# Question 1

A free particle has mass $m$, energy $E$ and momentum $\vec{\mathrm{p}}$.

Which of the following is true? Here $p$ is the magnitude of $\vec{\mathrm{p}}$.

1. $E = \dfrac{p}{m}$
2. $E = \dfrac{p}{2m}$
3. $E = \dfrac{p^2}{m}$
4. $E = \dfrac{p^2}{2m}$
5. None of these.

# Question 2

Consider a free particle for which

$$E = \frac{p^2}{2m}$$

and which is described by the wavefunction

$$\Psi(x,t) = Ae^{i(px-Et)/\hbar}.$$

Based on these, which of the following must the wavefunction satisfy?

1. $\dfrac{\partial\Psi}{\partial t} = \dfrac{1}{2m}\dfrac{\partial\Psi}{\partial x}$

2. $\dfrac{\partial\Psi}{\partial t} = \dfrac{1}{2m}\dfrac{\partial^2\Psi}{\partial x^2}$

3. $i\hbar\dfrac{\partial\Psi}{\partial t} = \dfrac{1}{2m}\dfrac{\partial^2\Psi}{\partial x^2}$

4. $-i\hbar\dfrac{\partial\Psi}{\partial t} = \dfrac{\hbar^2}{2m}\dfrac{\partial^2\Psi}{\partial x^2}$