

Physics 4610 Quantum mechanics
Quiz 1

NAME: key

In searching for a differential equation for the de Broglie's wave hypothesis for a free particle, Schrodinger considered the following wave function:

$$\psi_{\text{right}}(x, t) = e^{-i\omega t - ikx}$$

This wave function represents a wave moving to the right.

- 1) Write a similar equation for a wave that is moving to the left.

$$\psi_{\text{left}} = e^{-i\omega t + ikx}$$

- 2) Combine the right moving and the left moving waves and write the equation for the superposition of the two waves.

$$\psi_{\text{combine}} = e^{-i\omega t - ikx} + e^{-i\omega t + ikx}$$

- 3) Simplify your results of part (2) and explain why Schrodinger decided that this solution was a possible candidate for the wave function of a free particle.

$$\psi_{\text{combine}} = e^{-i\omega t} \left(e^{-ikx} + e^{ikx} \right)$$

$2 \cos kx$

$$= \boxed{2 e^{-i\omega t} \cos kx}$$

↓

This cannot be zero everywhere at any instant of time.