

Question 1

QUESTION 9

Two objects, P and Q, move in three-dimensional space such that their positions, r , over time, t , are described by the following vectors until they collide.

$$r_P = (t^2 - 4t)\mathbf{i} + (2t^2 - t + 3)\mathbf{j} - (6 - 5t)\mathbf{k}$$

$$r_Q = (-t^2 + 2t)\mathbf{i} + (3t + t^2)\mathbf{j} + t^2\mathbf{k}$$

The objects will collide at

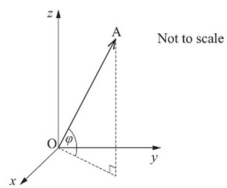
- (A) $t = 0$
- (B) $t = 1$
- (C) $t = 2$
- (D) $t = 3$

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Question 2

QUESTION 7

The altitude angle of \vec{OA} is represented as ϕ .



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Given the coordinates of A are (3, 4, 6), the altitude angle of \vec{OA} in radians is

- (A) 0.93
- (B) 0.88
- (C) 0.69
- (D) 0.66

Question 3

QUESTION 2

The Leslie matrix for a certain endangered species is given.

$$L = \begin{bmatrix} 0.8 & 2.4 & 0.3 \\ 0.4 & 0 & 0 \\ 0 & 0.55 & 0 \end{bmatrix}$$

A group of the species was moved into a secure property at the start of 2018. The initial female population is given.

$$N_0 = \begin{bmatrix} 150 \\ 80 \\ 40 \end{bmatrix}$$

The best estimate of the total female population at the start of 2025 is

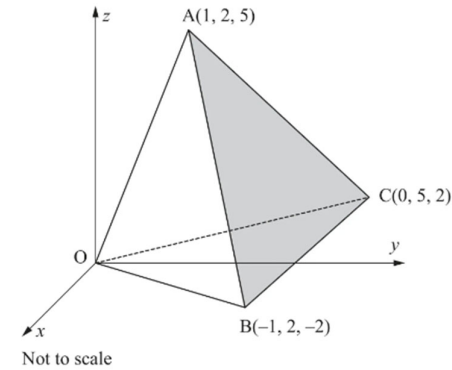
- (A) 3000
- (B) 4000
- (C) 5000
- (D) 6000

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Question 4

QUESTION 11 (4 marks)

OABC is a triangular-based pyramid, as shown.



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Use a vector method to determine the area of the shaded face of the pyramid.

Question 5

QUESTION 15 (5 marks)

Consider points A(3, -1, 3) and B(1, 1, 6).

- a) Determine \vec{AB} . [1 mark]
 - b) Determine the Cartesian equation of the line that passes through points A and B. [2 marks]
- Point A lies on the plane, ϕ , and \vec{AB} is perpendicular to this plane.
- c) Determine the Cartesian equation of the plane. [2 marks]

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