Stirling's Formula

Stirling's formula is an approximation to the factorial *n!*, which is difficult to evaluate exactly for very large integers *n*. Neglecting higher-order terms, this formula predicts

$$\ln n! \approx \frac{1}{2}\cdot\ln(2\pi)+(n+\frac{1}{2})\cdot\ln n-n \qquad (1)$$

This is not the only formula used to approximate f(n):=*n!*. The one in Eq. 2 stitches the exact formula at *n=22* to an approximate expression employing the Heaviside function Φ

$$f(n) := \Phi(22-n)\cdot n! + \Phi(n-22)\cdot\left[\left(\frac{n}{2.71828}\right)^{n}\cdot\sqrt{2\cdot\pi\cdot n}\cdot\left(1+\frac{1}{12\cdot n}+\frac{1}{288\cdot n\cdot n}\right)\right] \qquad (2)$$

The graph compares the exact factorial (solid line) to Eq.1 (circles) and Eq.2 (x) on a semi-Log_{10} scale. Obviously, Eq. 1 suffices in many cases.