1. A point A is translated to the point B by the vector $\begin{pmatrix} 4u \\ 3u \end{pmatrix}$

   $|\overline{AB}|$ = 12.5. Find u [3]

   0580/42/O/N/17 Q4(c)

2. A is the point $(7,2)$ and B is the point $(-5,8)$.

   AB is one side of the parallelogram $ABCD$ and

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

   Find the coordinates of D. [4]

   0580/42/F/M/21 Q12(b)(iii)

3. (a) The position vector of P is $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and

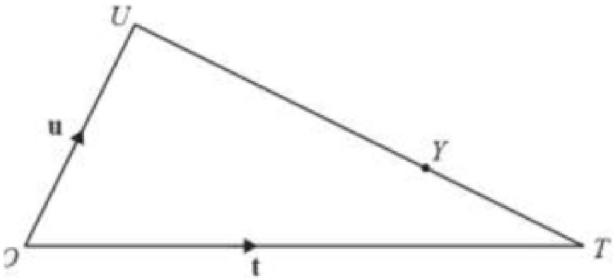
   the position vector of Q is $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$.

   (i) Find the vector $\overline{PQ}$. [2]

   (ii) R is the point such that $\overline{PR} = 3\overline{PQ}$.

   Find the position vector of R. [2]

   (b) $\overline{OT} = \mathbf{t}, \overline{OU} = \mathbf{u}$ and $UY = 2YT$.



(i) Find $\overline{OY}$ in terms of $\mathbf{t}$ and $\mathbf{u}$. Give your answer in its simplest form.

(ii) Z is on OT and YZ is parallel to UO.

Find $\overline{OZ}$ in terms of $\mathbf{t}$ and/or $\mathbf{u}$.

Give your answer in its simplest form.

0580/43/M/J/21 Q4

4. **In the diagram**, OAB and OED are straight lines.

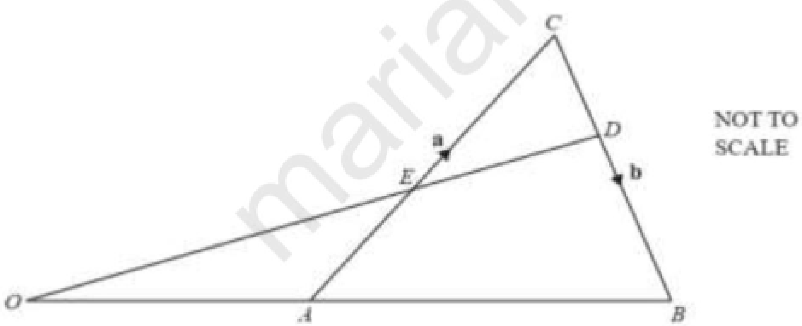
O is the origin, A is the midpoint of OB

and E is the midpoint of AC

$\overline{AC} = \boldsymbol{a}$ and $\overline{CB} = \boldsymbol{b}$

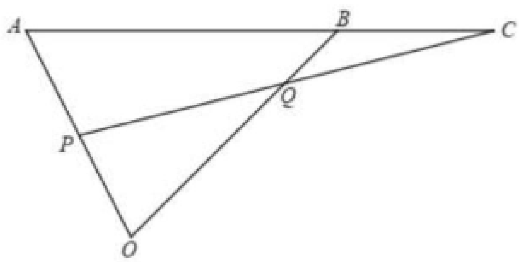
Find, in terms of **a** and **b**, in its simplest form

(i) $\overline{AB}$ [1] (ii) $\overline{OE}$ [2] (iii) the position vector of D [3]



0580/43/O/N/20 Q8(b)

5. OAB is a triangle and ABC and PQC are straight lines.



P is the midpoint of OA, Q is the midpoint of PC and OQ : QB = 3 : 1.

$\overline{OA}$ = 4**a** and $\overline{OB}$ = 8**b**.

