$$i\hbar \frac{d}{dt} \Psi(x,t) = H \, \Psi(x,t) \quad - \text{ Schrödinger eq.}$$

$$H = -\frac{\hbar^2}{2m}\frac{d^2}{dx^2} + V(x) \quad - \text{ Hamitonian}$$

IF $\quad H \psi_n(x) = E_n \psi_n(x) \quad , \quad \int_{-\infty}^{\infty} dx \; \psi_m(x)\psi_n(x) = \delta_{mn}$

ψ_n ↑ eigenstate, E_n ↑ eigenvalue

$$\Psi(x,t) = \sum_n c_n e^{-iE_nt/\hbar} \psi_n(x) \, ,$$

$$c_n = \int_{-\infty}^{\infty} dx \; \psi_n(x) \, \Psi(x,0)$$

Normalization: $\displaystyle \int_{-\infty}^{\infty} dx \; |\Psi(x,t)|^2 = \sum_n |c_n|^2 = 1$

Prob. to measure E_n : $\quad P(E_n) = |c_n|^2$

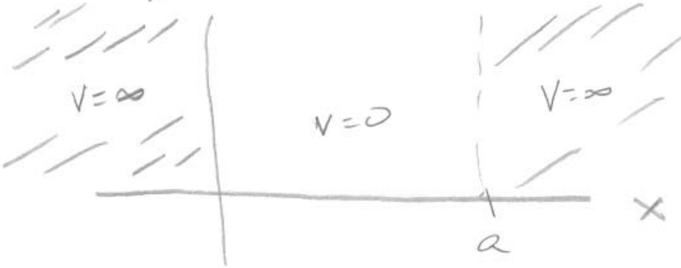
Prob. to measure position between a + b :

$$P_{ab} = \int_a^b dx \; |\Psi(x,t)|^2$$

Average value of momentum :

$$\langle \hat{p} \rangle = \int_{-\infty}^{\infty} dx \; \Psi^*(x,t) \left[-i\hbar \frac{d}{dx} \right] \Psi(x,t)$$

Square Well



$$H = -\frac{\hbar^2}{2m}\frac{d^2}{dx^2} + V_{sq.}(x)$$

$$V_{sq.}(x) = \begin{cases} 0, & 0 < x < a \\ \infty, & \text{outside} \end{cases}$$

$\Psi(x,t) = 0$ outside well

$$\boxed{\psi_n(x) = \sqrt{\frac{2}{a}}\,\sin\left(\frac{n\pi x}{a}\right)} \qquad \boxed{E_n = n^2 E_1 \qquad E_1 = \frac{\hbar^2\pi^2}{2ma^2}}$$

$$(n = 1, 2, 3, \ldots)$$

$$\sin(a)\sin(b) = \frac{1}{2}\left[\cos(a+b) - \cos(a-b)\right]$$

$$\cos(a)\cos(b) = \frac{1}{2}\left[\cos(a+b) + \cos(a-b)\right]$$

$$\cos(a)\sin(b) = \frac{1}{2}\left[\sin(a+b) - \sin(a-b)\right]$$

$$\int dx\,\cos(kx) = \frac{\sin(kx)}{k}, \qquad \int dx\,\sin(kx) = -\frac{\cos(kx)}{k}$$

$$\int dx\; x\cos(kx) = \frac{d}{dk}\int dx\,\sin(kx) = \frac{\cos(kx)}{k^2} + \frac{x\sin(kx)}{k}$$

$$\int dx\; x^2\cos(kx) = -\frac{d^2}{dk^2}\int dx\,\cos(kx)$$

$$\int dx\, x\sin(kx) = -\frac{d}{dk}\int dx\,\cos(kx) = \frac{\sin(kx)}{k^2} - \frac{x\cos(kx)}{k}$$

$$\int dx\; x^2\sin(kx) = -\frac{d^2}{dk^2}\int dx\,\sin(kx)$$