Reexam 01003 F25

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 $a \in \mathbb{R}$, and consider the 3rd-degree polynomial:

$$p(Z) = (Z - a)(Z^2 - 2Z + 5).$$

Which of the following numbers is a root of the polynomial?

Vælg en svarmulighed

- $2 + i$
- $1 - 2i$
- $-i$
- $2 - i$
- None of the listed options is a root of the polynomial.
- $1 + i$
- i
- $2 + 3i$

Which of the following complex numbers is located farthest from 0 in the complex plane?

Vælg en svarmulighed

- i
- e^{6i}
- $2+i$
- πi
- $1+i$
- All of the listed options have the same distance to 0.
- $1-i$
- $4e^{i}$

A discrete function $f : \{1, 2, 3\} \to \{1, 2, 3\}$ is given by the table:

n	$f(n)$
1	2
2	3
3	1

Furthermore, another discrete function $g : \{1, 2, 3\} \to \mathbb{N}$ is given by its functional expression $g(n) = 4 + n$.

The number $g(f^{-1}(3))$ equals:

Vælg en svarmulighed

- 2
- 1
- 7
- The correct answer is not listed.
- 5
- 3
- 6
- 0

We are given the homogeneous linear 2nd-order differential equation:

$$f''(t) - 2f'(t) + 5f(t) = 0.$$

Which of the below answers is not a solution to the differential equation?

Vælg en svarmulighed

- ○ $f(t) = 3e^t \sin(2t)$
- ○ $f(t) = 0$
- ○ $f(t) = e^t(\cos(2t) - \sin(2t))$
- ● $f(t) = e^t \cos(2t) + \sin(2t)$
- ○ $f(t) = e^t(\cos(2t) + \cos(2t))$
- ○ All of the options are solutions to the differential equation.
- ○ $f(t) = 3e^t \sin(2t) + 2e^t \cos(2t)$
- ○ $f(t) = -e^t \cos(2t)$

We are given $a \in \mathbb{R}$ as well as the real 3×3 matrix:

$$\mathbf{A} = \begin{bmatrix} 2 & 0 & 0 \\ 0 & a & 1 \\ 0 & -1 & 1 \end{bmatrix}.$$

For which of the following values of a does the matrix have an eigenvalue with an algebraic multiplicity larger than 1?

Vælg en svarmulighed

- ○ $a = 2$
- ○ $a = 1$
- ○ $a = -2$
- ○ $a = 0$
- ○ $a = -3$
- ○ $a = -4$
- ● $a = 3$
- ○ No value of a that fulfills the requirement exists.

We are given the matrices:

$$\mathbf{A} = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \in \mathbb{R}^{2\times 2} \text{ and } \mathbf{b} = \begin{bmatrix} -1 \\ 1 \end{bmatrix} \in \mathbb{R}^{2\times 1}.$$

Furthermore we are given the following recursive expression:

$$\mathbf{c}_0 = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \in \mathbb{R}^{2\times 1} \text{ and } \mathbf{c}_k = \mathbf{A}\mathbf{c}_{k-1} + \mathbf{b} \text{ for } k = 1, 2, 3, \ldots.$$

Which of the following options equals $\mathbf{c}_3$?

Vælg en svarmulighed

- (selected) $\mathbf{c}_3 = \begin{bmatrix} 0 \\ 2 \end{bmatrix}$
- $\mathbf{c}_3 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$
- $\mathbf{c}_3 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$
- $\mathbf{c}_3 = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$
- $\mathbf{c}_3 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
- $\mathbf{c}_3 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$
- None of the listed options equals $\mathbf{c}_3$.
- $\mathbf{c}_3 = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$

We are given the matrices:

$$\mathbf{A} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \in \mathbb{R}^{2\times 1} \text{ and } \mathbf{B} = \begin{bmatrix} 1 & 2 \end{bmatrix} \in \mathbb{R}^{1\times 2}.$$

Which of the following options shows the determinant of $\mathbf{A} \cdot \mathbf{B}$?

Vælg en svarmulighed

- ○ $\det(\mathbf{A} \cdot \mathbf{B}) = 1$
- ○ $\det(\mathbf{A} \cdot \mathbf{B}) = 2$
- ○ $\det(\mathbf{A} \cdot \mathbf{B}) = -1$
- ○ None of the listed options shows $\det(\mathbf{A} \cdot \mathbf{B})$.
- ○ $\det(\mathbf{A} \cdot \mathbf{B}) = 3$
- ○ $\det(\mathbf{A} \cdot \mathbf{B}) = -2$
- ○ $\det(\mathbf{A} \cdot \mathbf{B}) = -3$
- ● $\det(\mathbf{A} \cdot \mathbf{B}) = 0$

Consider the real vector space $W \subseteq \mathbb{R}[Z]$ consisting of polynomials of degree no higher than 2.

Consider the subspace $\operatorname{span}_{\mathbb{R}}(1 + Z^2, 1 + Z)$.

Which of the following polynomials does not belong to this subspace?

Vælg en svarmulighed

- $Z^2 + Z + 2$
- $-2Z^2 + 3Z + 2$
- $-Z^2 + 3Z + 2$
- $-Z^2 - Z - 2$
- $2Z^2 + 2$
- $Z^2 + 2Z + 3$
- All of the listed options belong to the subspace.
- $Z^2 - 3Z - 2$