(a) Find, in terms of **a** and/or **b**, in its simplest form

(i) $\overline{AB}$ [1] (ii) $\overline{OQ}$ [1] (iii) $\overline{PQ}$ [1]

(b) By using vectors, find the ratio AB : BC. [3]

0580/43/O/N/19 Q11)

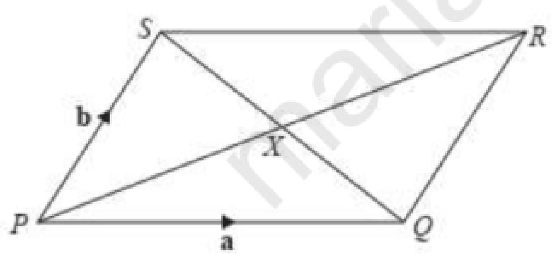
6. (a) OA = $\begin{pmatrix}4\\3\end{pmatrix}$ AB = $\begin{pmatrix}8\\-7\end{pmatrix}$ AC = $\begin{pmatrix}-3\\6\end{pmatrix}$

Find

(i) $|\overline{OB}|$ [3]

(ii) $\overline{BC}$ [2]

(b) PQRS is a parallelogram with diagonals PR and SQ intersecting at X.



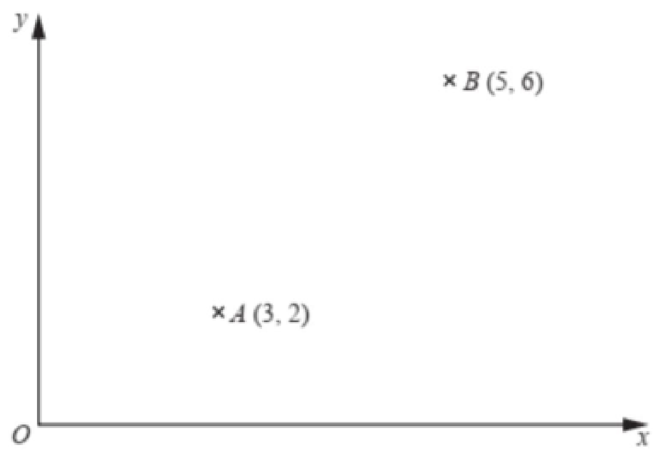
$\overline{PQ}$ = **a** and $\overline{PS}$ = **b**.

Find $\overline{QX}$ in terms of **a** and **b**.

Give your answer in its simplest form. [2]

0580/41/M/J/18 Q11

7.



(i) Find the column vector $\overline{AB}$. [1]

(ii) Find $|\overline{AB}|$. [2]

0580/43/O/N/18 Q1(b)

8. (a) a = $\begin{pmatrix}-3\\2\end{pmatrix}$ b = $\begin{pmatrix}5\\4\end{pmatrix}$ c = $\begin{pmatrix}14\\9\end{pmatrix}$

(i) Find 3**a** – 2**b**. [2]

(ii) Find $|\overline{\boldsymbol{a}}|$ [2]

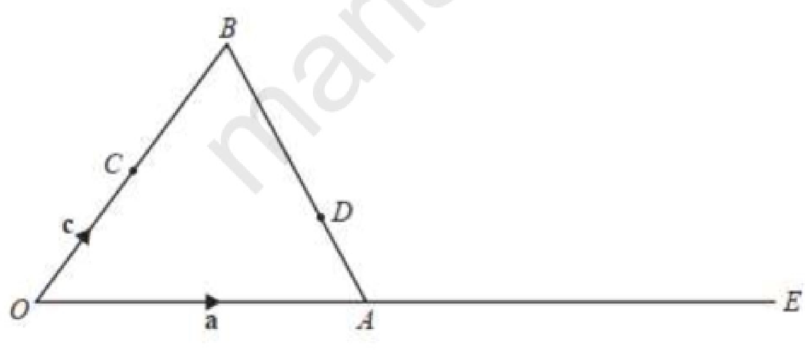
(iii) m**a** + n**b** = **c**

Write down two simultaneous equations

and solve them to find the value of m and the value of n.

Show all your working. [5]

(b) AB 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.

$\overline{OA}$ = **a** and $\overline{OC}$ = **c**.

