$$\boxed{\psi(x)} = A e^{-x^2/2} \sin(bx) \left(\frac{x}{c}\right)^2$$

@ some t

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

CLASSICAL

$$p_x = m\frac{d\boxed{x(t)}}{dt}$$

$$\underline{\underline{\hat{p}_x}}\,\underline{\underline{\psi(x)}} = \text{NONSENSE in general}$$

P.O.E. = Project Onto Eigenstates

Observable rep. by OPERATOR ... **FIND e-states** of $\hat{p}_x$: ... $\boxed{\text{Prob}(p) = \left|\langle\psi_p|\psi\rangle\right|^2}$

like $\hat{p}_x = \underline{\underline{-i\hbar\partial_x}}$

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

$$\psi_p = \frac{1}{\sqrt{2\pi\hbar}}e^{ikx} = \frac{e^{i\frac{px}{\hbar}}}{\sqrt{2\pi\hbar}}$$

where $\hbar k = p = \frac{h}{\lambda}$

op, e-value, e-func

$$\left[\hat{p}_x \cdot \psi_p = (\hbar k)\,\psi_p\right]$$

i.e. $\boxed{|\psi\rangle = \sum_{\text{e-values } q} c_q \, |\psi_q\rangle}$ where $\text{Prob}(q) = |c_q|^2$

$|\psi\rangle$ → $\psi(\vec r)$ functional representation

$|\psi\rangle$ → $\vec\psi$ matrix representation

cf. basis elements

$$\vec V = c_x \hat x + c_y \hat y + c_z \hat z$$

$$\vec V \cdot \hat x = c_x$$

generalize

$$\langle e_x | \vec V \rangle = \langle \hat x \,|\, \vec V \rangle = c_x$$

INNER PRODUCT = PROJECTION OPERATOR

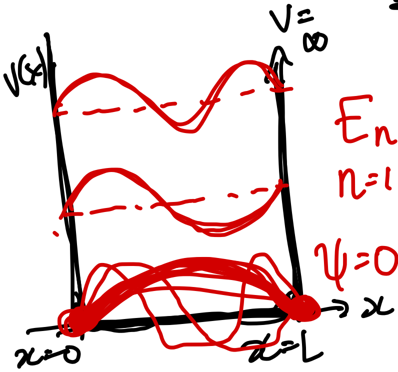
QM:

$$\langle \psi_q | \psi \rangle = \langle \underline{e_q} | \psi \rangle = \int dx \, e_q^*(x) \cdot \psi(x)$$

WAVEFUNC REPRES

$$= \vec e_q^{\,T*} \cdot \vec\psi$$

MATRIX REPRES



$E_n = \frac{\hbar^2 k^2}{2m} = $

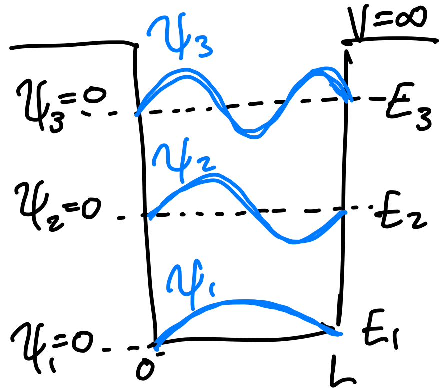
$n = 1, 2, 3, \ldots$

$\psi = 0$ @ $V = \infty$

$$E_n = \frac{\hbar^2}{2m}\left(\frac{2\pi}{\lambda_n}\right)^2 \text{ where } \lambda_n = \frac{2L}{n}$$

Representations of $|\psi\rangle$

place a pcle in ∞ well with $L=\pi$:



- $|\psi\rangle = A|e_{E_1}\rangle + B|e_{E_3}\rangle$

  $= A|1\rangle_n + B|3\rangle_n$

- matx $\vec{\psi}_E = \begin{pmatrix} A \\ 0 \\ B \\ \vdots \end{pmatrix}_n$

- $\psi(x) = \sqrt{\frac{2}{\pi}}\left[A\sin(x) + B\sin(3x)\right]$

e-states of $\hat{H} = \hat{T} + V$

= states of DEFINITE EN.

$\psi_{E_n}(x) = \sqrt{\frac{2}{L}}\sin\left(\frac{n\pi x}{L}\right)$

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