Question 1

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QUESTION 8

Let $u = 1 + i$ and $v = -12 + 5i$

$Re\left(u^5 - |v|\right)$ is

(A) –17

(B) –4

(C) 8

(D) 9

Question 2

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QUESTION 5

A vector normal to the plane that contains the vectors $\begin{pmatrix}1\\3\\0\end{pmatrix}$ and $\begin{pmatrix}1\\0\\2\end{pmatrix}$ is

(A) $6\hat{i}+2\hat{j}+3\hat{k}$

(B) $6\hat{i}+2\hat{j}-3\hat{k}$

(C) $6\hat{i}-2\hat{j}+3\hat{k}$

(D) $6\hat{i}-2\hat{j}-3\hat{k}$

Question 3

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QUESTION 2

The win/draw/loss results after a netball competition involving five teams is represented in matrix **M**.

$$\mathbf{M} = \begin{array}{c} \\ \text{Winning teams} \end{array} \begin{array}{c} \begin{array}{ccccc} \text{P} & \text{Q} & \text{R} & \text{S} & \text{T} \end{array} \\ \text{Losing teams} \\ \begin{bmatrix} 0 & 1 & 2 & 0 & 2 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 2 & 0 & 0 & 0 \\ 2 & 1 & 2 & 0 & 2 \\ 0 & 1 & 2 & 0 & 0 \end{bmatrix} \end{array} \begin{array}{l} \text{P} \\ \text{Q} \\ \text{R} \\ \text{S} \\ \text{T} \end{array}$$

Key: Team P drew with Team Q, defeated Team R and Team T, and lost to Team S

The model $\mathbf{M}+\mathbf{M}^2+\mathbf{M}^3$ is used to rank the teams. The final positions from first to fifth are

(A) S, Q, P, R, T

(B) S, Q, P, T, R

(C) S, P, Q, T, R

(D) S, P, Q, R, T

Question 4

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QUESTION 12 (5 marks)

A scientist collects data for a species of tree frog in a protected area. Details for the female tree frog population are shown in the table.

Age (years)	0–1	1–2	2–3	3–4
Population in Year 1	150	101	84	62
Birth (breeding) rate	0.4	0.7	0.5	0.1
Survival rate	0.6	0.3	0.2	0

The scientist uses a Leslie matrix model to make predictions about the female tree frog population.

a) State the initial population matrix. *[1 mark]*

b) Determine the Leslie matrix. *[1 mark]*

A species is considered to be endangered if the female population in a restricted area is predicted to fall to less than 125 in the next 20 years.

c) Determine whether this species of tree frog is considered to be endangered. *[3 marks]*

Question 5

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QUESTION 15 (4 marks)

The position vectors of points P and Q are $2\hat{\imath} - 3\hat{\jmath} + \hat{k}$ and $2\hat{\imath} + 2\hat{\jmath} - 4\hat{k}$ respectively.

Let O be the origin.

a) Determine the angle POQ. *[2 marks]*

Points O, P and Q are joined to form a triangle.

b) Determine the area of triangle POQ. *[2 marks]*