

5.73

Quiz 10 **ANSWERS**

1. Multiply the following pairs of matrices:

$$\text{A. } \begin{pmatrix} 0 & 1 & 0 & 0 \end{pmatrix} \otimes \begin{pmatrix} 0 \\ 1 \\ 0 \\ 0 \end{pmatrix} = \mathbb{1}$$

$$\text{B. } \begin{pmatrix} 0 \\ 1 \\ 0 \\ 0 \end{pmatrix} \otimes \begin{pmatrix} 0 & 1 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

$$\text{C. } \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 6 & 3 & 5 \\ 2 & 9 & 7 \\ 4 & 4 & 2 \end{pmatrix} = \begin{pmatrix} 6 & 3 & 5 \\ 2 & 9 & 7 \\ 4 & 4 & 2 \end{pmatrix}$$

- 2.

$$\langle i | = \begin{pmatrix} a^* & b^* & c^* & d^* \end{pmatrix}$$

$$|i\rangle = \begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix}$$

$$\langle i | i \rangle = |a|^2 + |b|^2 + |c|^2 + |d|^2$$

$$\text{Normalize } \begin{pmatrix} 5 \\ -2i \\ 3i \\ -4 \end{pmatrix} \quad \left(\begin{pmatrix} 5 & 2i & -3i & -4 \end{pmatrix} \right)^\dagger = 25 + 4 + 9 + 16 = 54$$

3. Consider the Hermitian matrix:

$$\mathbf{A} = \begin{pmatrix} 4 & 1 & 1 \\ 1 & 7 & -2 \\ 1 & -2 & 7 \end{pmatrix}$$

Is $\begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix}$ an eigenvector of \mathbf{A} ? If so, what is its eigenvalue?

$$\begin{pmatrix} 4 & 1 & 1 \\ 1 & 7 & -2 \\ 1 & -2 & 7 \end{pmatrix} \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix} = \begin{pmatrix} 8-2 \\ 2-7+2 \\ 2+2-7 \end{pmatrix} = \begin{pmatrix} 6 \\ -3 \\ -3 \end{pmatrix}$$

So it is not an eigenvector of \mathbf{A} .

4. Find a non-normalized vector that is orthogonal to both $\begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ 1 \\ -1 \end{pmatrix}$.

$$\begin{pmatrix} 1 & 1 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix} = 2 - 1 - 1 = 0$$

$$\begin{pmatrix} 1 & 1 & 1 \end{pmatrix} \begin{pmatrix} 0 \\ 1 \\ -1 \end{pmatrix} = 0 + 1 - 1 = 0$$

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