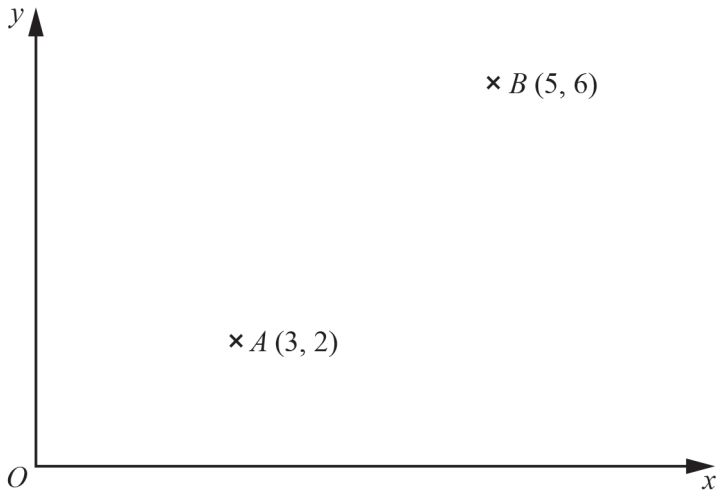
PapaCambridge

Topical Worksheets for Cambridge O LEVEL Mathematics D (4024)

Vectors

1st edition, for examination until 2025

1



(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]

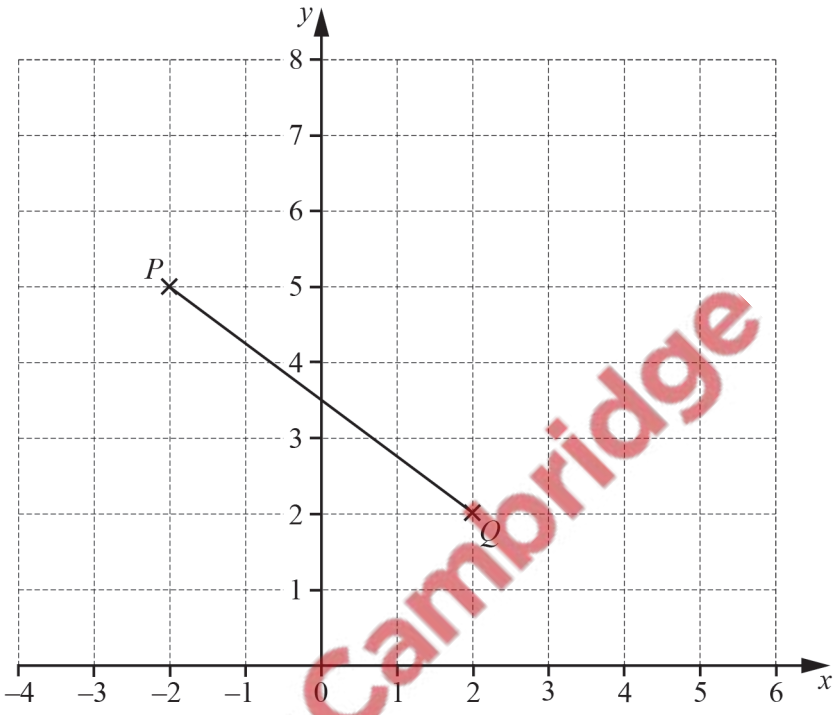
(e) The straight line that passes through A and B cuts the y-axis at D.

Write down the co-ordinates of D.

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

[Total: 9]

2



(a) Write down the co-ordinates of point P.

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

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

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

(c) $\overrightarrow{QR} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

On the grid, plot point R. [1]

