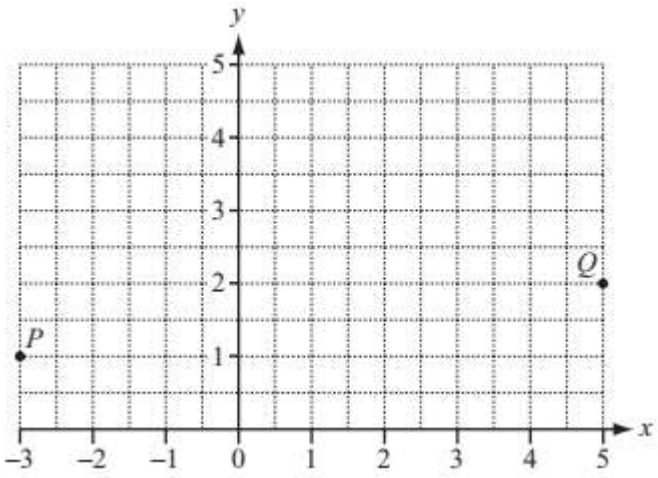
1. (a) The points P and Q have co-ordinates (–3, 1) and (5, 2).



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

(ii) QR = $2\begin{pmatrix}-1\\1\end{pmatrix}$

Mark the point R on the grid. [1]

(iii) Write down the position vector of the point P.[1]

0580/43/O/N/11 Q11)

2. (a) p = $\begin{pmatrix}3\\2\end{pmatrix}$ and q = $\begin{pmatrix}6\\3\end{pmatrix}$

(i) Find, as a single column vector, **p** + 2**q**. [2]

(ii) Calculate the value of | **p** + 2**q** |. [2]

0580/42/M/J/10 Q2)

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3. Find giving answer in surd form

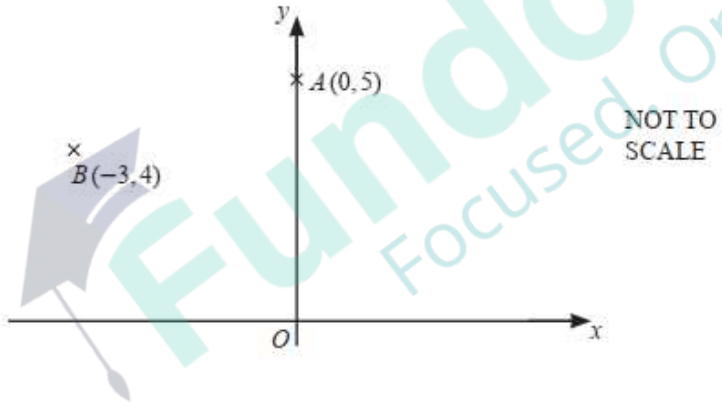
   (a) the magnitude of the vector $\begin{pmatrix}-1\\7\end{pmatrix}$ [2]

   (b) $|v|$ when , v = $\begin{pmatrix}-4\\-8\end{pmatrix}$ [2]

   0580/42/F/M/18 Q9

4. (i) Write $\overrightarrow{OA}$ as a column vector [1]

   (ii) Write $\overrightarrow{AB}$ as a column vector.[1]



   0580/42/O/N/19 Q8)(b)

5. $\overrightarrow{AB}=\begin{pmatrix}6\\-1\end{pmatrix}$ $\overrightarrow{BC}=\begin{pmatrix}-2\\5\end{pmatrix}$ $\overrightarrow{DC}=\begin{pmatrix}2\\-3\end{pmatrix}$ Find

   (i) $\overrightarrow{AC}$ [2] (ii) $\overrightarrow{BD}$ [2] (iii) $\left|\overrightarrow{BC}\right|$ in exact form[2]

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

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6. (a) $\mathbf{p} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

Find

(i) $3\mathbf{q}$, [1] (ii) $\mathbf{p} - \mathbf{q}$, [1] (iii) $|\mathbf{p}| = \sqrt{a}$, find a [2]

(b) B is the point $(2,7)$ and $\overrightarrow{AB} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$.

