

5.73

Quiz 24

$$\text{Pauli Matrices: } \mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \mathbf{\sigma}_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$
$$\mathbf{\sigma}_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \mathbf{\sigma}_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

- A. What are the eigenvalues of $\mathbf{\sigma}_x$, $\mathbf{\sigma}_y$, and $\mathbf{\sigma}_z$?
- B. Let $M = \begin{pmatrix} 1 & 3\cos\omega t \\ 3\cos\omega t & 4 \end{pmatrix}$. Find the trace of
- $\mathbf{M}\mathbf{I}$
 - $\mathbf{M}\mathbf{\sigma}_x$
 - $\mathbf{M}\mathbf{\sigma}_y$
 - $\mathbf{M}\mathbf{\sigma}_z$

C. Let $\rho(t) = \frac{1}{5}\mathbf{M}$. Consider the vector

$$a_x = \frac{1}{2}\text{Tr}(\rho\sigma_x)$$

$$a_y = \frac{1}{2}\text{Tr}(\rho\sigma_y)$$

$$a_z = \frac{1}{2}\text{Tr}(\rho\sigma_z).$$

Where is the vector \vec{a} pointing at $t = 0$ and at $t = \pi/2\omega$?

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