $\phi_{\mu\nu}$, is defined by

$$\{1\}\quad \bar{g}^{\mu\nu}=\delta^{\mu\nu}+\kappa\phi^{\mu\nu} \tag{2}$$

and

$$\{1\}\quad \mathcal{L}_B=-\frac{1}{2\alpha}(\partial_\mu\phi_{\mu\nu})^2 \tag{3}$$

is the gauge-breaking term.

Alternatively, it is possible in a different parametrization to set

$$\{2\}\quad \mathcal{L}=\frac{2}{\kappa^2}\sqrt{-g}R \tag{4}$$

to define the graviton field $h_{\mu\nu}$ by

$$\{2\}\quad g_{\mu\nu}=\delta_{\mu\nu}+\kappa h_{\mu\nu}\ , \tag{5}$$

and to choose a deDonder-type gauge-breaking term, i.e.,

$$\{2\}\quad \mathcal{L}_B=-\frac{1}{2\alpha}(\partial_\mu h_{\mu\nu}-\tfrac{1}{2}\partial_\nu h_{\mu\mu})^2\ . \tag{6}$$

The classical gravitational Lagrangian written as in Eq. (1) differs from the more familiar Einstein-Hilbert form, Eq. (4), by a surface term, and the only purpose of computing the graviton contribution to the graviton self-energy using both expressions is to control the accuracy of the results.

The determination of the graviton propagator $\Delta_{\lambda\beta,\lambda'\beta'}(p)$ in a momentum space of n dimensions, $n=2\omega$,

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is considerably simplified by use of the relation[17]

$$\Delta_{\lambda\beta,\lambda'\beta'}(p)\Delta^{-1}{}_{\lambda'\beta',\rho\sigma}(p)=-1_{\lambda\beta,\rho\sigma}\,. \tag{7}$$

The unit matrix is given by

$$1_{\lambda\beta,\rho\sigma}=\tfrac{1}{2}(\delta_{\lambda\rho}\delta_{\beta\sigma}+\delta_{\lambda\sigma}\delta_{\beta\rho})\,. \tag{8}$$

The factor $\Delta^{-1}{}_{\lambda'\beta',\rho\sigma}(p)$, in Eq. (7), represents the part of Einstein's Lagrangian quadratic in the graviton field, plus a gauge-breaking term, $\mathscr{L}_B$, after appropriate symmetrization of indices. Following this procedure the bare graviton propagators are obtained in both cases; for general α,

$$\{1\}\ \Delta_{\lambda\beta,\lambda'\beta'}(p)=\frac{1}{2p^2}[\delta_{\lambda\lambda'}\delta_{\beta\beta'}+\delta_{\lambda\beta'}\delta_{\lambda'\beta}-2(1+\alpha)\delta_{\lambda\beta}\delta_{\lambda'\beta'}]+\frac{(1+2\alpha)}{(p^2)^2}(\delta_{\lambda\beta}p_{\lambda'}p_{\beta'}+\delta_{\lambda'\beta'}p_{\lambda}p_{\beta})$$
$$-\frac{(1+2\alpha)}{2(p^2)^2}(\delta_{\lambda\lambda'}p_{\beta}p_{\beta'}+\delta_{\beta\beta'}p_{\lambda}p_{\lambda'}+\delta_{\lambda\beta'}p_{\lambda'}p_{\beta}+\delta_{\lambda'\beta}p_{\lambda}p_{\beta'})\,, \tag{9}$$

$$\{2\}\ \Delta_{\lambda\beta,\lambda'\beta'}(p)=\frac{1}{2p^2}\left[\delta_{\lambda\lambda'}\delta_{\beta\beta'}+\delta_{\lambda\beta'}\delta_{\lambda'\beta}-\frac{1}{\omega-1}\delta_{\lambda\beta}\delta_{\lambda'\beta'}\right]-\frac{(1+2\alpha)}{2(p^2)^2}(\delta_{\lambda\lambda'}p_{\beta}p_{\beta'}+\delta_{\beta\beta'}p_{\lambda}p_{\lambda'}+\delta_{\lambda\beta'}p_{\lambda'}p_{\beta}+\delta_{\lambda'\beta}p_{\lambda}p_{\beta'})\,; \tag{10}$$

factors of i and 2π are neglected in this work.

