$$|\Psi\rangle \doteq \Psi(x)$$
$$\Psi(x) = \langle x|\Psi\rangle$$
$$\mathcal{P}(x) = |\Psi(x)|^2$$
$$\mathcal{P}(x) = |\Psi(x)|^2$$

$$1 = \langle\Psi|\Psi\rangle = \int_{-\infty}^{\infty} |\Psi(x)|^2 \, dx = 1$$

$$|\Psi\rangle \to \Psi(x)$$
$$\langle\Psi| \to \Psi^*(x)$$

$$\hat{A} \to A(x)$$

$$\mathcal{P}(a<x<b) = \int_a^b |\Psi(x)|^2 \, dx$$

$$\mathcal{P}(E_n) = |\langle E_n|\Psi\rangle|^2 = \left| \int_{-\infty}^{\infty} E_n^*(x) \, \Psi(x) \, dx \right|^2$$

$$\hat{x} = x$$

$$\hat{p} = \frac{\hbar}{i} \frac{\partial}{\partial x}$$

$$\left(-\frac{\hbar^2}{2m} \frac{d^2}{dx^2} + V(x) \right) \psi_n(x) = E \, \psi_n(x)$$

Boundary conditions:

1) $\psi_n(x)$ is continuous.
2) $\frac{d}{dx} \psi_n(x)$ is continuous unless $V = \infty$.

Infinite square potential energy well:

$$E_n = \frac{n^2 \pi^2 \hbar^2}{2mL^2}, \quad n = 1, 2, 3, \ldots$$

$$\psi_n(x) = \sqrt{\left(\frac{2}{L}\right)} \sin\left(\frac{n\pi x}{L}\right), \quad n = 1, 2, 3, \ldots$$

Energy eigenstates obey the following properties:

Bra-ket Notation	Wavefunction Notation
Normalization	
$\langle E_n \| E_n \rangle = 1$	$\int_{-\infty}^{\infty} \lvert\psi_n(x)\rvert^2 \, dx = 1$
Orthogonality	
$\langle E_n \| E_m \rangle = \delta_{nm}$	$\int_{-\infty}^{\infty} \psi_n^*(x) \, \psi_m(x) \, dx = \delta_{nm}$
Completeness	
$\langle E_n \| E_m \rangle = \delta_{nm}$	$\int_{-\infty}^{\infty} \psi_n^*(x) \, \psi_m(x) \, dx = \delta_{nm}$