Questions

Q1.

Given that the point *A* has position vector 3**i** – 7**j** and the point *B* has position vector 8**i** + 3**j**,

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

(2)

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

(2)

(Total for question = 4 marks)

Q2.

Given that the point *A* has position vector 4**i** – 5**j** and the point *B* has position vector –5**i** –2**j**,

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

(2)

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

Give your answer as a simplified surd.

(2)

(Total for question = 4 marks)

Q3.

(i) Two non-zero vectors, **a** and **b**, are such that

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

Explain, geometrically, the significance of this statement.

(1)

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

The angle between vector **m** and vector **n** is 30°
Find the angle between vector **m** and vector **m** – **n**, giving your answer, in degrees, to
one decimal place.

(4)

(Total for question = 5 marks)

Q4.

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

A coastguard station *O* monitors the movements of a small boat.

At 10:00 the boat is at the point (4**i** − 2**j**) km relative to *O*.

At 12:45 the boat is at the point (−3**i** − 5**j**) km relative to *O*.

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

(a) Calculate the bearing on which the boat is moving, giving your answer in degrees to one decimal place.

(3)

(b) Calculate the speed of the boat, giving your answer in km h⁻¹

(3)

(Total for question = 6 marks)

Q5.

[*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)

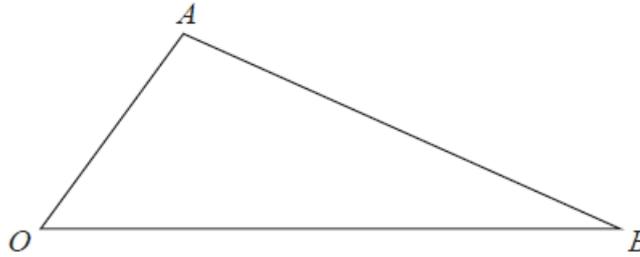(b) calculate the speed of the stone.

(3)

(Total for question = 5 marks)

Q6.

Figure 7

Figure 7 shows a sketch of triangle *OAB*.

The point *C* is such that $\overrightarrow{OC} = 2\overrightarrow{OA}$.

The point *M* is the midpoint of *AB*.

The straight line through *C* and *M* cuts *OB* at the point *N*.

Given $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

(a) Find $\overrightarrow{CM}$ in terms of **a** and **b**

(2)

(b) Show that $\overrightarrow{ON} = \left(2 - \dfrac{3}{2}\lambda\right)\mathbf{a} + \dfrac{1}{2}\lambda\mathbf{b}$, where λ is a scalar constant.

(2)

(c) Hence prove that *ON* : *NB* = 2 : 1

(2)

(Total for question = 6 marks)

Q7.

Relative to a fixed origin, points P, Q and R have position vectors **p**, **q** and **r** respectively.

Given that

- P, Q and R lie on a straight line
- Q lies one third of the way from P to R

show that

$$q = \frac{1}{3}(r + 2p)$$

(Total for question = 3 marks)