Divergent Triangle Integral 4: $I_3^{4-2\epsilon}(0,p_2^2,m^2;0,0,m^2)$

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Expression valid in the region $p_2^2<0, m^2>0$. Analytic continuation specified by $p_2^2 \to p_2^2+i\varepsilon$

$$I_3^{\{D=4-2\epsilon\}}(0,m^2,p_2^2;0,0,m^2) = \Big(\frac{\mu^2}{m^2}\Big)^\epsilon \frac{1}{p_2^2-m^2}$$
$$\times \left[\frac{1}{2\epsilon^2}+\frac{1}{\epsilon}\ln\Big(\frac{m^2}{m^2-p_2^2}\Big)+\frac{\pi^2}{12}+\frac{1}{2}\ln^2\Big(\frac{m^2}{m^2-p_2^2}\Big)-\mathrm{Li}_2\Big(\frac{-p_2^2}{m^2-p_2^2}\Big)\right]+\mathcal{O}(\epsilon) \quad (1)$$

For $\epsilon, \varepsilon, \ln, \mathrm{Li}_2$ etc, see the file on notation. This result can be derived from the second equation of Eq.(A2) of ref. [2].

We also present this function with the singularities regulated with a small mass λ, (from ref. [2],Eq.(A.3))

$$I_3^{\{D=4\}}(0,m^2,p_2^2;\lambda^2,\lambda^2,m^2) = \frac{1}{p_2^2-m^2}\left[\ln^2\left(\frac{m^2-p_2^2}{\lambda m}\right)+\mathrm{Li}_2\left(\frac{p_2^2}{m^2}\right)+\frac{\pi^2}{12}\right]+\mathcal{O}(\lambda^2). \quad (2)$$

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References

[1] S. Dawson, R. K. Ellis and P. Nason (unpublished)

[2] W. Beenakker, S. Dittmaier, M. Kramer, B. Plumper, M. Spira and P. M. Zerwas, Nucl. Phys. B **653**, 151 (2003) [arXiv:hep-ph/0211352]