Sunday, April 27, 2025 8:13 PM

$$I = \int_{-\infty}^{\infty} e^{-x^2}\,dx$$

$$I^2 = \int_{-\infty}^{\infty} e^{-x^2}\,dx \cdot \int_{-\infty}^{\infty} e^{-y^2}\,dy$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-x^2} \cdot e^{-y^2}\,dx\,dy$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(x^2+y^2)}\,dx\,dy$$

** Add Derivation for Jacobian

$$= \int_{0}^{2\pi}\int_{0}^{\infty} e^{-r^2}\,r\,dr\,d\theta$$

$$I^2 = 2\pi \left(-\frac{1}{2} e^{-r^2}\right)_0^{\infty}$$

$$I^2 = \pi$$

$$I = \sqrt{\pi}$$