1. In this quiz you will diagonalise some matrices and apply this to simplify calculations.

Given the matrix $T = \begin{bmatrix} 6 & -1 \\ 2 & 3 \end{bmatrix}$ and change of basis matrix $C = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$ (whose columns are eigenvectors of T), calculate the diagonal matrix $D = C^{-1}TC$.

- $\begin{bmatrix} 5 & 0 \\ 0 & 4 \end{bmatrix}$
- $\begin{bmatrix} 6 & 0 \\ 0 & 3 \end{bmatrix}$
- $\begin{bmatrix} 9 & 0 \\ 0 & 20 \end{bmatrix}$
- $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$

2. Given the matrix $T = \begin{bmatrix} 2 & 7 \\ 0 & -1 \end{bmatrix}$ and change of basis matrix $C = \begin{bmatrix} 7 & 1 \\ -3 & 0 \end{bmatrix}$ (whose columns are eigenvectors of T), calculate the diagonal matrix $D = C^{-1}TC$.

- $\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$
- $\begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix}$
- $\begin{bmatrix} -1 & 0 \\ 0 & 2 \end{bmatrix}$
- $\begin{bmatrix} 7 & 0 \\ 0 & 0 \end{bmatrix}$

3. Given the matrix $T = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}$ and change of basis matrix $C = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ (whose columns are eigenvectors of T), calculate the diagonal matrix $D = C^{-1}TC$.

- $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$
- $\begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$
- $\begin{bmatrix} 0 & 0 \\ 0 & -1 \end{bmatrix}$

4. Given a diagonal matrix $D = \begin{bmatrix} a & 0 \\ 0 & a \end{bmatrix}$, and a change of basis matrix $C = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ with inverse $C = \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$, calculate $T = CDC^{-1}$.

- $\begin{bmatrix} -a & 0 \\ 0 & a \end{bmatrix}$
- $\begin{bmatrix} -a & 0 \\ 0 & -a \end{bmatrix}$
- $\begin{bmatrix} a & 0 \\ 0 & -a \end{bmatrix}$
- $\begin{bmatrix} a & 0 \\ 0 & a \end{bmatrix}$

5. Given that $T = \begin{bmatrix} 6 & -1 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} 5 & 0 \\ 0 & 4 \end{bmatrix} \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix}$, calculate T^3.

- $\begin{bmatrix} 122 & 186 \\ -61 & 3 \end{bmatrix}$
- $\begin{bmatrix} 3 & 122 \\ 186 & -61 \end{bmatrix}$
- $\begin{bmatrix} 186 & -61 \\ 122 & 3 \end{bmatrix}$
- $\begin{bmatrix} -61 & 3 \\ 122 & 186 \end{bmatrix}$

6. Given that $T = \begin{bmatrix} 2 & 7 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} 7 & 1 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} -1 & 0 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 0 & -1/3 \\ 1 & 7/3 \end{bmatrix}$, calculate T^3.

- $\begin{bmatrix} 21 & 8 \\ 0 & -1 \end{bmatrix}$
- $\begin{bmatrix} 8 & 21 \\ 0 & -1 \end{bmatrix}$
- $\begin{bmatrix} 0 & -1 \\ 21 & 8 \end{bmatrix}$
- $\begin{bmatrix} -1 & 21 \\ 8 & 0 \end{bmatrix}$

7. Given that $T = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$, calculate T^5.

- $\begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix}$
- $\begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix}$
- $\begin{bmatrix} -1 & 0 \\ 2 & 1 \end{bmatrix}$