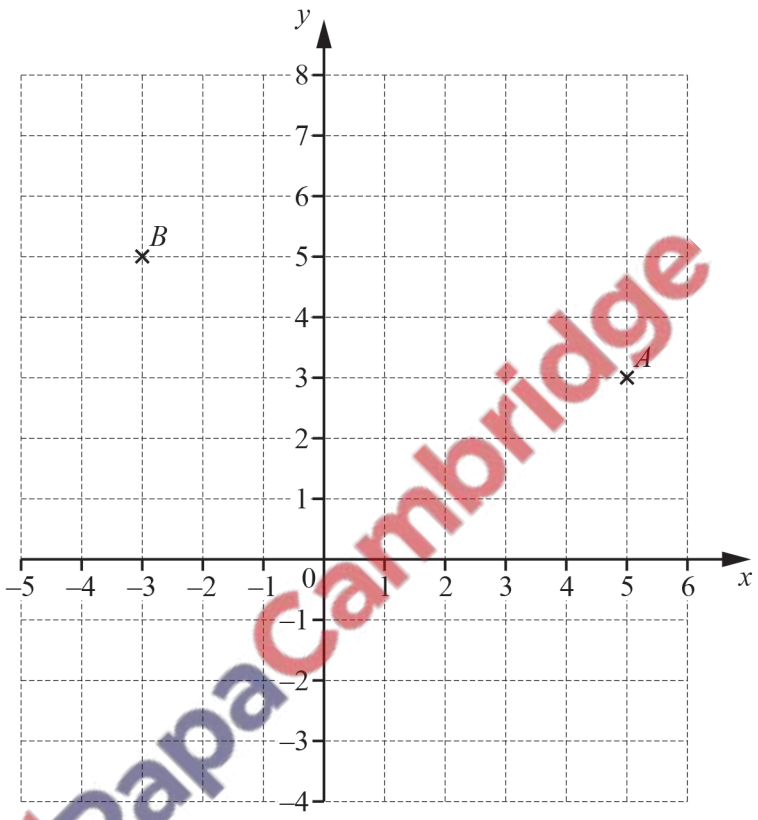
(d) *PQRS* is a parallelogram.

On the grid, complete the parallelogram *PQRS*.
Write down the co-ordinates of point *S*.

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

[Total: 5]

3



(a) Write down the co-ordinates of point *A*.

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

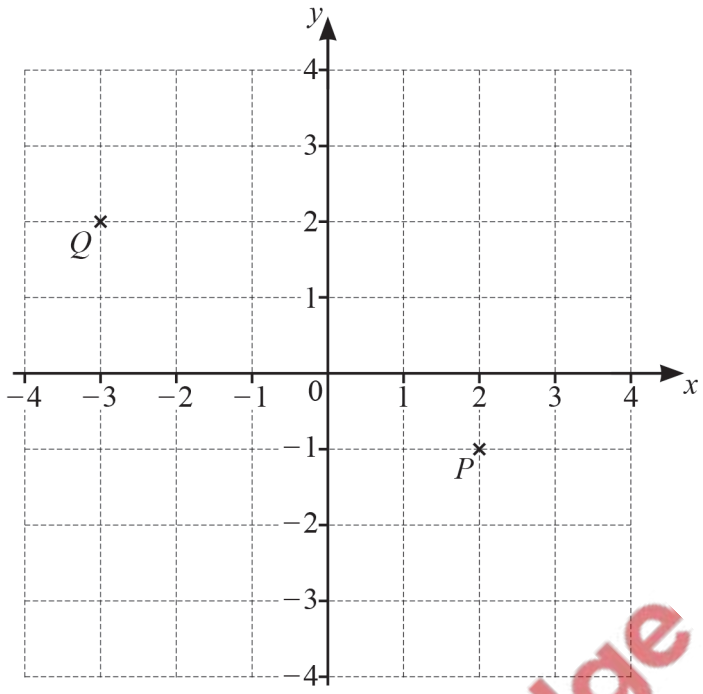
(b) Plot the point *C* at (4, –3). [1]

(c) Find the vector $\overrightarrow{AB}$.

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

[Total: 3]

4



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

( ) [1]

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

( ) [1]

[Total: 2]

5 Work out.

(a) $\begin{pmatrix} 4 \\ -2 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

( ) [1]

(b) $6\begin{pmatrix} 3 \\ 0 \end{pmatrix}$

( ) [1]

[Total: 2]

6 $\mathbf{p} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} 1 \\ 6 \end{pmatrix}$

Work out $2\mathbf{p} + 3\mathbf{q}$.

( ) [2]

[Total: 2]

7 $\mathbf{e} = \begin{pmatrix} -5 \\ 4 \end{pmatrix}$ $\mathbf{f} = \begin{pmatrix} 0 \\ 6 \end{pmatrix}$

Write as a single vector

(a) $3\mathbf{e}$,

( ) [1]

(b) $\mathbf{f} - \mathbf{e}$.

( ) [1]

[Total: 2]

8 Work out.

(a) $\begin{pmatrix} -2 \\ 5 \end{pmatrix} - \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

( ) [1]

(b) $7\begin{pmatrix} -3 \\ 4 \end{pmatrix}$

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

[Total: 2]

9 $\mathbf{a} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 14 \\ 9 \end{pmatrix}$

(a) Find $3\mathbf{a} - 2\mathbf{b}$.

