Mathematical coincidences concerning $\pi$ and $\sqrt{2}$

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Abstract

In this note I present mathematical coincidences concerning the mathematical constant Pi ($\pi$) and Archimedes’ constant ($\sqrt{2}$), containing other mathematical constants i.e. The Golden Ratio ($\varphi$), the Silver Ratio ($\delta_s$) and the Euler’s number (e).

$$\pi \approx \sqrt{\left[\left\{\sum_{i=0}^{10} \left(\ln\left(\frac{\varphi^i}{2i}\right)\right)\right\} - \ln^2(\varphi) - \left\{\sum_{j=0}^{\infty} \left(\frac{1}{10^j+1}\right)\right\}\right]} \approx 3.141522 \ldots$$

Being about 0.0022% accurate and correct up to 4 decimal places.

$$\pi \approx \sqrt{\left(\sqrt{(\delta_s)^2 + (\varphi)^2}\right)} + 1.998888 \ldots \approx 3.141549 \ldots$$

Being about 0.0014% accurate and correct up to 4 decimal places.

$$\pi \approx 2\delta_s\sqrt{\varphi} - 3 \approx 3.141854 \ldots$$

Being about 0.008% accurate and correct up to 3 decimal places.

$$\sqrt{2} \approx \left\{\sum_{k=0}^{3} \left(\sqrt{(\delta_s)^2 + (\varphi)^2 + (\pi)^2 + (e)^2}\right) - \sum_{k=0}^{\infty} \left(\frac{2}{10^{2k}}\right)\right\} \approx 1.414193 \ldots$$

Being about 0.0014% accurate and correct up to 3 decimal places.