Find the coordinates of A. [2]

0580/41/O/N/22 Q6

7. $\mathbf{a} = \begin{pmatrix} -3 \\ 8 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$

(i) Find

(a) $\mathbf{b} - \mathbf{a}$, [1]

(b) $2\mathbf{a} + \mathbf{b}$ **[2]**

(c) (i) $|\mathbf{b}| = \sqrt{k}$. Find k [2]

(ii) $\mathbf{a} + k\mathbf{b} = \begin{pmatrix} 13 \\ m \end{pmatrix}$, where k and m are integers

Find the value of k and the value of m. [3]

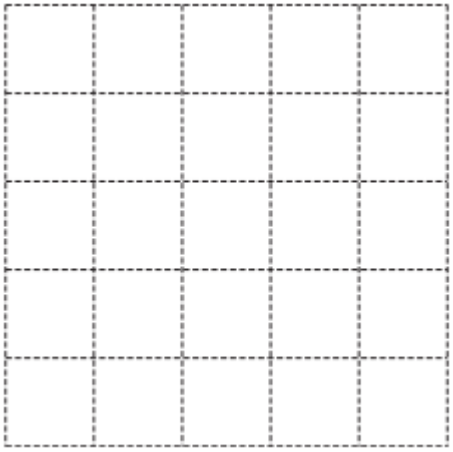
0580/42/M/J/21 Q5

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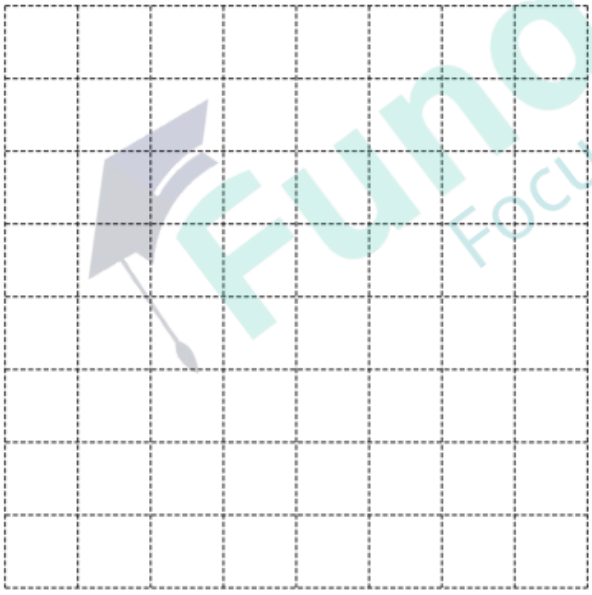


8. $a = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, b = \begin{pmatrix} -3 \\ 5 \end{pmatrix},$

(i) On the grid, draw and label vector 2a. [1]



(ii) On the grid, draw and label vector (a-b). [2]



0580/43/O/N/22 Q10(a)

9. Point A has coordinates (6, 4) and point B has coordinates (2, 7). Write $\overrightarrow{AB}$ as a column vector. [1]

0580/22/F/M/20 Q3

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10. O is the origin, $\overrightarrow{OA} = 2\boldsymbol{x} + 3\boldsymbol{y}$ and $\overrightarrow{BA} = \boldsymbol{x} - 4\boldsymbol{y}$
Find the position vector of **B**, in terms of $\boldsymbol{x}$ and $\boldsymbol{y}$, in its simplest form. [2]
0580/22/F/M/19 Q8)

11. The magnitude of the vector $\begin{pmatrix} 20 \\ k \end{pmatrix}$ is 29. Find the value of k.
[3]
0580/23/M/J/21 Q14)

