

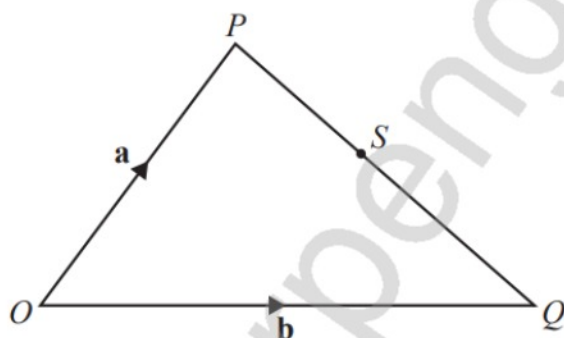
Q Vectors (Shapes and Position Vectors)

- 12** The position vector of A is $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ and $\overrightarrow{BA} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$.

Show that $|\overrightarrow{OB}| = 5.1$, correct to 1 decimal place.

[3]

18

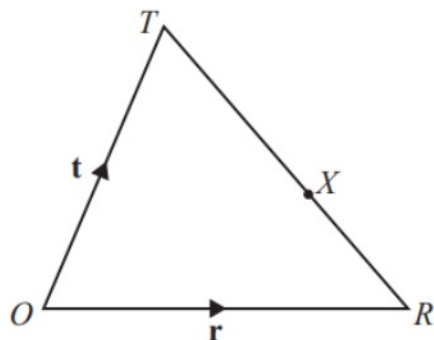


NOT TO
SCALE

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

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

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



NOT TO
SCALE

ORT is a triangle.

X is a point on TR so that $TX : XR = 3 : 2$.

O is the origin, $\overrightarrow{OR} = \mathbf{r}$ and $\overrightarrow{OT} = \mathbf{t}$.

Find the position vector of X .

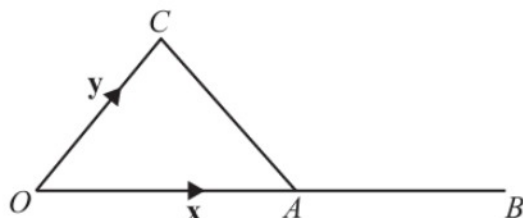
Give your answer in terms of $\mathbf{r}$ and $\mathbf{t}$ in its simplest form.

..... [3]

- 16 (a) Find the magnitude of the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$.

..... [2]

(b)



NOT TO
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The diagram shows a triangle OAC .
 A is the midpoint of the straight line OB .
 $\vec{OA} = \mathbf{x}$ and $\vec{OC} = \mathbf{y}$.

Find $\vec{CB}$ in terms of $\mathbf{x}$ and $\mathbf{y}$.

$\vec{CB} =$ [1]

17 (a) (i) $\mathbf{m} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$

Find $3\mathbf{m}$.

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

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

Find $|\overrightarrow{VW}|$.

..... [2]

(b)



NOT TO
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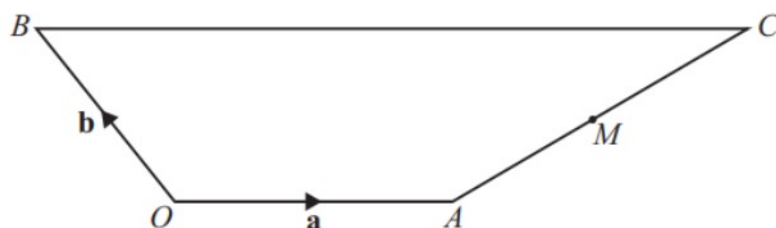
$OABC$ is a parallelogram.

$\overrightarrow{OA} = \mathbf{p}$ 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]



NOT TO
SCALE

In the diagram, OA is parallel to BC .

