

Question 1

QUESTION 1

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The position of a particle is given by $r = (t+2)\hat{i} + t^2\hat{j}$ for $t \geq 0$.
Determine the corresponding Cartesian equation.

- (A) $y = x^2 - 4$
- (B) $y = x^2 + 4$
- (C) $y = x^2 - 4x + 4$
- (D) $y = x^2 + 4x + 4$

Question 2

QUESTION 4

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The age-specific population distribution of a particular species of animal is shown.

Age (years)	0-1	1-2	2-3	3-4
Female population	94	82	37	6
Breeding rate	0	1.3	0.9	0.2
Survival rate	0.6	0.8	0.4	0

The Leslie matrix based on this data is

- (A) $\begin{bmatrix} 94 & 82 & 37 & 6 \\ 0.6 & 0 & 0 & 0 \\ 0 & 0.8 & 0 & 0 \\ 0 & 0 & 0.4 & 0 \end{bmatrix}$
- (B) $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 1.3 & 0 & 0 & 0 \\ 0 & 0.9 & 0 & 0 \\ 0 & 0 & 0.2 & 0 \end{bmatrix}$
- (C) $\begin{bmatrix} 0.6 & 0.8 & 0.4 & 0 \\ 1.3 & 0 & 0 & 0 \\ 0 & 0.9 & 0 & 0 \\ 0 & 0 & 0.2 & 0 \end{bmatrix}$
- (D) $\begin{bmatrix} 0 & 1.3 & 0.9 & 0.2 \\ 0.6 & 0 & 0 & 0 \\ 0 & 0.8 & 0 & 0 \\ 0 & 0 & 0.4 & 0 \end{bmatrix}$

Question 3

QUESTION 6

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The shaded region defined as $\{z : |z + 2 - i| \leq 5\} \cap \{z : \text{Re}(z) < 1\}, z \in \mathbb{C}$ is best represented by

- (A)
- (B)
- (C)
- (D)

Question 4

QUESTION 11 (5 marks)

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Determine the following definite integrals.

- a) $\int_0^1 \frac{1}{1+x^2} dx$ [2 marks]
- b) $\int_0^{\frac{\pi}{4}} 2\sin^2(x) dx$ [3 marks]

Question 5

QUESTION 16 (5 marks)

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A curve is defined by the parametric equations $x = 2\tan(\theta)$ and $y = 3\sin(2\theta)$, where $0 \leq \theta < \frac{\pi}{2}$.

Given that $\frac{dy}{dx}$ can be expressed in the form $a\cos^4(\theta) + b\cos^2(\theta)$, where $a, b \in \mathbb{R}$, determine the values of a and b .