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

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

..... [2]

(c) $m\mathbf{a} + n\mathbf{b} = \mathbf{c}$

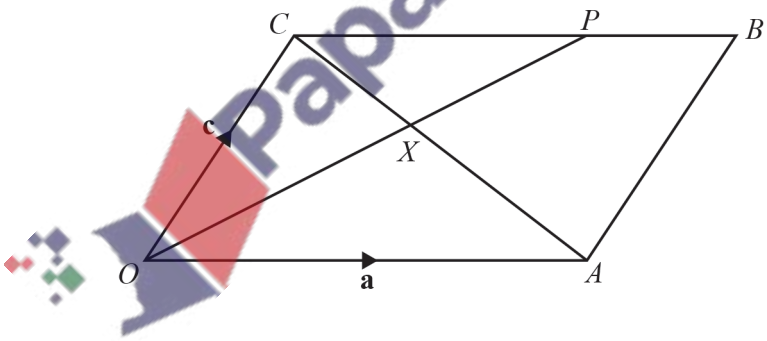
Write down two simultaneous equations and solve them to find the value of m and the value of n. Show all your working.

$m =$ .....

$n =$ ..... [5]

[Total: 9]

10



NOT TO SCALE

In the diagram, $OABC$ is a parallelogram.
OP and CA intersect at X and $CP : PB = 2 : 1$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

(a) Find $\overrightarrow{OP}$, in terms of $\mathbf{a}$ and $\mathbf{c}$, in its simplest form.

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

(b) $CX : XA = 2 : 3$

(i) Find $\overrightarrow{OX}$, in terms of **a** and **c**, in its simplest form.

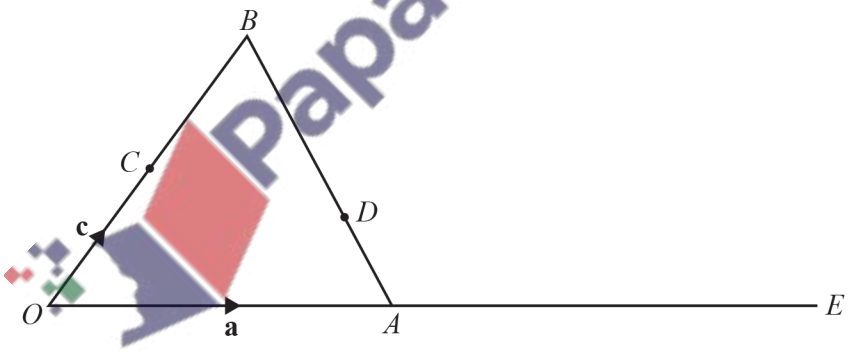
$\overrightarrow{OX}$ = ... [2]

(ii) Find $OX : XP$.

$OX : XP$ = ... : ..... [2]

[Total: 6]

11



NOT TO SCALE

OAB is a triangle and C is the mid-point of OB.
D is on AB such that $AD : DB = 3 : 5$.
OAE is a straight line such that $OA : AE = 2 : 3$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

(a) Find, in terms of **a** and **c**, in its simplest form,

(i) $\overrightarrow{AB}$,

$\overrightarrow{AB}$ = ... [1]

(ii) $\overrightarrow{AD}$,

$\overrightarrow{AD}$ = ... [1]

(iii) $\overrightarrow{CE}$,

$\overrightarrow{CE}$ = ... [1]

(iv) $\overrightarrow{CD}$.

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

(b) $\overrightarrow{CE} = k\overrightarrow{CD}$

Find the value of k.

k = ... [1]

[Total: 6]

12 $\overrightarrow{OA} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $\overrightarrow{AB} = \begin{pmatrix} 8 \\ -7 \end{pmatrix}$ $\overrightarrow{AC} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$

Find

(a) $\left|\overrightarrow{OB}\right|$,

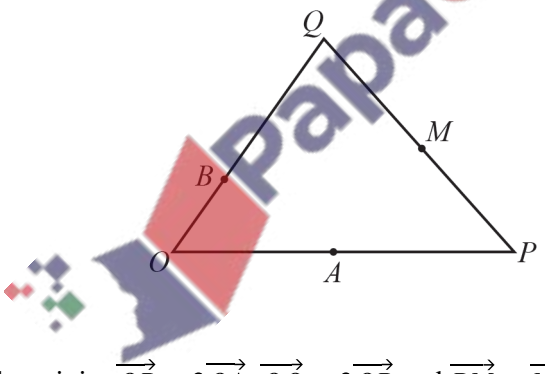
$\left|\overrightarrow{OB}\right|$ = ... [3]

(b) $\overrightarrow{BC}$.

