Question 1

The Schrödinger equation for a free particle is

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

Consider as a possible solution the function

$$\Psi(x,t) = A\left(x - Bt\right)^2$$

where A and B are constants.

Which of the following is true?

1. This is a solution regardless of A and B.
2. This is a solution if $x = Bt + \frac{1}{iB}$.
3. This is a solution if $x = Bt + \frac{\hbar}{2imB}$.
4. This cannot be a solution for all x and t.

Question 2

The Schrödinger equation for a free particle is

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

Consider as a possible solution the function

$$\Psi(x,t) = Ae^{i(kx-\omega t)}$$

where k and ω are constants.

Which of the following is true about $\Psi(x,t)$?

1. This cannot be a solution regardless of k and ω.
2. This is a solution regardless of k and ω.
3. This is a solution provided that $k^2 = \omega$.
4. This is a solution provided that $\frac{k^2\hbar^2}{2m} = -\hbar\omega$.
5. This is a solution provided that $\frac{k^2\hbar^2}{2m} = \hbar\omega$.