

Inequalities for the logarithm of the gamma function related to asymptotic expansions

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Many inequalities for the gamma function can be deduced from the convexity properties of some functions related to the logarithm of the gamma function. These inequalities involve finite sums of terms of pertinent asymptotic expansions. Considering a particular case of a generalization of the asymptotic expansion of $\ln \Gamma(x)$, we give inequalities which overvalue $\ln \Gamma(x)$, whereas Stirling's formula undervalue or viceversa. Moreover we obtain inequalities of the same kind for the polygamma function.