For $\alpha=-\frac{1}{2}$ the simplest form of the bare graviton propagator is recovered:

$$\{1\}\ \Delta_{\lambda\beta,\lambda'\beta'}(p)=\frac{1}{2p^2}(\delta_{\lambda\lambda'}\delta_{\beta\beta'}+\delta_{\lambda\beta'}\delta_{\lambda'\beta}-\delta_{\lambda\beta}\delta_{\lambda'\beta'})\,, \tag{11}$$

$$\{2\}\ \Delta_{\lambda\beta,\lambda'\beta'}(p)=\frac{1}{2p^2}\left[\delta_{\lambda\lambda'}\delta_{\beta\beta'}+\delta_{\lambda\beta'}\delta_{\lambda'\beta}-\frac{1}{\omega-1}\delta_{\lambda\beta}\delta_{\lambda'\beta'}\right]. \tag{12}$$

A simple pole $1/(n-2)$ is always present in the Feynman rules for the gravitational field, indicating that the Einstein-Hilbert Lagrangian is meaningless in two dimensions, $\omega=1$, reducing to a total divergence.[1,17] The appearance of the pole in the free graviton propagator or in the graviton vertices depends on the choice of $g_{\mu\nu}$ or $\bar{g}^{\mu\nu}$, respectively, for the graviton field definition.

The derivation of the three-graviton vertex function and the Feynman rules for the fictitious particles follows immediately. Then one is faced with the task of multiplying appropriately propagators and vertices, with subsequent evaluation of the corresponding integrals in order to obtain the divergent one-loop graviton contribution to the graviton self-energy.

Once the one-particle-irreducible amputated Green's function is obtained, referred to as $\Pi_{\lambda\beta,\lambda'\beta'}(p)$, the connected one can be built:

$$\Pi^{c}_{\mu\nu,\rho\sigma}(p)=\Delta_{\mu\nu,\lambda\beta}(p)\Pi_{\lambda\beta,\lambda'\beta'}(p)\Delta_{\lambda'\beta',\rho\sigma}(p)\,, \tag{13}$$

where superscript c stands for connected.

Proceeding further, the generalized Slavnov-Ward identities are investigated for the quantized gravitational field by using functional techniques. From 't Hooft's technique[1,2,11] the results are

$$\{1\}\ \frac{1}{\alpha}\langle 0\,|\,T(\partial_\mu\phi_{\mu\nu}(x)\partial_\rho\phi_{\rho\sigma}(y))\,|\,0\rangle=-\delta_{\nu\sigma}\delta(x-y)\,,\qquad \alpha\neq 0\,, \tag{14}$$

$$\{2\}\ \frac{1}{\alpha}[\langle 0\,|\,T(\partial_\mu h_{\mu\nu}(x)\partial_\rho h_{\rho\sigma}(y))\,|\,0\rangle - \langle 0\,|\,T(\partial_\nu h_{\mu\mu}(x)\partial_\rho h_{\rho\sigma}(y))\,|\,0\rangle + \tfrac{1}{4}\langle 0\,|\,T(\partial_\nu h_{\mu\mu}(x)\partial_\sigma h_{\rho\rho}(y))\,|\,0\rangle]$$
$$=-\delta_{\nu\sigma}\delta(x-y),\quad \alpha\neq 0\,. \tag{15}$$

In momentum space, to order κ^2, these relations read

$$\{1\}\ p_\mu p_\rho\Pi^{c}_{\mu\nu,\rho\sigma}(p)=0\,, \tag{16}$$

$$\{2\}\ p_\mu p_\rho\Pi^{c}_{\mu\nu,\rho\sigma}(p)-p_\nu p_\rho\Pi^{c}_{\mu\mu,\rho\sigma}(p)+\tfrac{1}{4}p_\nu p_\sigma\Pi^{c}_{\mu\mu,\rho\rho}(p)=0\,. \tag{17}$$

