ELIJAH MATHS
GCSE and A Level Maths

as level

VECTORS

Question 1

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)

Question 2

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)

Question 3

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)

Question 4

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

(a) Find $\overrightarrow{QR}$

(2)

(b) Hence find $\left|\overrightarrow{QR}\right|$ 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)

Question 5

[*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)

Question 6

[*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 $(4\mathbf{i} - 2\mathbf{j})$ km relative to O.

At 12:45 the boat is at the point $(-3\mathbf{i} - 5\mathbf{j})$ 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)

Question 7

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)