$BC = 3OA$

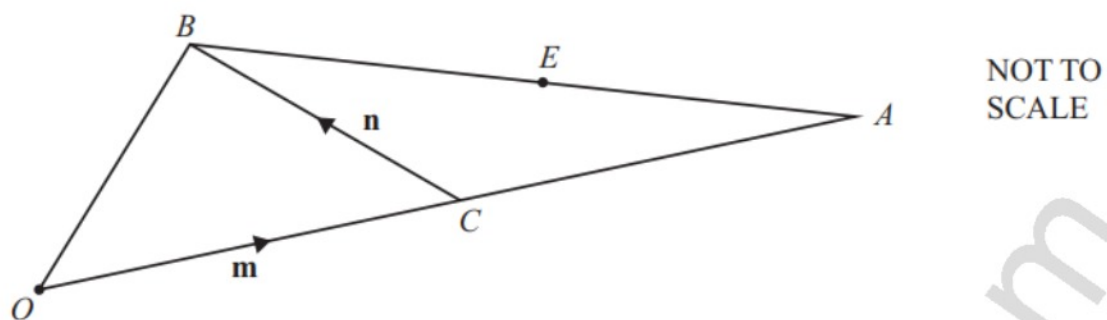
M is the midpoint of AC .

The position vector of A is $\mathbf{a}$ and the position vector of B is $\mathbf{b}$.

Find the position vector of M .

Give your answer in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form.

..... [3]



OAB is a triangle.

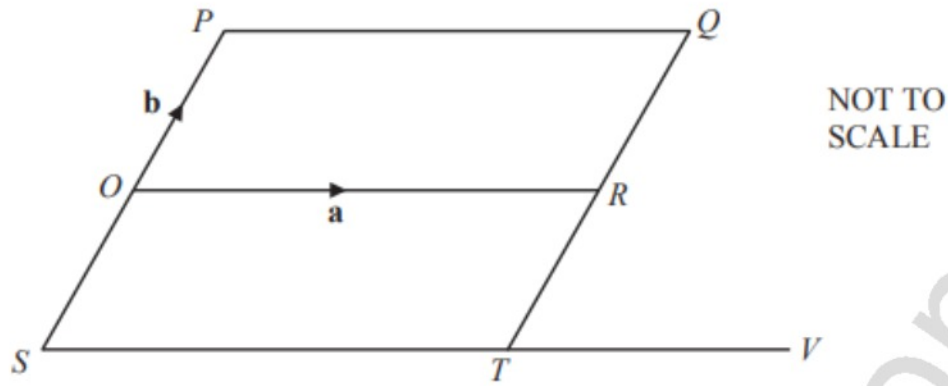
C is the midpoint of OA .

$\vec{OC} = \mathbf{m}$ and $\vec{CB} = \mathbf{n}$.

E lies on AB and $AE : EB = 4 : 5$.

Find, in terms of $\mathbf{m}$ and $\mathbf{n}$, the position vector of E .
Give your answer in its simplest form.

..... [4]



O is the origin and $OPQR$ is a parallelogram.

SOP is a straight line with $SO = OP$.

TRQ is a straight line with $TR = RQ$.

STV is a straight line and $ST:TV = 2:1$.

$\vec{OR} = \mathbf{a}$ and $\vec{OP} = \mathbf{b}$.

(a) Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form,

(i) the position vector of T ,

..... [2]

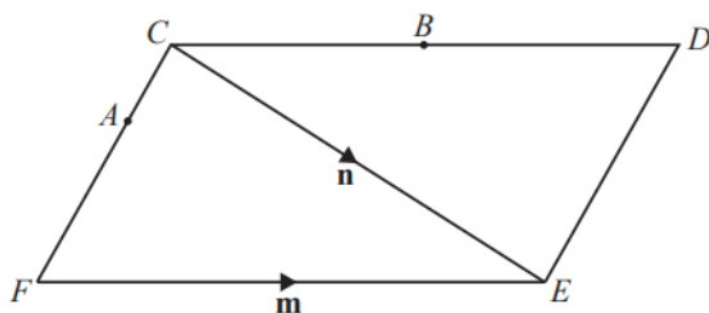
(ii) $\vec{RV}$.

$\vec{RV} =$ [1]

(b) Show that PT is parallel to RV .

[2]

23 (a)



NOT TO
SCALE

The diagram shows a parallelogram $CDEF$.

$\overrightarrow{FE} = \mathbf{m}$ and $\overrightarrow{CE} = \mathbf{n}$.

