QUANTUM STATES FOR SINGLE QUBIT SYSTEMS

Question 1

Recall: A state $|\psi\rangle = \alpha\,|0\rangle + \beta\,|1\rangle$ is a quantum state if $|\alpha|^2 + |\beta|^2 = 1$.

Which of the following equations are quantum states?

(a) Example: $|\psi\rangle = \frac{1}{\sqrt{2}}\,|0\rangle + \frac{1}{\sqrt{2}}\,|1\rangle$

Here: $\alpha = \frac{1}{\sqrt{2}}$ and $\beta = \frac{1}{\sqrt{2}}$.

Therefore $\underline{\alpha^2 + \beta^2} = (\frac{1}{\sqrt{2}})^2 + (\frac{1}{\sqrt{2}})^2 \underline{= 1}$.

$|\psi\rangle = \frac{1}{\sqrt{2}}\,|0\rangle + \frac{1}{\sqrt{2}}\,|1\rangle$ is a valid quantum state.

(b) $|\psi\rangle = |0\rangle + |1\rangle$

(c) $|\psi\rangle = \frac{3}{5}|0\rangle + \frac{4}{5}|1\rangle$

(d) $|\psi\rangle = |1\rangle$

(e) $|\psi\rangle = \frac{\sqrt{3}}{2}|0\rangle + \frac{1}{2}|1\rangle$