These identities are independent of the way in which the Lorentz-covariant gauge-breaking terms are chosen. For example, if Eq. (3) were replaced by an expression like

$$-\frac{1}{2\alpha}(\partial_\mu\phi_{\mu\nu}-J_\nu)^2\,,$$

for an arbitrary J_ν, Eqs. (14) and (16) would still hold. This arbitrariness, in some sense, obscures the behavior of the purely longitudinal part of the graviton propagator. However, if someone is particularly interested in understanding the problem of transversality in quantum gravity by following the analogy with the QED theory, in which case the longitudinal part of the photon propagator does not suffer radiative corrections, instead of the method suggested by 't Hooft, it is advisable to use the prescription outlined by Slavnov to derive Ward identities for the gauge theories.[12,13] Doing so, one has

$$\{1\}\ \frac{1}{\alpha}\langle 0\,|\,T(\phi_{\rho\sigma}(x)\partial_\mu\phi_{\mu\lambda}(y))\,|\,0\rangle=\langle 0\,|\,T(A_{\rho\sigma\lambda}(x,y))\,|\,0\rangle,\quad \alpha\neq 0\,, \tag{18}$$

$$\{2\}\ \frac{1}{\alpha}[\langle 0\,|\,T(h_{\rho\sigma}(x)\partial_\mu h_{\mu\lambda}(y))\,|\,0\rangle - \tfrac{1}{2}\langle 0\,|\,T(h_{\rho\sigma}(x)\partial_\lambda h_{\mu\mu}(y))\,|\,0\rangle]=\langle 0\,|\,T(B_{\rho\sigma\lambda}(x,y))\,|\,0\rangle,\quad \alpha=0\,. \tag{19}$$

It is clear looking at the right-hand side of Eqs. (18) and (19) that the longitudinal and transverse parts of the graviton propagator are equally interacting and suffer radiative corrections. Exploiting the freedom of the gauge independence of the S matrix it is possible to fix the gauge parameter α in such a way that the longitudinal contribution in the loop will vanish. So, multiplying the above expressions, on both sides, by α and taking the limit as $\alpha \to 0$, one obtains

$$\{1\}\ \langle 0 | T(\phi_{\rho\sigma}(x)\partial_\mu \phi_{\mu\lambda}(y)) | 0\rangle = 0\,, \tag{20}$$

$$\{2\}\ \langle 0 | T(h_{\rho\sigma}(x)\partial_\mu h_{\mu\lambda}(y)) | 0\rangle - \tfrac{1}{2}\langle 0 | T(h_{\rho\sigma}(x)\partial_\lambda h_{\mu\mu}(y)) | 0\rangle = 0\,, \tag{21}$$

which in momentum space takes the form

$$\{1\}\ p_\mu \Pi^c_{\mu\lambda,\rho\sigma}(p) = 0\,, \tag{22}$$

$$\{2\}\ p_\mu \Pi^c_{\mu\lambda,\rho\sigma}(p) - \tfrac{1}{2} p_\lambda \Pi^c_{\mu\mu,\rho\sigma}(p) = 0\,. \tag{23}$$

The Slavnov-Ward identities, presented in this way, for both parametrizations, establish that the *total graviton propagator is transverse and the Landau gauge is essential*[14] in order to eliminate the undesirable longitudinal contribution to the graviton self-energy.

All the above relations were first derived analytically and later verified up to second order in the coupling constant by employing SCHOONSCHIP.[15] In fact, extensive use of this computer program for symbolic evaluation of algebraic expressions was required at each step of the calculation, from the derivation of the graviton Feynman rules until the explicit confirmation of the gauge invariance through the Slavnov-Ward identities.

In view of the complexity of the computations in quantum gravity the determination of the structure of the counterterms, even in pure gravity, is still an object that deserves intensive studies[16–19] and certainly will occupy physicists for many years to come.

The purpose of this paper was to show that consistent with the Slavnov-Ward identities the total graviton propagator is transverse in the Landau gauge, and, undoubtedly, it is possible to define the counterterms for pure gravity by using generally covariant objects which are essentially built up from the products of the Riemann tensors. In the case of the one-loop these objects are $\sqrt{-g}R^2$, $\sqrt{-g}R_{\mu\nu}R^{\mu\nu}$, and $\sqrt{-g}R_{\alpha\mu\beta\nu}R^{\alpha\mu\beta\nu}$.[16,17] In this regard, it could be interesting to observe that there is no disagreement between the conclusions derived from the flat-spacetime expansion and the background-field approaches.

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