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

(a) $\overline{AB}$, [1]

(b) $\overline{AD}$, [1]

(c) $\overline{CE}$, [1]

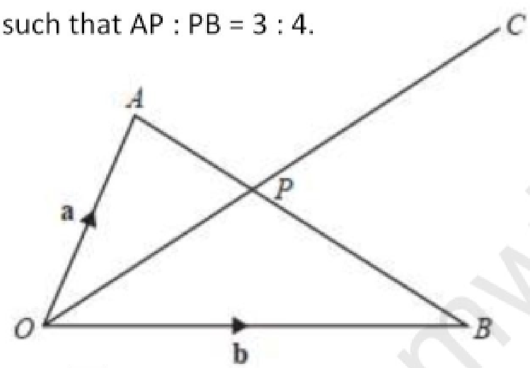
(d) $\overline{CD}$. [2]

(ii) $\overline{CE}$ = k$\overline{CD}$

Find the value of k. [1]

0580/42/O/N/18 Q11)

9. **In the diagram**, O is the origin and P lies on AB such that AP : PB = 3 : 4.



$\overline{OA}$ = **a** and $\overline{OB}$ = **b**.

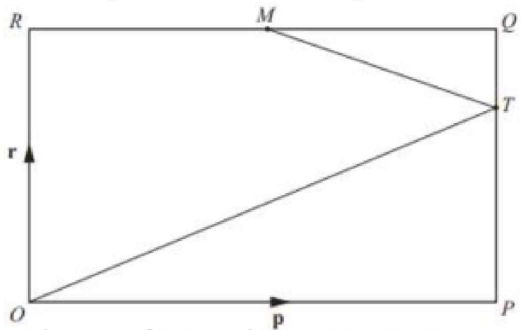
(i) Find $\overline{OP}$, in terms of **a** and **b**, in its simplest form. [3]

(ii) The line OP is extended to C such that $\overline{OC}$ = m$\overline{OP}$ and $\overline{BC}$ = k**a.**

Find the value of m and the value of k. [2]

0580/41/O/N/17 Q11(d)

10. OPQR is a rectangle and O is the origin.



M is the midpoint of RQ and PT : TQ = 2 : 1.

OP = **p** and OR = **r**.

(a) Find, in terms of **p** and/or **r**, in its simplest form

(i) $\overline{MQ}$, [1]

(ii) $\overline{MT}$, [1]

(iii) $\overline{OT}$ [1]

(b) **RQ and OT are extended** to meet at U.

Find the position vector of U in terms of **p** and **r**.

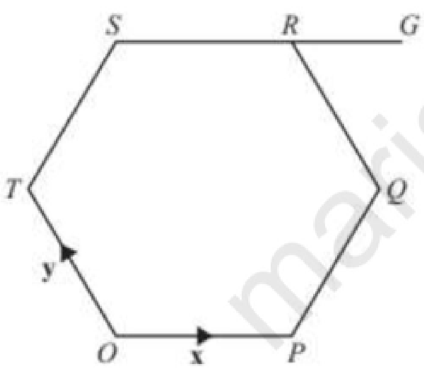
Give your answer in its simplest form. [2]

(c) $\overline{MT} = \begin{pmatrix} 2k \\ -k \end{pmatrix}$ and $|\overline{MT}| = \sqrt{180}$

Find the positive value of k. [3]

0580/41/M/J/16 Q7)

11. O is the origin and OPQRST is a regular hexagon.



OP = x and OT = y.

(a) Write down, in terms of x and/or y,

in its simplest form,

(i) $\overline{QR}$, [1]

(ii) $\overline{PQ}$, [1]

(iii) the position vector of S. [2]

(b) The line SR is extended to G so that SR : RG = 2 : 1.

Find $\overline{GQ}$, in terms of x and y, in its simplest form. [2]

(c) M is the midpoint of OP.

(i) Find $\overline{MG}$, in terms of x and y, in its simplest form. [2]

(ii) H is a point on TQ such that TH : HQ = 3 : 1.

Use vectors to show that H lies on MG.[2]

0580/42/F/M/16 Q9)

12. (a) $\mathbf{m} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$, $\mathbf{n} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$

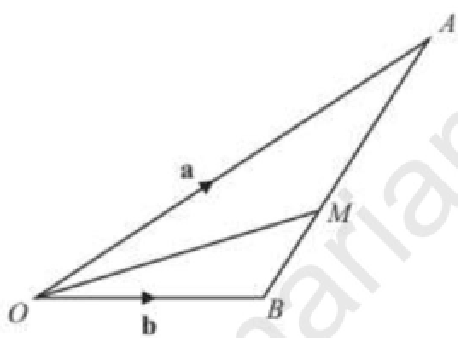
(i) Work out 2**m** – 3**n** [2]

(ii) Calculate $|2\boldsymbol{m} - 3\boldsymbol{n}|$. [2]

(b)(i) In the diagram, O is the origin, $\overline{OA}$ = **a** and $\overline{OB}$ = **b**.

