Terminology

- Say $\psi(x, t_0)$ is the prob. amplitude to find the particle at x at t_0.

- Say that the particle is a superposition of different places.

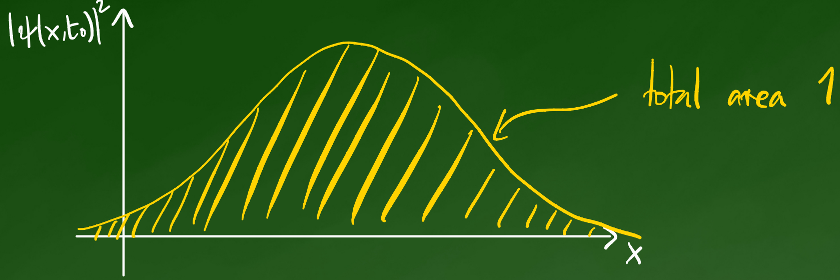
Normalisation

- Particle must somewhere with prob. 1

Mathematically :

$$\boxed{\int_{-\infty}^{\infty} |\psi(x, t_0)|^2 \, dx = 1}$$

Normalisation Condition.



- Normalisation is not very restrictive

↳ It is possible to normalise wavefunctions

Imagine: $$\int_{-\infty}^{\infty} |\psi(x,t_0)|^2 \, dx = N \quad (*) \qquad N < \infty$$

Def $$\psi'(x,t_0) = \frac{1}{\sqrt{N}} \psi(x,t_0)$$

$$\int_{-\infty}^{\infty} |\psi'(x,t_0)|^2 \, dx = \int_{-\infty}^{\infty} \psi'^*(x,t_0)\, \psi'(x,t_0) \, dx$$

$$= \int_{-\infty}^{\infty} \frac{1}{\sqrt{N}} \psi^*(x,t_0) \frac{1}{\sqrt{N}} \psi(x,t_0) \, dx$$

$$= \frac{1}{N} \underbrace{\int_{-\infty}^{\infty} \psi^*(x,t_0)\,\psi(x,t_0)\,dx}_{N} = 1$$

$\rightarrow$ $\psi'(x,t_0)$ is normalised.

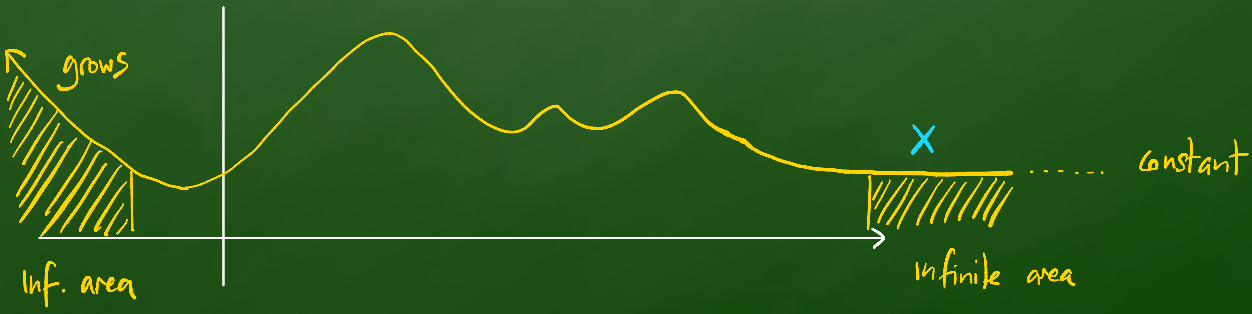
$\rightarrow$ It is possible to normalise wavefunctions.

(*) Called being SQUARE INTEGRABLE

NORMALISABLE

Behaviour at infinity

- Prob. density to find the particle "at infinity" must be zero!



- wavefunctions must decay faster than $\frac{1}{\sqrt{|x|}}$

Freedom in specifying state

Apart from above (i.e. being normalisable) have complete freedom in specifying wavefunction.