B is the midpoint of CD .

$FA = 2AC$

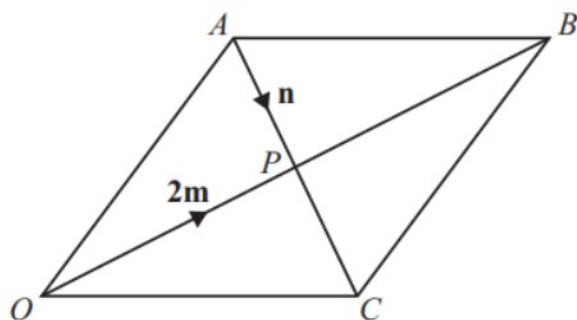
Find an expression, in terms of $\mathbf{m}$ and $\mathbf{n}$, for $\overrightarrow{AB}$.
Give your answer in its simplest form.

$\overrightarrow{AB} = \dots\dots\dots$ [3]

(b) $\overrightarrow{GH} = \frac{5}{6}(2\mathbf{p} + \mathbf{q})$ $\overrightarrow{JK} = \frac{5}{18}(2\mathbf{p} + \mathbf{q})$

Write down **two** facts about vectors $\overrightarrow{GH}$ and $\overrightarrow{JK}$.

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



NOT TO
SCALE

$OABC$ is a rhombus and O is the origin.
The diagonals of the rhombus intersect at P .
 $\vec{OP} = 2\mathbf{m}$ and $\vec{AP} = \mathbf{n}$.

(a) Find, in terms of $\mathbf{m}$ and $\mathbf{n}$, in its simplest form

(i) $\vec{OA}$

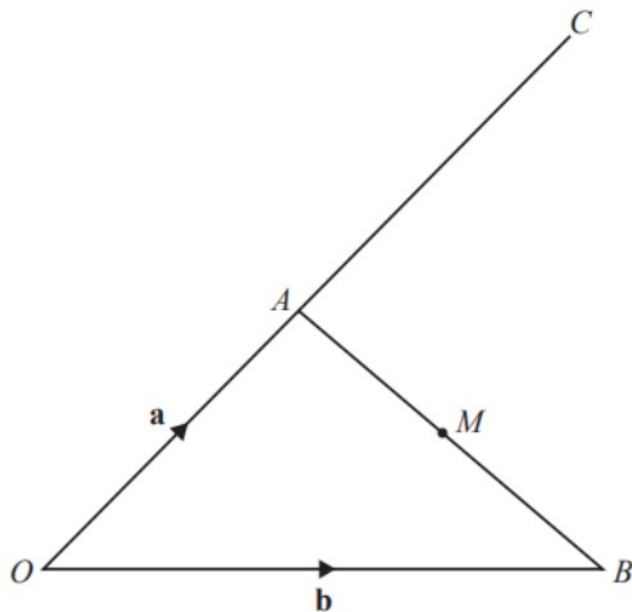
$\vec{OA} = \dots\dots\dots$ [1]

(ii) $\vec{OC}$.

$\vec{OC} = \dots\dots\dots$ [1]

(b) D is the point such that $\vec{AD} = 10\mathbf{m} - 3\mathbf{n}$.

Show that $OADC$ is a trapezium.



The diagram shows a triangle OAB and a straight line OAC .

$OA : OC = 2 : 5$ and M is the midpoint of AB .

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

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form

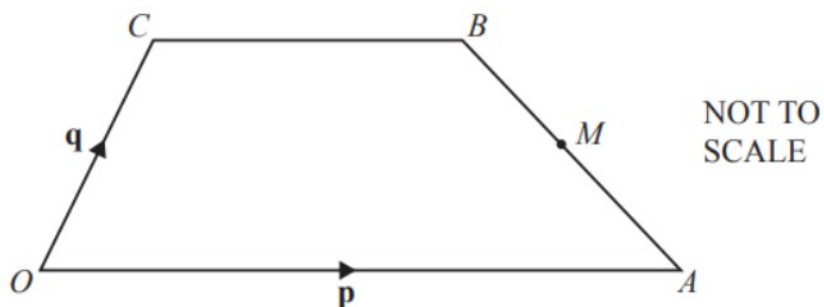
(a) $\overrightarrow{AB}$,

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

(b) $\overrightarrow{MC}$.

