Submission 7

The respondent's email (**deepanshu21249@iiitd.ac.in**) was recorded on submission of this form.

Question *

Let A be a 3×3 matrix such that the linear transformation $\mathbf{x} \mapsto A\mathbf{x}$ reflects every vector in $\mathbb{R}^3$ across the plane

$$2x + 3y + 5z = 0.$$

Choose a correct statement from the following:

- ○ The eigenvalues of A are 2 and 3
- ○ A is not diagonalizable
- ○ 1 is the only real eigenvalue of A
- ○ The eigenvalues of A are 1 and -1
- ◉ A is diagonalizable
- ○ Other: _____

Question *

Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be the linear transformation which sends $\mathbf{x} \mapsto A\mathbf{x}$, where

$$A = \begin{bmatrix} 4 & -6 \\ 2 & -2 \end{bmatrix}.$$

Let $\mathcal{B}$ be a basis of $\mathbb{R}^2$ such that T is the composite of a 2D rotation and a scaling transformation with respect to $\mathcal{B}$-coordinates.

Identify a correct change-of-coordinates matrix $P_{\mathcal{B}}$ from the following options:

$\begin{bmatrix} 15 & -5\sqrt{3} \\ 10 & 0 \end{bmatrix}$

Screenshot from 2022-03-31 16-55-21.png

$\begin{bmatrix} 15 & 5\sqrt{3} \\ 10 & 0 \end{bmatrix}$

Screenshot from 2022-03-31 16-58-30.png

$\begin{bmatrix} 3/2 & 1 \\ \sqrt{3}/2 & 0 \end{bmatrix}$

Screenshot from 2022-03-31 16-59-30.png

$\begin{bmatrix} 3/2 & 1 \\ -\sqrt{3}/2 & 0 \end{bmatrix}$

Screenshot from 2022-03-31 16-57-08.png

Question *

Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be the linear transformation which sends $\mathbf{x} \mapsto A\mathbf{x}$, where

$$A = \begin{bmatrix} 2 & -3 \\ 1 & -1 \end{bmatrix}.$$

Let $\mathcal{B}$ be a basis of $\mathbb{R}^2$ such that $[T]_{\mathcal{B}}$ is a counter-clockwise rotation by an angle of θ.

Identify a correct choice of θ from the following options.

- -30 degrees
- -15 degrees
- 15 degrees
- 30 degrees
- -60 degrees
- 60 degrees
- -45 degrees
- 45 degrees
- Other:

Question *

$$A = \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix}$$

Let $W = \text{Span}\{A^4, A^3, A^2, A, I\} \subset M_{4\times 4}(\mathbb{R})$.

What is the dimension of W?

- 2
- 5
- 3
- 12
- 4
- 1
- 16
- Other: _____