Exam Questions – Chapter 11 Vectors (AS)

Q1.

[*In this question the unit vectors* **i** *and* **j** *are due east and due north respectively*.]

A stone slides horizontally across ice.

Initially the stone is at the point $A(-24\mathbf{i} - 10\mathbf{j})$ m relative to a fixed point O.

After 4 seconds the stone is at the point $B(12\mathbf{i} + 5\mathbf{j})$ m relative to the fixed point O.

The motion of the stone is modelled as that of a particle moving in a straight line at constant speed.

Using the model,

(a) prove that the stone passes through O,

(2)

(b) calculate the speed of the stone.

(3)

(Total for question = 5 marks)

Q2.

Relative to a fixed origin O

- the point A has coordinates $(3, -8)$
- the point B is such that $\overrightarrow{AB} = -5\mathbf{i} + 2\mathbf{j}$

(a) Find the exact value of $|\overrightarrow{OB}|$

(3)

(b) Find the size of angle OAB, giving your answer in degrees to one decimal place.

(3)

(Total for question = 6 marks)

Q3.

Given that the point A has position vector $4\mathbf{i} - 5\mathbf{j}$ and the point B has position vector $-5\mathbf{i} - 2\mathbf{j}$,

(a) find the vector $\overrightarrow{AB}$,

(2)

(b) find $|\overrightarrow{AB}|$.

Give your answer as a simplified surd.

(2)

(Total for question = 4 marks)

Q4.

The triangle *PQR* is such that $\overrightarrow{PQ}$ = 3**i** + 5**j** and $\overrightarrow{PR}$ = 13**i** − 15**j**

(a) Find $\overrightarrow{QR}$

(2)

(b) Hence find $|\overrightarrow{QR}|$ giving your answer as a simplified surd.

(2)

The point *S* lies on the line segment *QR* so that *QS*:*SR* = 3:2

(c) Find $\overrightarrow{PS}$

(2)

(Total for question = 6 marks)

Q5.

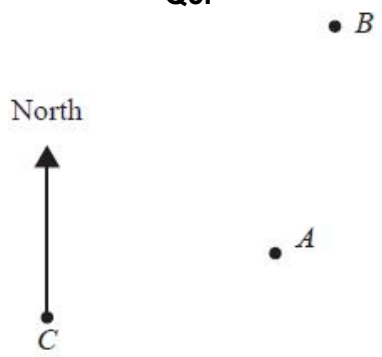

Figure 1

Figure 1 is a sketch showing the position of three phone masts, *A*, *B* and *C*.

The masts are identical and their bases are assumed to lie in the same horizontal plane.

From mast *C*

- mast *A* is 8.2 km away on a bearing of 072°
- mast *B* is 15.6 km away on a bearing of 039°

(a) Find the distance between masts *A* and *B*, giving your answer in km to one decimal place.

(3)

An engineer needs to travel from mast *A* to mast *B*.

(b) Give a reason why the answer to part (a) is unlikely to be an accurate value for the distance the engineer travels.

(1)

(Total for question = 4 marks)

Q6.

Relative to a fixed origin O,

- point P has position vector $9\mathbf{i} - 8\mathbf{j}$
- point Q has position vector $3\mathbf{i} - 5\mathbf{j}$

(a) Find $\overrightarrow{PQ}$

(2)

Given that R is the point such that $\overrightarrow{QR} = 9\mathbf{i} + 18\mathbf{j}$

(b) show that angle $PQR = 90°$

(2)

Given also that S is the point such that $\overrightarrow{PS} = 3\overrightarrow{QR}$

(c) find the exact area of $PQRS$

(4)

(Total for question = 8 marks)

Q7.

Relative to a fixed origin O

- point A has position vector $10\mathbf{i} - 3\mathbf{j}$
- point B has position vector $-8\mathbf{i} + 9\mathbf{j}$
- point C has position vector $-2\mathbf{i} + p\mathbf{j}$ where p is a constant

(a) Find $\overrightarrow{AB}$

(2)

(b) Find $\left|\overrightarrow{AB}\right|$ giving your answer as a fully simplified surd.

(2)

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

(c) (i) find the value of p,

(ii) state the ratio of the area of triangle AOC to the area of triangle AOB.

(3)

(Total for question = 7 marks)

Q8.

Given that the point A has position vector $3\mathbf{i} - 7\mathbf{j}$ and the point B has position vector $8\mathbf{i} + 3\mathbf{j}$,

(a) find the vector $\overrightarrow{AB}$.

(2)

(b) Find $|\overrightarrow{AB}|$. Give your answer as a simplified surd.

(2)

(Total for question = 4 marks)

Q9.

(i) Two non-zero vectors, $\mathbf{a}$ and $\mathbf{b}$, are such that

$$|\mathbf{a} + \mathbf{b}| = |\mathbf{a}| + |\mathbf{b}|$$

Explain, geometrically, the significance of this statement.

(1)

(ii) Two different vectors, $\mathbf{m}$ and $\mathbf{n}$, are such that $|\mathbf{m}| = 3$ and $|\mathbf{m} - \mathbf{n}| = 6$

The angle between vector $\mathbf{m}$ and vector $\mathbf{n}$ is 30°
Find the angle between vector $\mathbf{m}$ and vector $\mathbf{m} - \mathbf{n}$, giving your answer, in degrees, to one decimal place.

(4)

(Total for question = 5 marks)