1 $\mathbf{p} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$

(a) Find $2\mathbf{p} + \mathbf{q}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(b) Find $|\mathbf{p}|$.

..... [2]

[Total: 4]

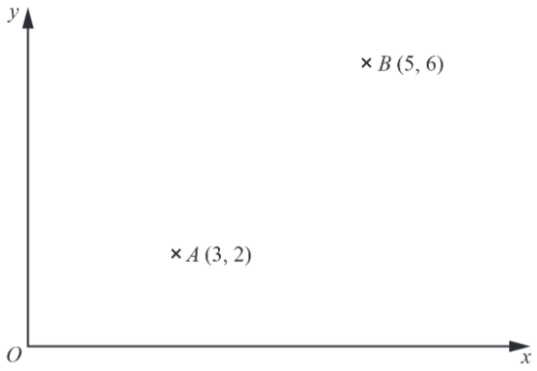
2 A is the point (4, 1) and $\overrightarrow{AB} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$.

Find the coordinates of B.

(..... , ...) [1]

[Total: 1]

3 **(a)** Find the column vector $\overrightarrow{AB}$.



$\overrightarrow{AB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

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

$\left|\overrightarrow{AB}\right|$ = ... [2]

(c) B is the mid-point of the line AC.

Find the co-ordinates of C.

(..... , ...) [2]

(d) Find the equation of the straight line that passes through A and B.

..... [3]

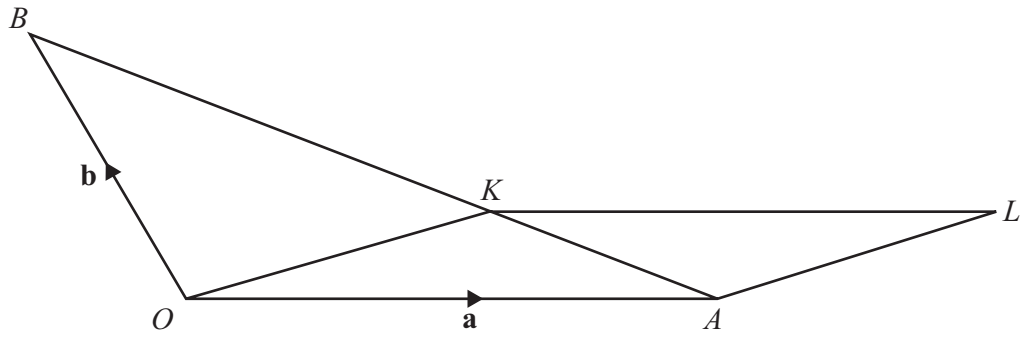
(e) The straight line that passes through A and B cuts the y-axis at D.

Write down the co-ordinates of D.

(..... , ...) [1]

[Total: 9]

4



NOT TO SCALE

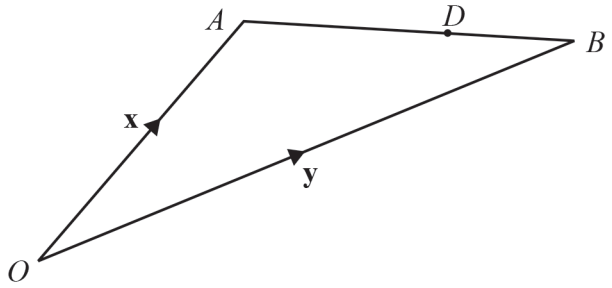
The diagram shows a triangle OAB and a parallelogram $OALK$.
The position vector of A is **a** and the position vector of B is **b**.
K is a point on AB so that $AK : KB = 1 : 2$.

Find the position vector of L, in terms of **a** and **b**.
Give your answer in its simplest form.

..... [4]

[Total: 4]

5



NOT TO SCALE

$\overrightarrow{OA} = \mathbf{x}$, $\overrightarrow{OB} = \mathbf{y}$ and $\overrightarrow{OD} = \frac{3}{7}\mathbf{x} + \frac{4}{7}\mathbf{y}$.

Calculate the ratio $AD : DB$.

..... : ..... [2]

[Total: 2]

6 $\mathbf{p} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

Find $|\mathbf{p} - \mathbf{q}|$.

..... [2]

[Total: 2]

7 A has coordinates $(-2, 7)$, B has coordinates $(1, -5)$ and C has coordinates $(5, 4)$.

(a) Find the coordinates of the midpoint of the line AB.

(..... , ...) [2]

(b) Find $\overrightarrow{AC}$.

$\overrightarrow{AC} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(c) Find $\left|\overrightarrow{AC}\right|$.

