

Pure 2 Ch12 – Vectors in 3D

Q1.

Relative to a fixed origin O

- the point A has position vector $5\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$
- the point B has position vector $2\mathbf{i} + 4\mathbf{j} + a\mathbf{k}$

where a is a positive integer.

(a) Show that $|\vec{OA}| = \sqrt{38}$

(1)

(b) Find the smallest value of a for which

$$|\vec{OB}| > |\vec{OA}|$$

(2)

(Total for question = 3 marks)

Q2.

Relative to a fixed origin O ,

the point A has position vector $(2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k})$,

the point B has position vector $(4\mathbf{i} - 2\mathbf{j} + 3\mathbf{k})$,

and the point C has position vector $(a\mathbf{i} + 5\mathbf{j} - 2\mathbf{k})$, where a is a constant and $a < 0$

D is the point such that $\vec{AB} = \vec{BD}$.

(a) Find the position vector of D .

(2)

Given $|\vec{AC}| = 4$

(b) find the value of a .

(3)

(Total for question = 5 marks)

Q3.

Relative to a fixed origin O

- the point A has position vector $4\mathbf{i} - 3\mathbf{j} + 5\mathbf{k}$
- the point B has position vector $4\mathbf{j} + 6\mathbf{k}$
- the point C has position vector $-16\mathbf{i} + p\mathbf{j} + 10\mathbf{k}$

where p is a constant.

Given that A , B and C lie on a straight line,

(a) find the value of p .

(3)

The line segment OB is extended to a point D so that $\vec{CD}$ is parallel to $\vec{OA}$

(b) Find $|\vec{OD}|$, writing your answer as a fully simplified surd.

(3)

(Total for question = 6 marks)

Q4.

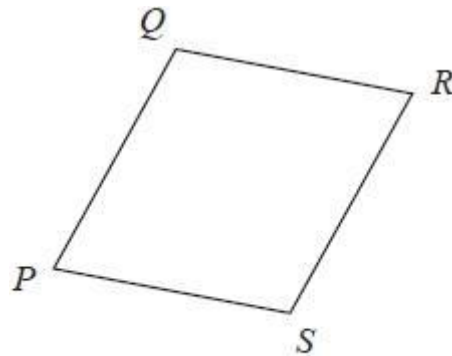


Figure 3

Figure 3 shows a sketch of a parallelogram $PQRS$.

Given that

• $\vec{PQ} = 2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$

• $\vec{QR} = 5\mathbf{i} - 2\mathbf{k}$

(a) show that parallelogram $PQRS$ is a rhombus.

(2)

(b) Find the exact area of the rhombus $PQRS$.

(4)

(Total for question = 6 marks)

Q5.

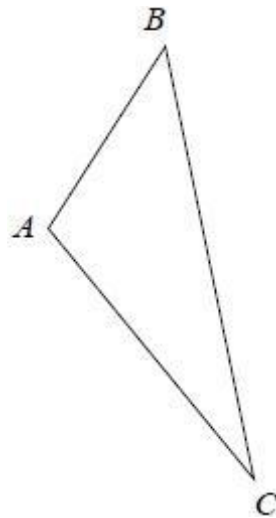


Figure 2

Figure 2 shows a sketch of a triangle ABC .

Given $\vec{AB} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$ and $\vec{BC} = \mathbf{i} - 9\mathbf{j} + 3\mathbf{k}$,
show that $\angle BAC = 105.9^\circ$ to one decimal place.

(5)

(Total for question = 5 marks)

Q6.

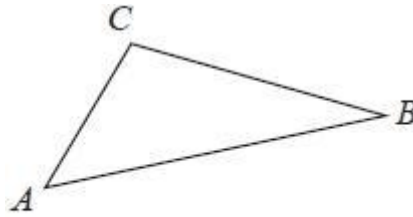


Figure 1

Figure 1 shows a sketch of triangle ABC .

Given that

- $\vec{AB} = -3\mathbf{i} - 4\mathbf{j} - 5\mathbf{k}$

- $\vec{BC} = \mathbf{i} + \mathbf{j} + 4\mathbf{k}$

(a) find $\vec{AC}$

(2)

(b) show that $\cos ABC = \frac{9}{10}$

(3)

(Total for question = 5 marks)

Q7.

Relative to a fixed origin O

- point A has position vector $2\mathbf{i} + 5\mathbf{j} - 6\mathbf{k}$
- point B has position vector $3\mathbf{i} - 3\mathbf{j} - 4\mathbf{k}$
- point C has position vector $2\mathbf{i} - 16\mathbf{j} + 4\mathbf{k}$

(a) Find $\vec{AB}$

(2)

(b) Show that quadrilateral $OABC$ is a trapezium, giving reasons for your answer.

(2)

(Total for question = 4 marks)

