1. Is the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ diagonalizable? If it is, diagonalize it.

2. Find all complex numbers z such that $z^4 = i$.

3. Let $A = \begin{bmatrix} 0 & -4 & -8 & -4 \\ 8 & 2 & -8 & 0 \\ -3 & 1 & -1 & 2 \end{bmatrix}$ Find a basis for $\text{row}(A)$, $\text{col}(A)$ and $\ker(A)$.

4. Without doing any calculations, find the eigenvalues of $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 3 & 3 \\ 0 & 0 & 5 \end{bmatrix}$.

5. If A is an $n \times n$ matrix, write down 5 statements equivalent to "A is **NOT** invertible".

6. What is the shortest distance between the point $(1, 0, -1)$ and the line going through the origin with direction $(5, -1, 1)$?

7. Suppose $U = \text{span}\{v, w\}$. Prove that $U = \text{span}\{v - w, v + w\}$.

8. Write down two possible ways of proving that a given set is a subspace. Use either method to prove that the plane through the origin with normal vector $n = (4, -1, 2)$ is a subspace (note that such a plane would be the set of all vectors that are orthogonal to n).

9. Find the standard matrix of the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^2$ such that $T(1, 1) = (4, 6)$ and $T(1, -1) = (2, 1)$.

10. Proof or counterexample: the rows of a matrix are linearly independent, then its columns are also linearly independent.