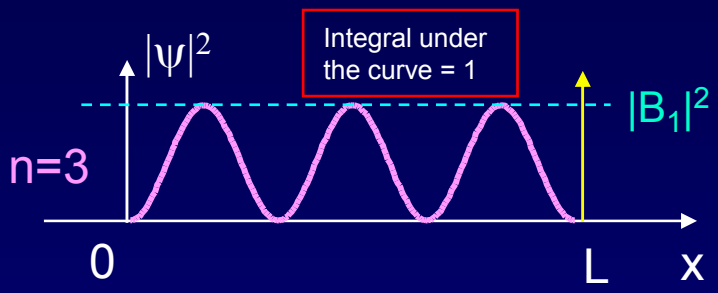
# Probability and Normalization

We now know that $\psi_n(x) = B_1 \sin\left(\frac{n\pi}{L}x\right)$. How can we determine $B_1$?

We need another constraint. It is the requirement that total probability equals 1.

The probability density at x is $|\psi(x)|^2$:




Therefore, the total probability is the integral:

$$P_{tot} = \int_{-\infty}^{\infty} |\psi(x)|^2 \, dx$$

In our square well problem, the integral is simpler, because $\psi = 0$ for $x < 0$ and $x > L$:

$$P_{tot} = |B_1|^2 \int_0^L \left|\sin\left(\frac{n\pi}{L}x\right)\right|^2 dx$$

$$= |B_1|^2 \frac{L}{2}$$

Requiring that $P_{tot} = 1$ gives us: $\boxed{B_1 = \sqrt{\frac{2}{L}}}$