

MAT 399**Quiz 0****Fall 2025**

For complex matrix A , let the adjoint of A , written A^* , denote the conjugate transpose $A^* = \overline{A^T}$, where conjugate means take complex conjugate of each entry, and transpose is the usual linear algebra operation, and the order of transpose and conjugate does not matter.

1. Find the sum of complex numbers: $(\frac{1}{2} + \frac{\sqrt{3}}{2}i) + (\frac{1}{2} - \frac{\sqrt{3}}{2}i)$

a) 1 b) 2 c) i d) $1 + i$ e) $2i$

Correct Answer: 1

2. Find the product of complex numbers: $(\frac{1}{2} + \frac{\sqrt{3}}{2}i)(\frac{1}{2} - \frac{\sqrt{3}}{2}i)$

a) 2 b) i c) $1 + i$ d) $2i$ e) 1

Correct Answer: 1

3. Multiply and convert to Cartesian form: $e^{i\frac{\pi}{4}} \cdot e^{i\frac{\pi}{4}}$

a) -1 b) $-i$ c) 1 d) i e) 0

Correct Answer: i

4. Find the length (distance from the origin) of the complex number: $\frac{1}{2} + \frac{\sqrt{3}}{2}i$

a) 1 b) 2 c) $\frac{\sqrt{3}}{2}$ d) $2\sqrt{2}$ e) $\sqrt{2}$

Correct Answer: 1

5. Simplify and find the length of the complex number: $(1 + i)^2$

a) 1 b) 2 c) $\frac{\sqrt{3}}{2}$ d) $2\sqrt{2}$ e) $\sqrt{2}$

Correct Answer: 2

6. Let A be the complex matrix: $\begin{pmatrix} i & -i \\ 1 & 1 \end{pmatrix}$. Find the adjoint of A .

a) $\begin{pmatrix} i & i \\ -1 & 1 \end{pmatrix}$ b) $\begin{pmatrix} i & -i \\ -1 & 1 \end{pmatrix}$ c) $\begin{pmatrix} i & -1 \\ i & -1 \end{pmatrix}$ d) $\begin{pmatrix} -i & i \\ 1 & -1 \end{pmatrix}$ e) $\begin{pmatrix} -i & 1 \\ i & 1 \end{pmatrix}$

Correct Answer: $\begin{pmatrix} -i & 1 \\ i & 1 \end{pmatrix}$

7. Same matrix A as in the previous problem. Find the product AA^* :

a) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ b) $\begin{pmatrix} i & 0 \\ 0 & 1 \end{pmatrix}$ c) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ d) $\begin{pmatrix} 2i & 0 \\ 0 & 2i \end{pmatrix}$ e) $\begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$

Correct Answer: $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$

8. Let H be the matrix: $\frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$. Find H^2 .

a) $\begin{pmatrix} 2 & 0 \\ 1 & 2 \end{pmatrix}$ b) $\begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ d) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ e) $\begin{pmatrix} -1 & 1 \\ 1 & -1 \end{pmatrix}$

Correct Answer: $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$