

Please attempt the following questions in preparation for the online session on 11th October 2018.

Q1

Given that the points $S(-4,5,1)$, $T(-16,-4,16)$ and $U(-24,-10,26)$ are collinear, calculate the ratio in which T divides SU .

Q2

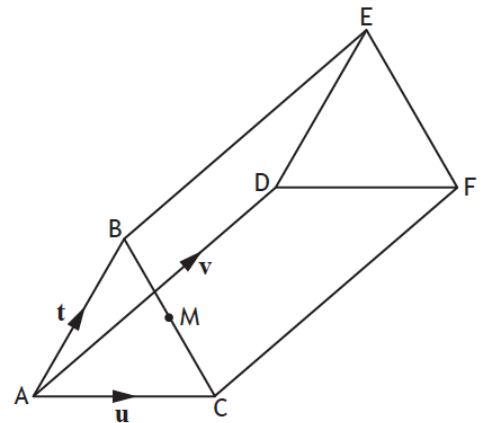
The diagram shows a triangular prism $ABCDEF$.

$$\overrightarrow{AB} = \mathbf{t}, \overrightarrow{AC} = \mathbf{u} \text{ and } \overrightarrow{AD} = \mathbf{v}.$$

(a) Express \overrightarrow{BC} in terms of \mathbf{u} and \mathbf{t} .

M is the midpoint of \overrightarrow{BC} .

(b) Express \overrightarrow{MD} in terms of \mathbf{t} , \mathbf{u} and \mathbf{v} .



Q3

$A(-3,4,-7)$, $B(5,t,5)$ and $C(7,9,8)$ are collinear.

(a) State the ratio in which B divides AC .

(b) State the value of T .

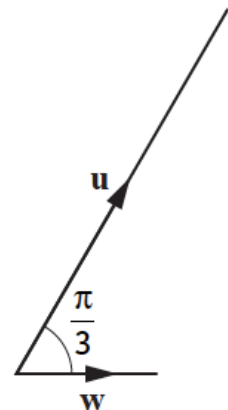
Q4

Vectors \mathbf{u} and \mathbf{v} are $\begin{pmatrix} 5 \\ 1 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ -8 \\ 6 \end{pmatrix}$ respectively.

(a) Evaluate $\mathbf{u} \cdot \mathbf{v}$.

Vector \mathbf{w} makes an angle of $\frac{\pi}{3}$ with \mathbf{u} and $|\mathbf{w}| = \sqrt{3}$.

(b) Calculate $\mathbf{u} \cdot \mathbf{w}$.



Q5

Vectors $\mathbf{u} = 8\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ and $\mathbf{v} = -3\mathbf{i} + a\mathbf{j} - 6\mathbf{k}$ are perpendicular.
What is the value of a ?

Q6

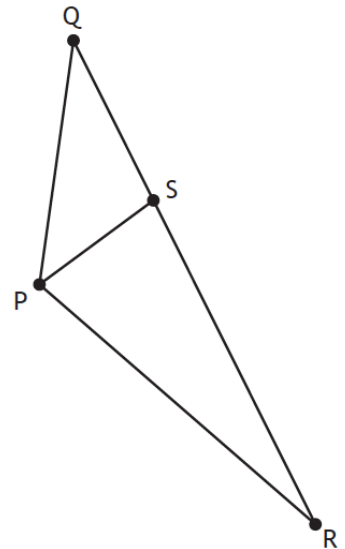
In the diagram, $\overrightarrow{PR} = 9\mathbf{i} + 5\mathbf{j} + 2\mathbf{k}$ and $\overrightarrow{RQ} = -12\mathbf{i} - 9\mathbf{j} + 3\mathbf{k}$.

(a) Express \overrightarrow{PQ} in terms of \mathbf{i} , \mathbf{j} and \mathbf{k} .

The point S divides QR in the ratio $1:2$.

(b) Show that $\overrightarrow{PS} = \mathbf{i} - \mathbf{j} + 4\mathbf{k}$.

(c) Hence, find the size of angle QPS .



Q7

Vectors \mathbf{u} and \mathbf{v} are $\begin{pmatrix} -1 \\ 4 \\ -3 \end{pmatrix}$ and $\begin{pmatrix} -7 \\ 8 \\ 5 \end{pmatrix}$ respectively.

(a) Evaluate $\mathbf{u} \cdot \mathbf{v}$.

(b) Calculate the acute angle between \mathbf{u} and \mathbf{w} .