Proof of $\left(\frac{1}{2}\right)! = \frac{\sqrt{\pi}}{2}$

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Abstract: In our study, we prove that the value of $\left(\frac{1}{2}\right)!$ is $\frac{\sqrt{\pi}}{2}$.

Preparations: We know that

(1) $x! = \Gamma(1+x)$ for $x \in \mathbb{R}^+$

(2) $\Gamma(1+x) = x.\Gamma(x)$ for $x \in \mathbb{R}^+$

(3) $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

Proof:

From **(1)**

$$\left(\frac{1}{2}\right)! = \Gamma\left(1+\frac{1}{2}\right)$$

from **(2)**

$$\left(\frac{1}{2}\right)! = \frac{1}{2}\Gamma\left(\frac{1}{2}\right)$$

from **(3)**

$$\left(\frac{1}{2}\right)! = \frac{1}{2}\sqrt{\pi}\,.$$