$\overrightarrow{BC}$ = ( ) [2]

[Total: 5]

13



NOT TO SCALE

O is the origin, $\overrightarrow{OP} = 2\overrightarrow{OA}$, $\overrightarrow{OQ} = 3\overrightarrow{OB}$ and $\overrightarrow{PM} = \overrightarrow{MQ}$.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.

Find, in terms of **p** and **q**, in its simplest form

(a) $\overrightarrow{BA}$,

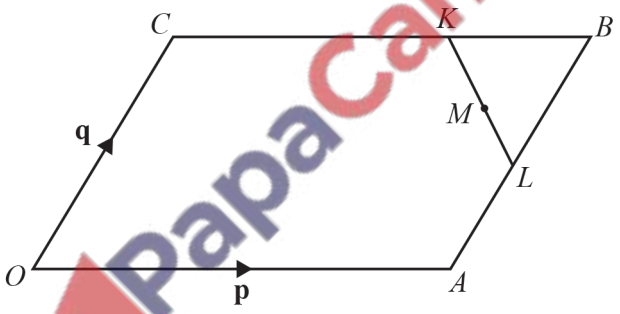
$\overrightarrow{BA}$ = ... [2]

(b) the position vector of M.

..... [2]

[Total: 4]

14



NOT TO SCALE

$OABC$ is a parallelogram and O is the origin.
$CK = 2KB$ and $AL = LB$.
M is the midpoint of KL.
$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$.

Find, in terms of **p** and **q**, giving your answer in its simplest form

(a) $\overrightarrow{KL}$,

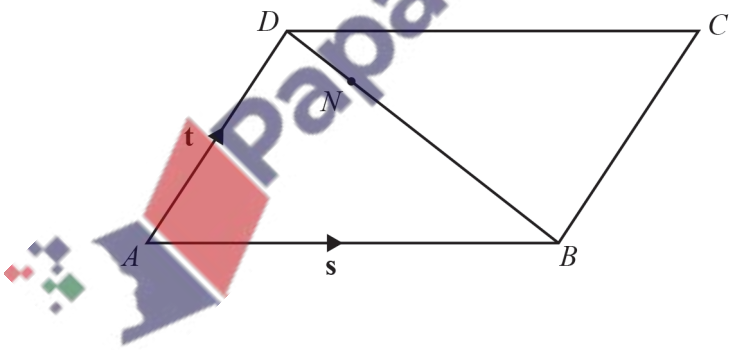
$\overrightarrow{KL}$ = ... [2]

(b) the position vector of M.

..... [2]

[Total: 4]

15



NOT TO SCALE

$ABCD$ is a parallelogram.
N is the point on BD such that $BN : ND = 4 : 1$.
$\overrightarrow{AB} = \mathbf{s}$ and $\overrightarrow{AD} = \mathbf{t}$.

Find, in terms of **s** and **t**, an expression in its simplest form for

(a) $\overrightarrow{BD}$,

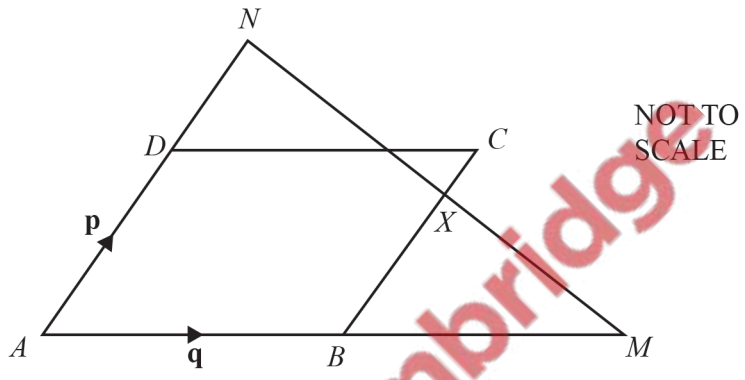
$\overrightarrow{BD}$ = ... [1]

(b) $\overrightarrow{CN}$.

