

Pure 2 Ch12 - Vectors in 3D

Q1.

Relative to a fixed origin O

- the point A has position vector 5i + 3j + 2k
- the point B has position vector 2i + 4j + ak
 where a is a positive integer.
- (a) Show that $|\overrightarrow{OA}| = \sqrt{38}$
- (b) Find the smallest value of a for which

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

(2)

(1)

(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 (ai + 5j - 2k), where a is a constant and a < 0

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

(a) Find the position vector of D.

(2)

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

(b) find the value of a.

(3)

(Total for question = 5 marks)



Relative to a fixed origin O

- the point A has position vector 4i 3j + 5k
- the point B has position vector 4j + 6k
- the point C has position vector -16i + pj + 10k

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 \overrightarrow{CD} is parallel to \overrightarrow{OA}

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

(3)

(Total for question = 6 marks)



Q4.

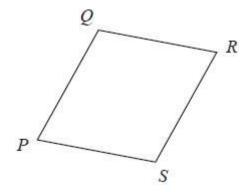


Figure 3

Figure 3 shows a sketch of a parallelogram PQRS.

Given that

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

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

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

(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.

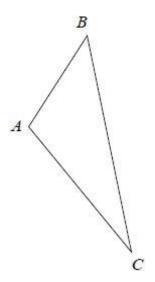


Figure 2

Figure 2 shows a sketch of a triangle ABC.

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

(5)

(Total for question = 5 marks)



Q6.

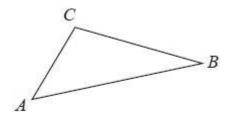


Figure 1

Figure 1 shows a sketch of triangle ABC.

Given that

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

• $\overrightarrow{BC} = \mathbf{i} + \mathbf{j} + 4\mathbf{k}$

•
$$\overrightarrow{BC} = \mathbf{i} + \mathbf{j} + 4\mathbf{k}$$

(a) find
$$\overrightarrow{AC}$$

(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 2i + 5j 6k
- point B has position vector 3i 3j 4k
- point C has position vector 2i 16j + 4k
- (a) Find \overrightarrow{AB}

(2)

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

(2)

(Total for question = 4 marks)