

68. (a) We use Euler's formula $e^{i\phi} = \cos \phi + i \sin \phi$ to re-write $\psi(x)$ as

$$\begin{aligned}\psi(x) &= \psi_0 e^{ikx} = \psi_0 (\cos kx + i \sin kx) \\ &= (\psi_0 \cos kx) + i(\psi_0 \sin kx) = a + ib ,\end{aligned}$$

where $a = \psi_0 \cos kx$ and $b = \psi_0 \sin kx$ are both real quantities.

(b)

$$\begin{aligned}\psi(x, t) &= \psi(x) e^{-i\omega t} = \psi_0 e^{ikx} e^{-i\omega t} = \psi_0 e^{i(kx - \omega t)} \\ &= [\psi_0 \cos(kx - \omega t)] + i [\psi_0 \sin(kx - \omega t)] .\end{aligned}$$