$\overrightarrow{MC} = \dots\dots\dots$ [3]

(b)



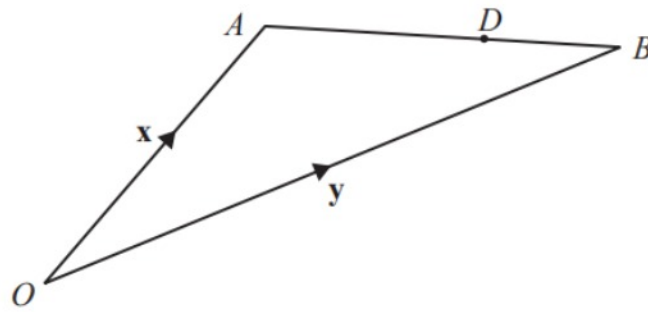
$OABC$ is a trapezium and O is the origin.

M is the midpoint of AB .

$\overrightarrow{OA} = \mathbf{p}$, $\overrightarrow{OC} = \mathbf{q}$ and $OA = 2CB$.

Find, in terms of $\mathbf{p}$ and $\mathbf{q}$, the position vector of M .
Give your answer in its simplest form.

..... [3]

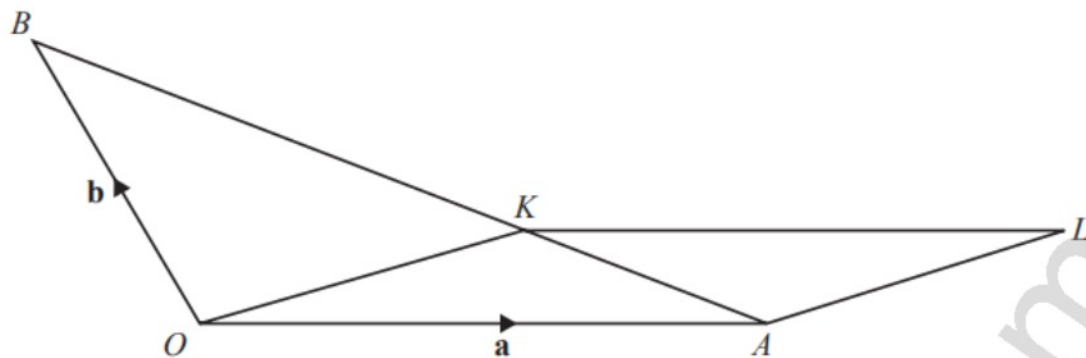


NOT TO
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$$\overrightarrow{OA} = \mathbf{x}, \overrightarrow{OB} = \mathbf{y} \text{ and } \overrightarrow{OD} = \frac{3}{7}\mathbf{x} + \frac{4}{7}\mathbf{y}.$$

Calculate the ratio $AD : DB$.

..... : [2]

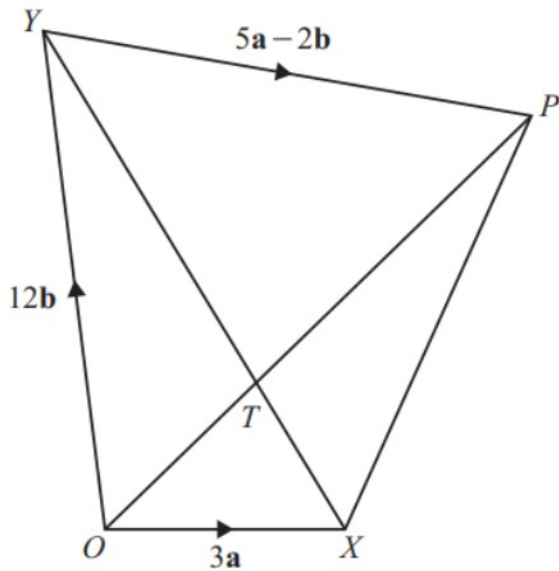


NOT TO
SCALE

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

Find the position vector of L , in terms of $\mathbf{a}$ and $\mathbf{b}$.
Give your answer in its simplest form.

