Name:

Quiz 5

1. Find the eigenvalues and eigenvectors of the Hamiltonian $H = E_o(|1\rangle\langle 2| + |2\rangle\langle 1|)$.

eigenvalues	eigenvectors
$+E_o$	$\frac{1}{\sqrt{2}}(\|1\rangle + \|2\rangle) = \|\psi_1\rangle$
$-E_o$	$\frac{1}{\sqrt{2}}(\|1\rangle - \|2\rangle) = \|\psi_2\rangle$

2. For the Hamiltonian in part 1. find $|\psi(t)\rangle$ if $|\psi(0)\rangle = |2\rangle$.

$$|\psi(t)\rangle = |\psi_1\rangle\langle\psi_1|\psi(0)\rangle e^{-iE_ot/\hbar} + |\psi_2\rangle\langle\psi_2|\psi(0)\rangle e^{iE_ot/\hbar}$$

$$= \frac{1}{\sqrt{2}}\begin{pmatrix}1\\1\end{pmatrix}\frac{1}{\sqrt{2}}e^{-iE_ot/\hbar} + \frac{1}{\sqrt{2}}\begin{pmatrix}1\\-1\end{pmatrix}\left(\frac{-1}{\sqrt{2}}\right)e^{iE_ot/\hbar}$$

$$= \begin{pmatrix}-i\sin(E_ot/\hbar)\\ \cos(E_ot/\hbar)\end{pmatrix}$$

$$= -i\sin(E_ot/\hbar)|1\rangle + \cos(E_ot/\hbar)|2\rangle$$