The point M lies on AB such that AM : MB = 3 : 2.

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



(a) $\overline{AB}$, [1]

(b) $\overline{AM}$, [1]

(c) the position vector of M. [2]

(ii) OM is extended to the point C.

The position vector of C is **a** + k**b**.

Find the value of k. [1]

0580/43/O/N/16 Q9)

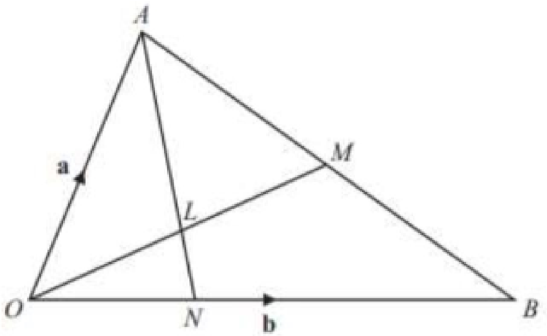
13. (a) $\overline{PQ} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$

(i) Find the value of $\left|\overline{PQ}\right|$ [2]

(ii) Q is the point (2, −3).

Find the co-ordinates of the point P [2]

(b) In the diagram, M is the midpoint of AB and L is the midpoint of OM.



The lines OM and AN intersect at L and ON = $\frac{1}{3}$ OB.

$\overline{OA}$ = **a** and $\overline{OB}$ = **b**.

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

(a) $\overline{OM}$, [2]

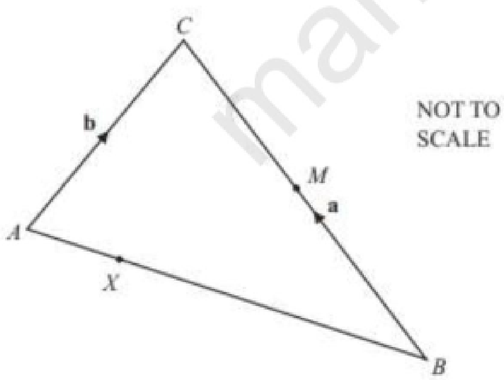
(b) $\overline{OL}$, [1]

(c) $\overline{AL}$ [2]

(ii) Find the ratio AL :AN in its simplest form. [3]

0580/42/M/J/15 Q10)

14. $\overline{BC}$ = **a** and $\overline{AC}$ = **b**.



(a) Find $\overline{AB}$ in terms of **a** and **b**. [1]

(b) M is the midpoint of BC.

X divides AB in the ratio 1:4.

Find $\overline{XM}$ in terms of **a** and **b**.

Show all your working and write your answer in its simplest form. [4]

0580/41/O/N/15 Q10)

15. (a) $\overline{PQ} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$

(i) P is the point (–2, 3).

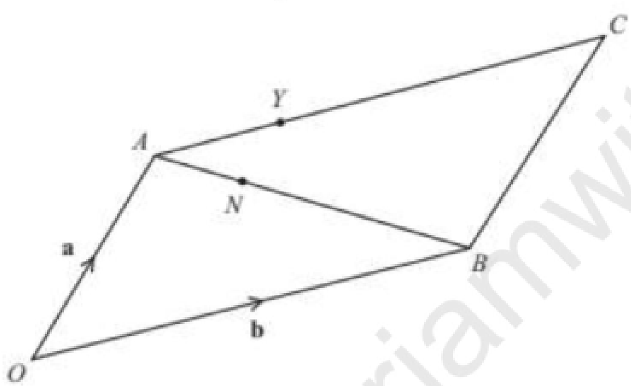
Work out the co-ordinates of Q. [1]

(ii) Work out $|\overline{PQ}|$ the magnitude of $\overline{PQ}$. [2]

(b) OACB is a parallelogram.

$\overline{OA}$ = **a** and $\overline{OB}$ = **b**.