$\overrightarrow{CN}$ = ... [3]

[Total: 4]

16



ABCD is a parallelogram with $\overrightarrow{AB}$ = **q** and $\overrightarrow{AD}$ = **p**.
ABM is a straight line with *AB* : *BM* = 1 : 1.
ADN is a straight line with *AD* : *DN* = 3 : 2.

(a) Write $\overrightarrow{MN}$, in terms of **p** and **q**, in its simplest form.

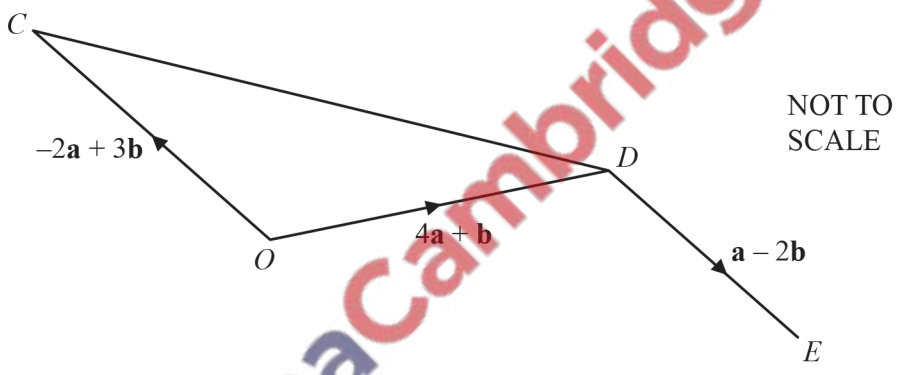
$\overrightarrow{MN}$ = ... [2]

(b) The straight line NM cuts BC at X.
X is the midpoint of MN.
$\overrightarrow{BX} = k\mathbf{p}$

Find the value of k.

$k =$ ..... [2]

[Total: 4]



17 In the diagram, O is the origin, $\overrightarrow{OC} = -2\mathbf{a} + 3\mathbf{b}$ and $\overrightarrow{OD} = 4\mathbf{a} + \mathbf{b}$.

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

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

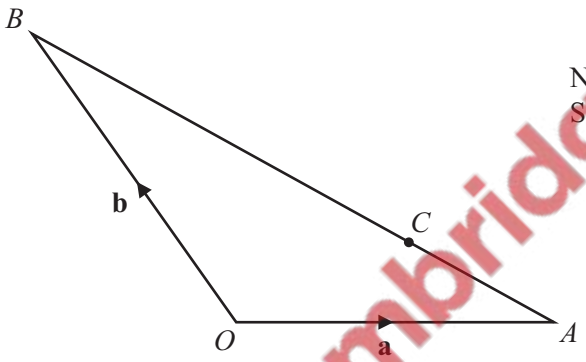
(b) $\overrightarrow{DE} = \mathbf{a} - 2\mathbf{b}$

Find the position vector of E, in terms of **a** and **b**, in its simplest form.

..... [2]

[Total: 4]

18



In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
C is on the line AB so that $AC : CB = 1 : 2$.

Find, in terms of **a** and **b,** in its simplest form,

(a) $\overrightarrow{AC}$,

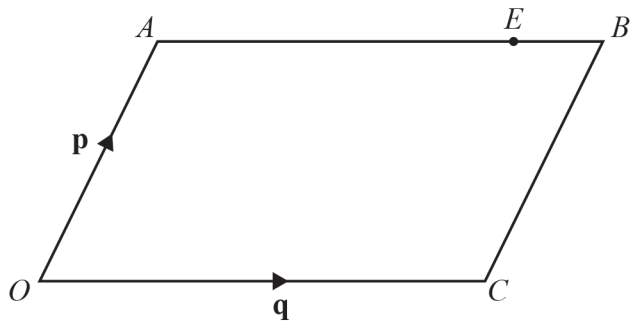
Answer(a) $\overrightarrow{AC} =$ ..... [2]

(b) the position vector of C.

Answer(b) ..... [2]

[Total: 4]

19



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 $\mathbf{p}$ and $\mathbf{q}$, in its simplest form.

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

[Total: 2]

20

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

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

..... [2]

[Total: 2]

21 O is the origin, $\overrightarrow{OA} = 2\mathbf{x} + 3\mathbf{y}$ and $\overrightarrow{BA} = \mathbf{x} - 4\mathbf{y}$.

Find the position vector of B, in terms of $\mathbf{x}$ and $\mathbf{y}$, in its simplest form.

..... [2]

[Total: 2]