..... [2]

(d) Find the equation of the line AB.
Give your answer in the form $y = mx + c$.

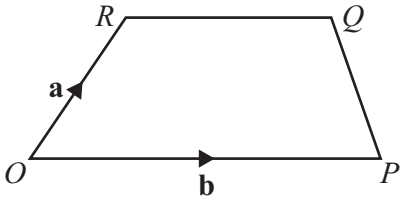
$y =$ ..... [3]

(e) Find the equation of the line perpendicular to AB that passes through C.
Give your answer in the form $y = mx + c$.

$y =$ ..... [3]

[Total: 12]

8



NOT TO SCALE

The diagram shows a trapezium $OPQR$.
O is the origin, $\overrightarrow{OR} = \mathbf{a}$ and $\overrightarrow{OP} = \mathbf{b}$.

$$\left|\overrightarrow{RQ}\right| = \frac{3}{5}\left|\overrightarrow{OP}\right|$$

(a) Find $\overrightarrow{PQ}$ in terms of **a** and **b** in its simplest form.

$\overrightarrow{PQ} =$ ..... [2]

(b) When PQ and OR are extended, they intersect at W.

Find the position vector of W.

..... [2]

[Total: 4]

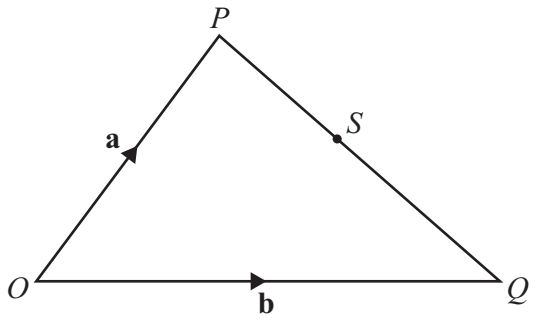
9 The magnitude of the vector $\begin{pmatrix} 20 \\ k \end{pmatrix}$ is 29.

Find the value of k.

$k =$ ..... [3]

[Total: 3]

10



NOT TO SCALE

S is a point on PQ such that $PS : SQ = 4 : 5$.

Find $\overrightarrow{OS}$, in terms of **a** and **b**, in its simplest form.

$\overrightarrow{OS} =$ ..... [2]

[Total: 2]

11 A is the point (7, 2) and B is the point (−5, 8).

(a) Calculate the length of AB.

..... [3]

(b) Find the equation of the line that is perpendicular to AB and that passes through the point $(-1, 3)$.
Give your answer in the form $y = mx + c$.

$y =$ ..... [4]

(c) AB is one side of the parallelogram $ABCD$ and

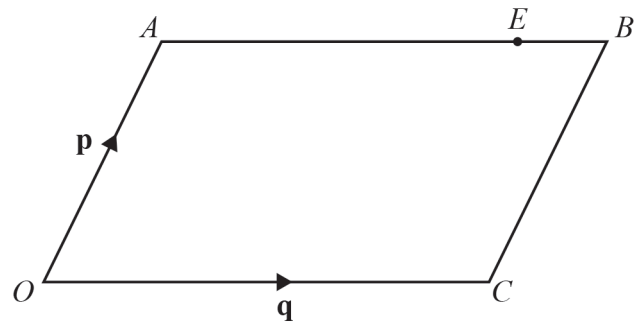
- $\overrightarrow{BC} = \begin{pmatrix} -a \\ -b \end{pmatrix}$ where $a > 0$ and $b > 0$
- the gradient of BC is 1
- $\left|\overrightarrow{BC}\right| = \sqrt{8}$.

Find the coordinates of D.

(..... , ...) [4]

[Total: 11]

12



NOT TO SCALE

OABC is a parallelogram.

$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$.
E is the point on *AB* such that *AE* : *EB* = 3 : 1.

Find $\overrightarrow{OE}$, in terms of **p** and **q**, in its simplest form.

$\overrightarrow{OE}$ = ... [2]

[Total: 2]

13 $\overrightarrow{VW} = \begin{pmatrix} 10 \\ -24 \end{pmatrix}$

Find $\left|\overrightarrow{VW}\right|$.

..... [2]

[Total: 2]

14 $\mathbf{a} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 7 \\ -4 \end{pmatrix}$

Work out.

(a) $4\mathbf{a}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) $2\mathbf{a} - \mathbf{b}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

[Total: 3]

15 **(a)** Write down the coordinates of point P.