AN:NB = 2:3 and AY = $\frac{2}{5}$AC.



(i) Write each of the following in terms of **a** and/or **b**.

Give your answers in their simplest form.

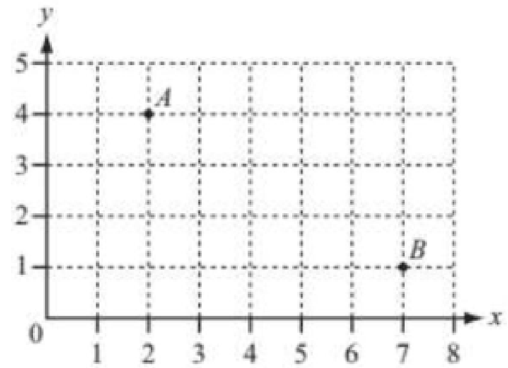
(a) $\overline{ON}$ [2]

(b) $\overline{NY}$ [2]

(ii) Write down two conclusions you can make about the line segments NY and BC. [2]

0580/41/M/J/14 Q11)

16. (a)



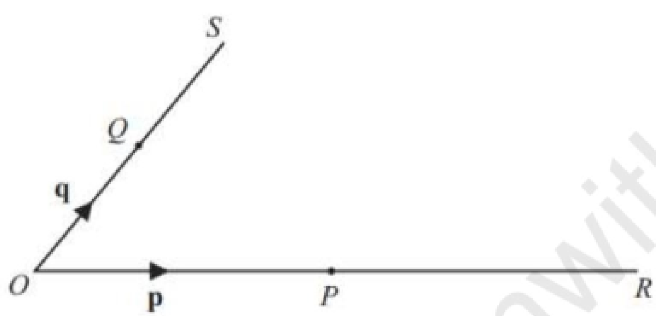
(i) Write down the position vector of A. [1]

(ii) Find $|\overline{AB}|$, the magnitude of $\overline{AB}$. [2]

(b) **O is the origin**, $\overline{OP}$ = **p** and $\overline{OQ}$ = **q**.

OP is extended to R so that OP = PR.

OQ is extended to S so that OQ = QS



(i) Write down $\overline{RQ}$ in terms of **p** and **q** [1]

(ii) PS and RQ intersect at M and RM = 2MQ.

Use vectors to find the ratio PM : PS, showing all your working. [4]

0580/43/M/J/14 Q5)

17. (a) **p** = $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ **q** = $\begin{pmatrix} 5 \\ 12 \end{pmatrix}$

Find

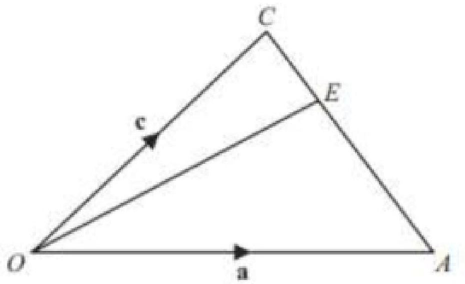
(i) **p** – 2**q**, [2]

(ii) the value of k when k**p** + **q** = $\begin{pmatrix} 1 \\ 6 \end{pmatrix}$ [2]

(b) In triangle OAC, $\overline{OA}$ = **a** and $\overline{OC}$ = **c**.

E lies on AC so that AE : EC = 2 : 1.

Find the following, in terms of **a** and **c**, in their simplest form.



(i) $\overline{AC}$ [1]

(ii) $\overline{AE}$ [1]

(iii)$\overline{OE}$ [2]

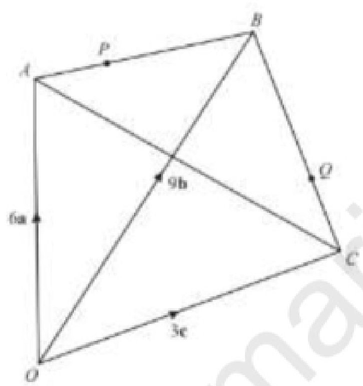
0580/47/M/J/14 Q9)

18. In the diagram, O is the origin and $\overline{OA}$ = 6**a**,

$\overline{OB}$ = 9**b** and $\overline{OC}$ = 3**c**.

