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In[45]:= `$Assumptions = {x, t, m, ω, ℏ, p} ∈ Reals`

Out[45]= $(x \mid t \mid m \mid \omega \mid \hbar \mid p) \in \text{Reals}$

$$\alpha := \left(\frac{m*\omega}{\pi*\hbar}\right)^{\frac{1}{4}}$$

$$\eta := \left(\frac{m*\omega}{2*\hbar}\right)$$

(* In Mathematica Log[z] returns the natural log i.e. to base e. Log[b,z] gives the logarithm to base b. We also kno that m, ℏ, and ω are greater than zero.*)

$$\Phi_0[p\_, t\_] = \text{Assuming}\left[m > 0 \;\&\&\; \omega > 0 \;\&\&\; \hbar > 0, \left(\frac{\alpha * e^{\frac{-(i*\omega*t)}{2}}}{\sqrt{2*\pi*\hbar}}\right) * \text{Integrate}\left[e^{\frac{-(i*p*x)}{\hbar}} * e^{-\eta*x^2}, \{x, -\infty, \infty\}\right]\right]$$

Out[40]= $$\frac{e^{-\frac{1}{2} i t \omega - \frac{p^2}{2 m \omega \hbar}} \left(\frac{m \omega}{\hbar}\right)^{1/4} \sqrt{\hbar}}{\pi^{1/4} \sqrt{m \omega \hbar}}$$

In[67]:= $$\text{Assuming}\left[(m*\omega*\hbar) > 0, \text{Integrate}\left[\text{Abs}[\Phi_0[p, t]]^2, \left\{p, -\sqrt{m*\omega*\hbar}, \sqrt{m*\omega*\hbar}\right\}\right]\right]$$

Out[67]= Erf[1]

In[69]:= `N[Erf[1], 6]`

Out[69]= 0.842701

In[68]:= `pquantum = 1 - N[Erf[1], 6]`

Out[68]= 0.157299

In[65]:= `N[pquantum, 2]`

Out[65]= 0.16