(..... , ...) [1]

(b) On the grid, plot point Q at (–4, 2). [1]

(c) $\overrightarrow{PR} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$

On the grid, plot point R. [1]

(d) On the grid, draw the line $y = 3$. [1]

[Total: 4]

16 $\mathbf{p} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

Find

(a) $\mathbf{p} - \mathbf{q}$,

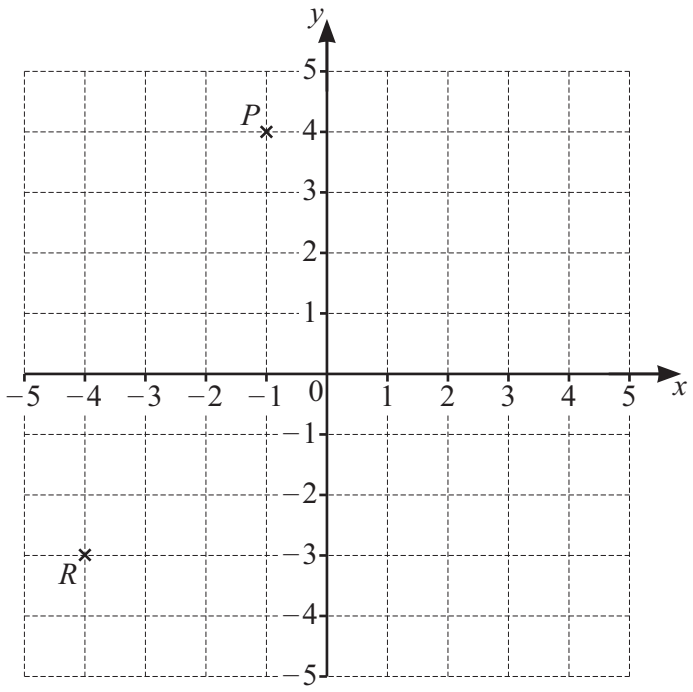
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) 6**p**.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

[Total: 2]

17 The grid shows point P and point R.



(a) Write down the coordinates of point P.

(..... , ...) [1]

(b) $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$

Mark point Q on the grid. [1]

(c) Find $\overrightarrow{QR}$.

$\overrightarrow{QR} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(d) Complete this statement.

$\overrightarrow{PQ} + \overrightarrow{QR} =$ $\overrightarrow{\quad\quad}$

.....

[1]

[Total: 4]

18 Work out.

$3\begin{pmatrix} -4 \\ 7 \end{pmatrix}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

[Total: 1]

19 Work out.

$\begin{pmatrix} 6 \\ -5 \end{pmatrix} + \begin{pmatrix} 8 \\ -1 \end{pmatrix}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

[Total: 1]

20 $\mathbf{a} = \begin{pmatrix} 5 \\ -7 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -2 \\ 6 \end{pmatrix}$

Work out $\mathbf{a} - \mathbf{b}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$

[1]

[Total: 1]

21 Point L has coordinates $(-3, 6)$ and $\overrightarrow{LM} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$.

Find the coordinates of point M.

(..... , ...) [1]

[Total: 1]

22 Work out.

(a) $2\begin{pmatrix} -3 \\ 7 \end{pmatrix}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) $\begin{pmatrix} 8 \\ -6 \end{pmatrix} + \begin{pmatrix} -5 \\ 2 \end{pmatrix}$

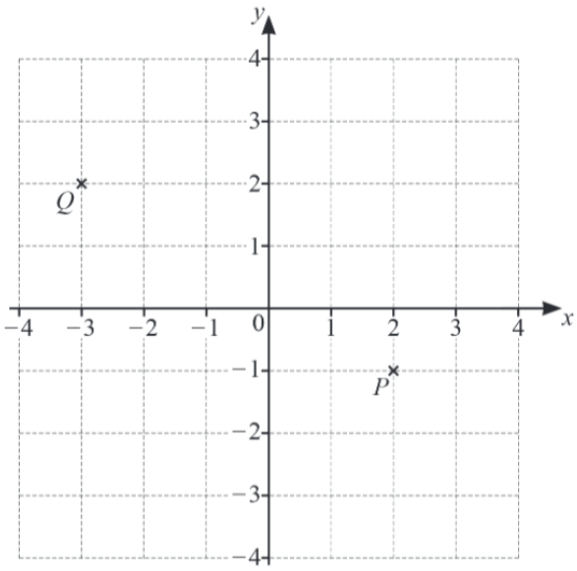
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

[Total: 2]

23 **(a)** Write $\overrightarrow{PQ}$ as a column vector.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