The point P lies on AB such that $\overline{AP}$ = 3**b** – 2**a**.

The point Q lies on BC such that $\overline{BQ}$ = 2**c** – 6**b**



(a) Find, in terms of **b** and **c**, the position vector of Q.

Give your answer in its simplest form. [2]

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

(i) $\overline{AC}$, [1]

(ii) $\overline{PQ}$. [2]

(c) Explain what your answers in **part (b)**

tell you about PQ and AC. [2]

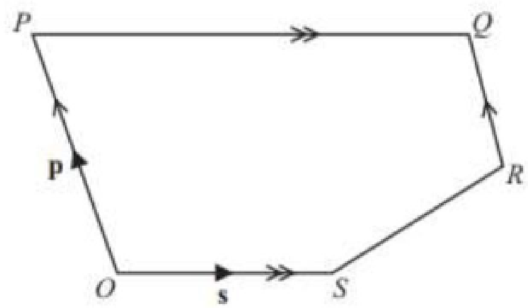
0580/41/O/N/14 Q8)

19. (a) In the pentagon OPQRS, OP is parallel to RQ and OS is parallel to PQ.

PQ = 2OS and OP = 2RQ.

O is the origin, $\overline{OP}$ = **p** and $\overline{OS}$ = **s**.

Find, in terms of **p** and **s**, in their simplest form,



(i) the position vector of Q, [2]

(ii) $\overline{SR}$. [2]

(b) Explain what your answers in part (b) tell you about the lines OQ and SR. [1]

0580/41/O/N/13 Q5)

20. (a) The co-ordinates of P are (−4, −4) and the co-ordinates of Q are (8, 14).

(i) Find the gradient of the line PQ. [2]

(ii) Find the equation of the line PQ. [2]

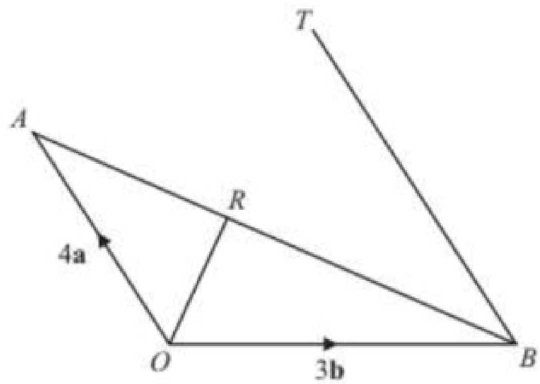
(iii) Write $\overline{PQ}$ as a column vector. [1]

(iv) Find the magnitude of $\overline{PQ}$. [2]

(b) In the diagram, $\overline{OA}$ = 4**a** and $\overline{OB}$ = 3**b**.

R lies on AB such that $\overline{OR} = \frac{1}{5}(12\mathbf{a} + 6\mathbf{b})$.

T is the point such that $\overline{BT} = \frac{3}{2}\overline{OA}$



(i) Find the following in terms of **a** and **b**, giving each answer in its simplest form.

(a) $\overline{AB}$ [1]

(b) $\overline{AR}$ [2]

(c) $\overline{OT}$ [1]

(ii) Complete the following statement.

The points O, R and T are in a straight line

because ……………………………………………………….[1]

(iii) Triangle OAR and triangle TBR are similar.

Find the value of $\frac{area\ of\ triangle\ TBR}{\text{area of triangle OAR}}$ [2]

0580/43/O/N/13 Q7) (a)

21. (a) P is the point (2, 5) and PQ = $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$

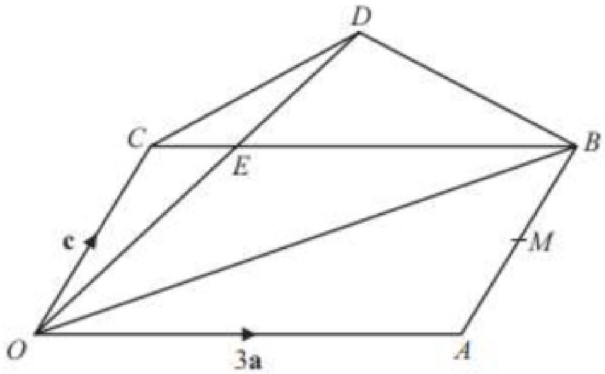
Write down the co-ordinates of Q. [1]

(b) O is the origin and OABC is a parallelogram.

