

$$I_3^{\{D=4-2\epsilon\}}(m^2, s, m^2; 0, m^2, m^2)$$

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Expression valid in the region $s < 0, m^2 > 0, \beta > 1,$

$$\beta^2 = 1 - \frac{4m^2}{s}, \quad x = \frac{\beta - 1}{\beta + 1}$$

$$\begin{aligned} I_3^{\{D=4-2\epsilon\}}(m^2, s, m^2; 0, m^2, m^2) &= \left(\frac{\mu^2}{m^2}\right)^\epsilon \frac{1}{s\beta} \left(\frac{1}{\epsilon} \ln(x) - 2 \operatorname{Li}_2(-x) - 2 \ln(x) \ln(1+x) + \frac{1}{2} \ln^2(x) - \frac{\pi^2}{6} \right) + \mathcal{O}(\epsilon) \\ &\equiv \left(\frac{\mu^2}{m^2}\right)^\epsilon \frac{1}{s\beta} \left(\frac{1}{\epsilon} \ln(x) + 2 \operatorname{Li}_2\left(\frac{\beta-1}{2\beta}\right) + \ln^2\left(\frac{\beta-1}{2\beta}\right) - \frac{1}{2} \ln^2(x) - \frac{\pi^2}{6} \right) + \mathcal{O}(\epsilon) \end{aligned}$$

See the file on **notation**. This result on the first line can be derived from the fourth equation of Eq.(A2) of ref. [1]. The equivalent second form is taken from ref.[2].

We also present this function with the singularities regulated with a small mass λ , (from ref. [1],Eq.(A.3))

$$I_3^{\{D=4\}}(m^2, m^2, s, \lambda, m, m) = \frac{1}{s\beta} \left[\ln\left(\frac{\lambda^2}{m^2}\right) \ln(x) - 2\operatorname{Li}_2(-x) - 2 \ln(x) \ln(1+x) + \frac{1}{2} \ln^2(x) - \frac{\pi^2}{6} \right] + \mathcal{O}(\lambda).$$

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References

- [1] W. Beenakker, S. Dittmaier, M. Kramer, B. Plumper, M. Spira and P. M. Zerwas, Nucl. Phys. B **653**, 151 (2003) [arXiv:hep-ph/0211352]. [\[arXiv:hep-ph/0211352\]](#)
- [2] S. Dawson, R. K. Ellis and P. Nason (unpublished)