..... [4]



NOT TO
SCALE

The diagram shows a quadrilateral $OXPY$ with diagonals meeting at T .
 $\vec{OX} = 3\mathbf{a}$ and $\vec{OY} = 12\mathbf{b}$.

- (a) Find $\vec{XY}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

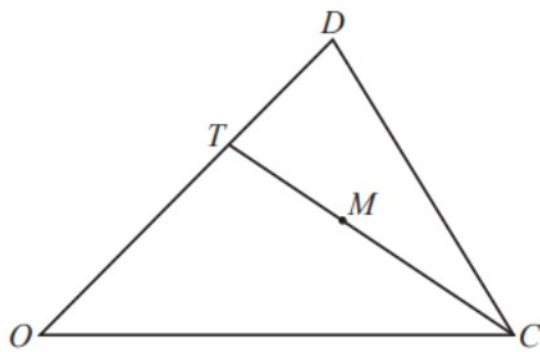
..... [1]

- (b) $XT : TY = 1 : 2$ and $\vec{YP} = 5\mathbf{a} - 2\mathbf{b}$.

Find the ratio $OT : TP$.

..... : [4]

(d)



NOT TO
SCALE

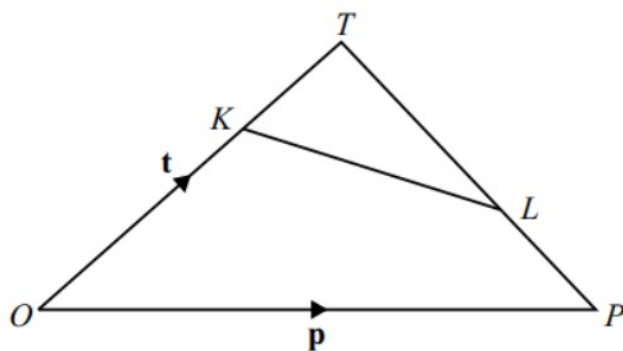
In the diagram, O is the origin, $OT = 2TD$ and M is the midpoint of TC .
 $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{OD} = \mathbf{d}$.

Find the position vector of M .

Give your answer in terms of $\mathbf{c}$ and $\mathbf{d}$ in its simplest form.

..... [3]

22 The diagram shows triangle OPT .



NOT TO
SCALE

In the diagram $\overrightarrow{OT} = \mathbf{t}$ and $\overrightarrow{OP} = \mathbf{p}$.
 $OK:KT = 2:1$ and $TL:LP = 2:1$.

(a) Find, in terms of $\mathbf{t}$ and $\mathbf{p}$, in its simplest form

(i) $\overrightarrow{PL}$

(ii) $\overrightarrow{KL}$.

..... [2]

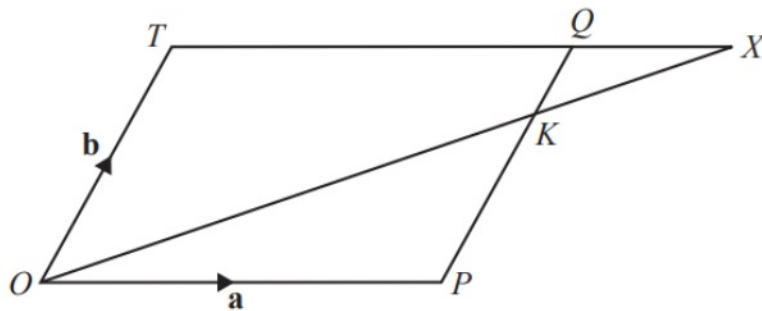
..... [2]

(b) KL is extended to the point M .

$$\overrightarrow{KM} = -\frac{2}{3}\mathbf{t} + \frac{4}{3}\mathbf{p}.$$

Show that M lies on OP extended.

[2]



NOT TO
SCALE

The diagram shows a parallelogram $OPQT$.

The position vector of P is $\mathbf{a}$ and the position vector of T is $\mathbf{b}$.

K is on PQ so that $PK : KQ = 3 : 1$.