M is the midpoint of AB.

$\overline{OC}$ = **c**, $\overline{OA}$ = 3**a** and $\overline{CE}$ = $\frac{1}{3}CB$.

OED is a straight line with OE : ED = 2 : 1.



Find in terms of **a** and **c**, in their simplest forms

(i) $\overline{OB}$, [1]

(ii) the position vector of M, [2]

(iii) $\overline{OE}$, [1]

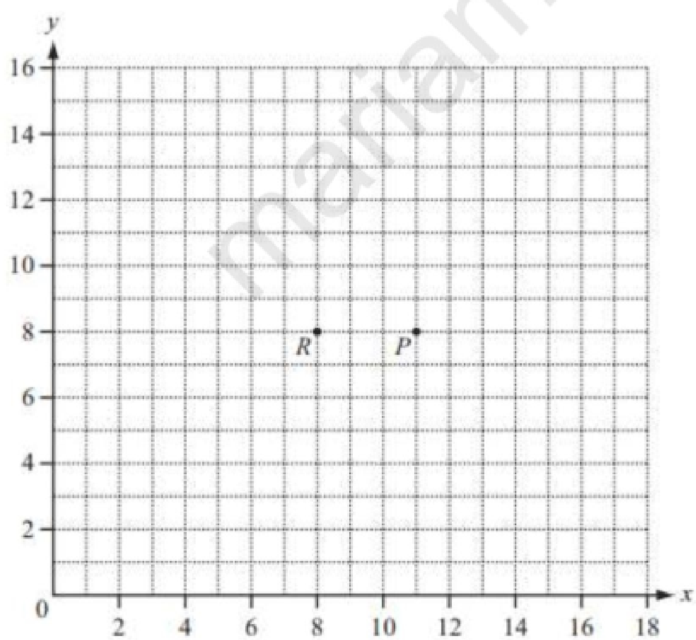
(iv) $\overline{CD}$. [2]

(c) Write down two facts about the lines CD and OB.[2]

0580/42/M/J/12 Q7)

22. (a) Calculate the magnitude of the vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ [2]

(b)



(i) The points P and R are marked on the grid above.

$\overline{PQ} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$, Draw the vector $\overline{PQ}$ on the grid above. [1]

(ii) Draw the image of vector after rotation by 90° anticlockwise about R. [2]

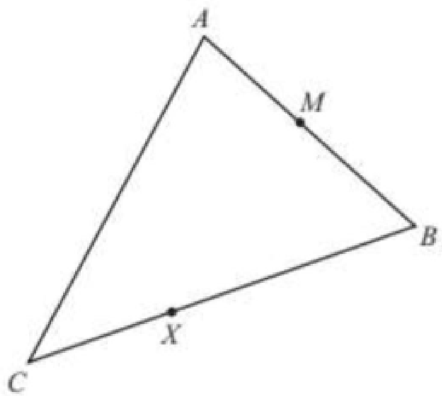
(c) $\overline{DE}$ = 2**a** + **b** and $\overline{DC}$ = 3**b** - **a**.

Find $\overline{CE}$ in terms of **a** and **b**. Write your answer in its simplest form. [2]

(d) $\overline{OT} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\overline{OV} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

Write $\overline{TV}$ as a column vector. [2]

(e)$\overline{AB}$ = **b** and $\overline{AC}$ = **c**.



(i) Find $\overline{CB}$ in terms of **b** and **c**. [1]

(ii) X divides CB in the ratio 1 : 3.

M is the midpoint of AB.

Find $\overline{MX}$ in terms of **b** and **c**.

