MC exam Math 1a 01003

The following approach to scoring responses is implemented and is based on "One best answer":

There is always only one correct answer – a response that is more correct than the rest
Students are only able to select one answer per question
Every correct answer corresponds to 1 point
Every incorrect answer corresponds to 0 points (incorrect answers do NOT result in subtraction of points)

Let the matrices $\mathbf{A}$ and $\mathbf{B}$ be given by:

$$\mathbf{A} = \begin{bmatrix} 2 & -1 & 3 \\ 1 & 3 & 0 \\ 0 & 7 & -2 \end{bmatrix} \text{ and } \mathbf{B} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}.$$

Which of the below numbers state the determinant of $\mathbf{A} \cdot \mathbf{B}$?

Vælg en svarmulighed

- $\det(\mathbf{A} \cdot \mathbf{B}) = 0$
- $\det(\mathbf{A} \cdot \mathbf{B}) = 42$
- $\det(\mathbf{A} \cdot \mathbf{B}) = -42$
- $\det(\mathbf{A} \cdot \mathbf{B}) = 21$
- $\det(\mathbf{A} \cdot \mathbf{B}) = -21$

Let $\mathbf{A} = \begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix}$ be an invertible matrix, and let $\mathbf{b} = \begin{bmatrix} 4 \\ 12 \end{bmatrix}$ be a column vector. Which column vector $\mathbf{x} \in \mathbb{R}^2$ is a solution to the equation $\mathbf{A}\mathbf{x} = \mathbf{b}$?

Vælg en svarmulighed

- $\mathbf{x} = \begin{bmatrix} 10 \\ 6 \end{bmatrix}$
- $\mathbf{x} = \begin{bmatrix} -10 \\ 6 \end{bmatrix}$
- $\mathbf{x} = \begin{bmatrix} -6 \\ -10 \end{bmatrix}$
- $\mathbf{x} = \begin{bmatrix} 10 \\ -6 \end{bmatrix}$
- $\mathbf{x} = \begin{bmatrix} 6 \\ 10 \end{bmatrix}$

We are given the second-degree polynomial:

$$p(z) = 3z^2 - 6z + 6 \quad , \quad z \in \mathbb{C} \,.$$

Which of the below options state the discriminant d of the polynomial as well as one of the roots r of the polynomial?

Vælg en svarmulighed

- $d = -6i, r = 1 - i$
- $d = -36, r = 1 - i$
- $d = -36, r = i - 1$
- $d = 0, r = 1 + i$
- $d = 6i, r = 1 + i$

Consider the real differential equation:

$f'(t) = \frac{1}{t} f(t) + t$ where $t > 0$.

Which of the below expressions is a particular solution to the differential equation?

Vælg en svarmulighed

- $f(t) = t^2 \ , \ t > 0$
- $f(t) = t^2 + ce^t \ , \ t > 0\,, c \in \mathbb{R}$
- $f(t) = t^2 - 1 \ , \ t > 0$
- $f(t) = ce^t + 1 \ , \ t > 0\,, c \in \mathbb{R}$
- $f(t) = t(t^2 + t) \ , \ t > 0$

Consider the real second-order differential equation:

$$f''(t) - 6f'(t) + 9f(t) = 0$$

Which of the below expressions is ***NOT*** a solution to the differential equation?

Vælg en svarmulighed

- $f(t) = e^{3t}(t-1)\ ,\ t \in \mathbb{R}$
- $f(t) = 0\ ,\ t \in \mathbb{R}$
- $f(t) = \cos(3t) + \sin(3t)\ ,\ t \in \mathbb{R}$
- $f(t) = te^{3t}\ ,\ t \in \mathbb{R}$
- $f(t) = 4e^{3t}\ ,\ t \in \mathbb{R}$

Let a matrix $\mathbf{A}$ be given by:

$$\mathbf{A} = \begin{bmatrix} 2 & 3 & 5 \\ 0 & 0 & -2 \\ 0 & -2 & 0 \end{bmatrix}.$$

In which of the below expressions are $\mathbf{v}_1$ and $\mathbf{v}_2$ eigenvectors of matrix $\mathbf{A}$?

Vælg en svarmulighed

- $\mathbf{v}_1 = \begin{bmatrix} 5 \\ 0 \\ 0 \end{bmatrix}$ and $\mathbf{v}_2 = \begin{bmatrix} -2 \\ 1 \\ 1 \end{bmatrix}$
- $\mathbf{v}_1 = \begin{bmatrix} -1 \\ 0 \\ 0 \end{bmatrix}$ and $\mathbf{v}_2 = \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}$
- $\mathbf{v}_1 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$ and $\mathbf{v}_2 = \begin{bmatrix} -4 \\ 2 \\ 2 \end{bmatrix}$
- $\mathbf{v}_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ and $\mathbf{v}_2 = \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix}$
- $\mathbf{v}_1 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ and $\mathbf{v}_2 = \begin{bmatrix} 2 \\ -1 \\ -1 \end{bmatrix}$

Let $\mathbf{A} \in \mathbb{R}^{3\times 3}$ be a matrix.

Let $L_{\mathbf{A}} : \mathbb{R}^3 \to \mathbb{R}^3$ be a linear map given by: $L_{\mathbf{A}}(\mathbf{v}) = \mathbf{A}\mathbf{v}$.

We are informed that $L_{\mathbf{A}}$ has the eigenvalues $\lambda_1 = 1\ ,\ \lambda_2 = -1\ ,\ \lambda_3 = 2$ with corresponding eigenspaces:

$$E_{\lambda_1} = \mathrm{span}_{\mathbb{R}}\left(\begin{bmatrix}0\\1\\0\end{bmatrix}\right)\ ,\ E_{\lambda_2} = \mathrm{span}_{\mathbb{R}}\left(\begin{bmatrix}1\\0\\1\end{bmatrix}\right)\ ,\ E_{\lambda_3} = \mathrm{span}_{\mathbb{R}}\left(\begin{bmatrix}-1\\0\\1\end{bmatrix}\right).$$

Choose which of the following matrices that is matrix $\mathbf{A}$.

Vælg en svarmulighed

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