

## Note on the paper "An improvement of Batir's asymptotic formula and some estimates related to the gamma function"

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**ABSTRACT.** The aim of this note is to correct a result given in [Cristea, V. C. and Dumitrescu, S., *An improvement of Batir's asymptotic formula and some estimates related to the gamma function*, *Creat. Math. Inform.*, **25** (2016), No. 2 165–173]

One of the purposes announced in [2] is to improve Batir's approximation formula [1]:

$$\Gamma(n+1) \sim \sqrt{2\pi n} \left(\frac{n}{e}\right)^n \left(1 + \frac{1}{3n} + \frac{1}{18n^2} - \frac{2}{405n^3} - \frac{31}{9720n^4}\right)^{\frac{1}{4}}, \text{ as } n \rightarrow \infty. \quad (1)$$

The authors use in [2] a method to add new terms in (1), in order to obtain better results.

Unfortunately, an inattention has appeared just in the beginning of the paper, as the authors of [2] incorrectly considered the term  $-\frac{2}{425n^3}$  instead of  $-\frac{2}{405n^3}$ .

As a result, Theorem 2.1-2.2, Proposition 3.1 in [2] should not be considered, being not extensions of (1).

However, by using the method presented in [2], the following correct results can be stated:

$$\sqrt{2\pi n} \left(\frac{n}{e}\right)^n \left(1 + \frac{1}{3n} + \frac{1}{18n^2} - \frac{2}{405n^3} - \frac{31}{9720n^4}\right)^{\frac{1}{4} + \frac{529}{272160n^4}} < \Gamma(n+1),$$

for every integer  $n \geq 19$  and

$$\Gamma(n+1) < \sqrt{2\pi n} \left(\frac{n}{e}\right)^n \left(1 + \frac{1}{3n} + \frac{1}{18n^2} - \frac{2}{405n^3} - \frac{31}{9720n^4}\right)^{\frac{1}{4} + \frac{529}{272160n^4} + \frac{497}{3499200n^5}},$$

for every integer  $n \geq 1$ .

### REFERENCES

- [1] Batir, N., *Very accurate approximations for the factorial function*, *J. Math. Inequal.*, **4** (2010), No. 3, 335–344
- [2] Cristea, V. C. and Dumitrescu, S., *An improvement of Batir's asymptotic formula and some estimates related to the gamma function*, *Creat. Math. Inform.*, **25** (2016), No. 2, 165–173

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