Show all your working and write your answer in its simplest form. [4]

0580/42/O/N/12 Q6)

1) ± 2.5	12) (a) (i) $\begin{pmatrix}12\\-5\end{pmatrix}$ (ii) 13 (b)(i)(a) b – a (i)(b) $\frac{3}{5}b-\frac{3}{5}a$ (i)(c) $\frac{2}{5}a+\frac{3}{5}b$ (ii)3/2
2) (5,0)	13) (a) (i) 9.43 (ii) (−3, $\underline{-11}$) (b) (i) (a) $\frac{1}{2}a+\frac{1}{2}b$ (b) $\frac{1}{4}a+\frac{1}{4}b$ (c) $\frac{1}{4}b-\frac{3}{4}a$ (ii) 3 : 4
3) (a) (i) $\begin{pmatrix}0\\2\end{pmatrix}$ (ii) $\begin{pmatrix}-2\\9\end{pmatrix}$ (b)(i) $\frac{2}{3}\mathrm{t}+\frac{1}{3}\mathrm{u}$ or $\frac{1}{3}(2\mathrm{t}+\mathrm{u})$ (ii) $\frac{2}{3}\mathrm{t}$	14) (a) b – a (b) $\frac{4}{5}b-\frac{3}{10}a$
4) (i)a+b (ii) $\frac{3}{2}a+b$ (iii)2a + $\frac{4}{3}b$	15) (a) (i) (– 5, 7) (ii) 5 (b) (i)(a) $\frac{3}{5}a+\frac{2}{5}b$ (b) $\frac{2}{5}a$ (ii) NY = $\frac{2}{5}$ BC oe [NY] parallel to [BC]
5) (a)(i) 8b – 4a (ii) 6b (iii) 6b – 2a (b) 2 : 1	16) (a) (i) $\begin{pmatrix}2\\4\end{pmatrix}$ (ii) 5.83 (b) (i) – 2p + q (ii)1 : 3
6) (a) (i) 12.6 (ii) $\begin{pmatrix}-11\\13\end{pmatrix}$ (b) $\frac{1}{2}(b-a)$	17) (a)(i) $\begin{pmatrix}-8\\-21\end{pmatrix}$ (ii) – 2 (b) (i) – a + c (ii) $\frac{2}{3}(-a+c)$ (iii) $\frac{1}{3}a+\frac{2}{3}c$
7) (i) $\begin{pmatrix}2\\4\end{pmatrix}$ (ii) 4.47	18) (a) 2c + 3b (b) (i)3c – 6a (ii) 2c – 4a (c)PQ= $\frac{2}{3}AC$ & PQ is parallel to AC
8) (a)(i) $\begin{pmatrix}-19\\-2\end{pmatrix}$ (ii) 3.61 (iii)m = -1/2 , n = 2.5 (b) (i)(a) –a + 2c (i)(b) $-\frac{3}{8}a+\frac{3}{4}c$ (i)(c) $\frac{5}{2}a-c$ (i)(d) $\frac{5}{8}a-\frac{1}{4}c$ (ii)4	19) (a) (i) p + 2s (ii)s + $\frac{1}{2}p$ (b) parallel and OQ = 2SR
9) (i) $\frac{4}{7}a+\frac{3}{7}b$ (ii) m = 7/3 , k = 4/3	20) (i)1.5 (ii) $y=\frac{3}{2}x+2$ (iii) $\begin{pmatrix}12\\18\end{pmatrix}$ (iv) 21.6 (b) (i) (a) 3b – 4a (b) $\frac{1}{5}(6b-8a)$ (c) $6a+3b$ (ii) OR is parallel to OT (iii) 9/4
10) (a) (i) $\frac{1}{2}p$ (ii) $\frac{1}{2}p-\frac{1}{3}r$ (iii) p + $\frac{2}{3}r$ (b) r + $\frac{3}{2}p$ (c)6	21) (a) (5, 3) (b) (i) 3a + c (ii) 3a + $\frac{1}{2}$ c (iii) a + c (iv) $\frac{3}{2}a+\frac{1}{2}c$ (c) (CD) parallel (to OB) , CD = $\frac{1}{2}$ OB oe cao
11) (a) (i) y (ii) $x+y$ (iii) $x+2y$ (b) $-\frac{1}{2}x-y$ (c)(i) $2x+2y$ (ii)MH $=x+y$, $\overline{HG}=x+y$, $\overline{MG}=2\overline{MH}$	22) (a) 5.83 (b) (i) Vector drawn from P to Q at (14, 3) (ii) Points at (8, 11) and (13, 14) (c) 3a – 2b (d) $\begin{pmatrix}7\\-6\end{pmatrix}$ (e) (i) b – c (ii) $\frac{3}{4}c-\frac{b}{4}$