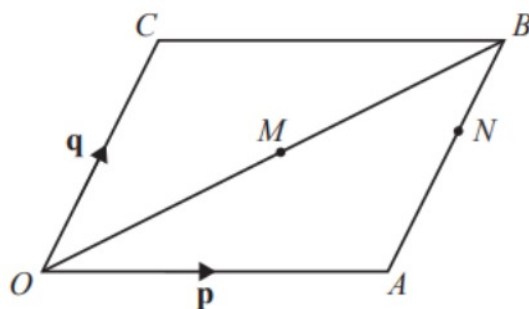
The lines OK and TQ are extended to meet at X .

Find the position vector of X in terms of $\mathbf{a}$ and $\mathbf{b}$.

Give your answer in its simplest form.

..... [3]

(b)



NOT TO
SCALE

$OABC$ is a parallelogram and O is the origin.
 M is the midpoint of OB .
 N is the point on AB such that $AN : NB = 3 : 2$.
 $\vec{OA} = \mathbf{p}$ and $\vec{OC} = \mathbf{q}$.

(i) Find, in terms of $\mathbf{p}$ and $\mathbf{q}$, in its simplest form.

(a) $\vec{OB}$

$\vec{OB} = \dots\dots\dots$ [1]

(b) $\vec{CM}$

$\vec{CM} = \dots\dots\dots$ [2]

(c) $\vec{MN}$

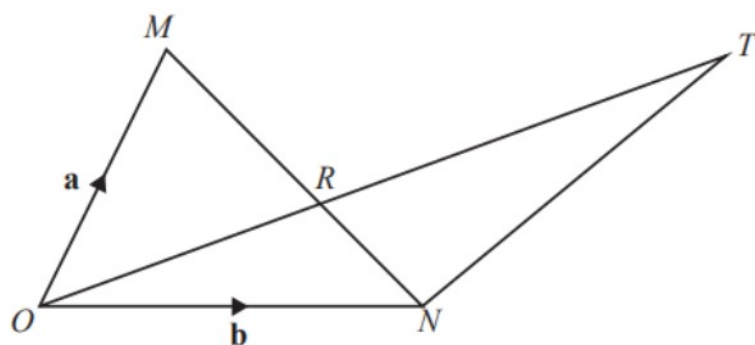
$\vec{MN} = \dots\dots\dots$ [2]

(ii) CB and ON are extended to meet at D .

Find the position vector of D in terms of $\mathbf{p}$ and $\mathbf{q}$.
Give your answer in its simplest form.

$\dots\dots\dots$ [3]

(b)



NOT TO
SCALE

OMN is a triangle.

$\vec{OM} = \mathbf{a}$ and $\vec{ON} = \mathbf{b}$.

R is a point on MN such that $MR : RN = 3 : 2$.

ORT is a straight line.

(i) Show that $\vec{OR} = \frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$.

[3]

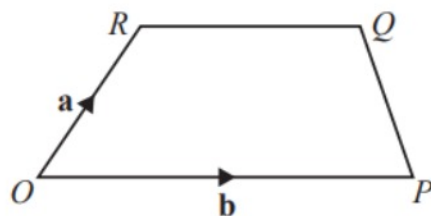
(ii) (a) $\vec{NT} = 4\mathbf{a} + k\mathbf{b}$ and $\vec{OT} = c\vec{OR}$.

Find the value of k and the value of c .

$k = \dots\dots\dots c = \dots\dots\dots$ [4]

(b) Find $\vec{MT}$.

$\vec{MT} = \dots\dots\dots$ [1]



NOT TO
SCALE

The diagram shows a trapezium $OPQR$.

O is the origin, $\overrightarrow{OR} = \mathbf{a}$ and $\overrightarrow{OP} = \mathbf{b}$.

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

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

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

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

Find the position vector of W .

$$\dots\dots\dots [2]$$

21 $\overrightarrow{XY} = 3\mathbf{a} + 2\mathbf{b}$ and $\overrightarrow{ZY} = 6\mathbf{a} + 4\mathbf{b}$.

Write down two statements about the relationship between the points X , Y and Z .

1

2 [2]

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