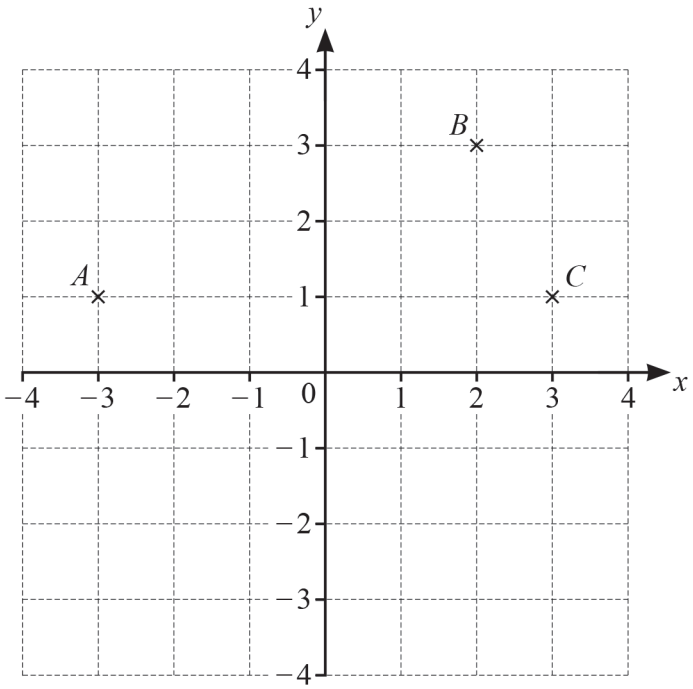
(b) Write $3\overrightarrow{PQ}$ as a single vector.



$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

[Total: 2]

24



Points A, B and C are shown on the grid.

(a) Write down the coordinates of point C.

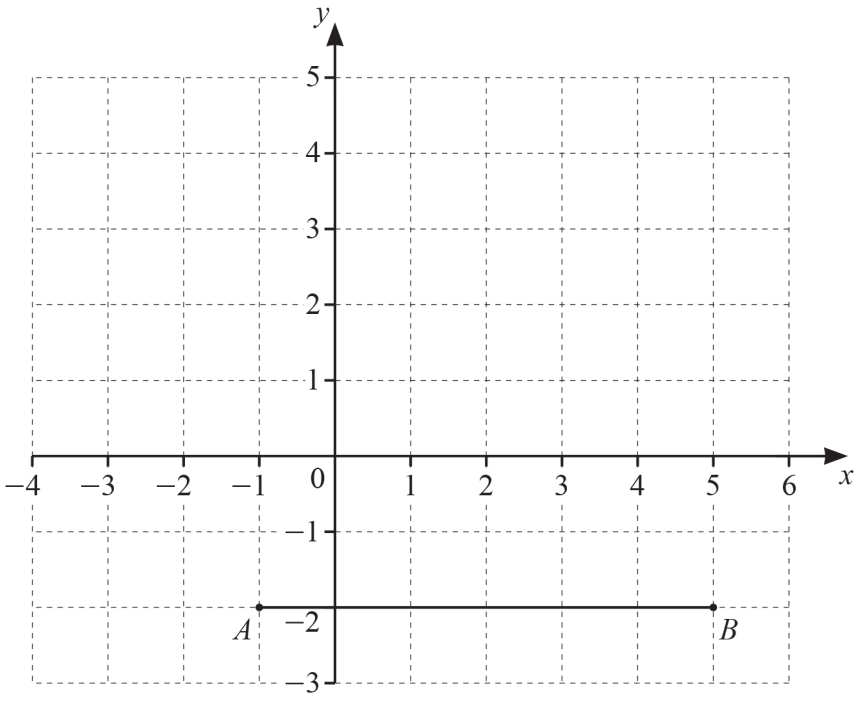
(..... , ...) [1]

(b) On the grid, plot point D so that $ABCD$ is a parallelogram. [1]

(c) On the grid, plot point E so that $\overrightarrow{EA} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$. [2]

[Total: 4]

25 The diagram shows a line AB on a 1 cm^2 grid.



(a) Write down the coordinates of point A.

(..... , ...) [1]

(b) Write down the vector $\overrightarrow{AB}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(c) $\overrightarrow{BC} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$

Mark point C on the grid. [1]

(d) **(i)** Work out $\overrightarrow{AB} + \overrightarrow{BC}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) Complete this statement.

$\overrightarrow{AB} + \overrightarrow{BC} =$ $\longrightarrow$ .....

[1]

(e) A, B and C are three vertices of a parallelogram, $ABCD$.

(i) Mark point D on the diagram and draw the parallelogram $ABCD$. [1]

(ii) Work out the area of the parallelogram.
Give the units of your answer.

.... [2]

[Total: 8]