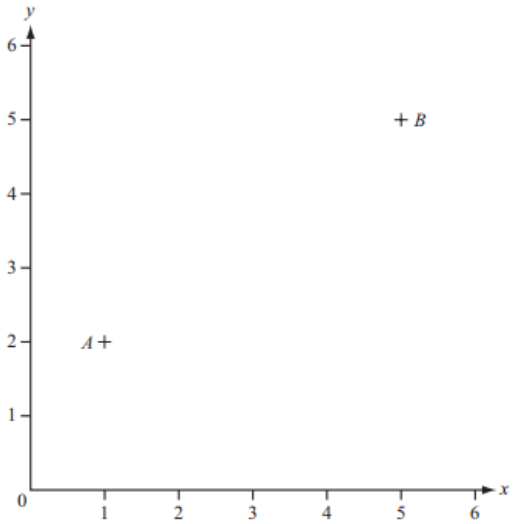
12. $\overrightarrow{XY} = 3\mathbf{a} + 2\mathbf{b}$ and $\overrightarrow{ZY} = 6\mathbf{a} + 4\mathbf{b}$.
Write down two statements about the relationship between the points X, Y and Z.

1. .....

2. ..... [2]

0580/22/F/M/20

13. The points A(1, 2) and B(5, 5) are shown on the diagram .
(a) Work out the co-ordinates of the midpoint of AB. [1]
(b) Write down the column vector $\overrightarrow{AB}$.[1]
0580/22/O/N/11 Q15



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14. A is the point (–1, 1) and B is the point (8, 7).



(a) Write $\overrightarrow{AB}$ as a column vector. [1]

(b) Find $|\overrightarrow{AB}|$. [2]

(c) $\overrightarrow{AC} = 2\overrightarrow{AB}$.

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

0580/21/O/N/13 Q16)

15. The position vector r is given by $\mathbf{r} = 2\mathbf{p} + t(\mathbf{p} + \mathbf{q})$.

(a) Complete the table below for the given values of t.

Write each vector in its simplest form.

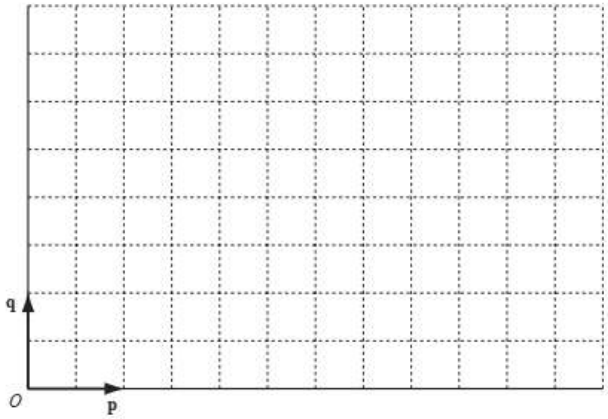
One result has been done for you. [3]

t	0	1	2	3
r			$4\mathbf{p} + 2\mathbf{q}$	

(b) O is the origin and p and q are shown on the diagram.

(i) Plot the 4 points given by the position vectors in the table. [2]

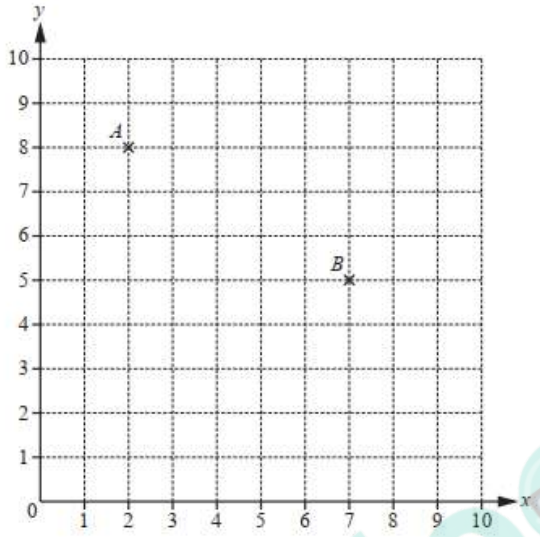
(ii) What can you say about these four points? [1]



0580/21/M/J/10 Q19)

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16. Points A and B are marked on the grid.



$\overrightarrow{BC} = \begin{pmatrix} -4 \\ 0 \end{pmatrix}$

(a) On the grid, plot the point C. [1]

(b) Write $\overrightarrow{AC}$ as a column vector. [1]

(c) $\overrightarrow{DE}$ is a vector that is perpendicular to $\overrightarrow{BC}$.

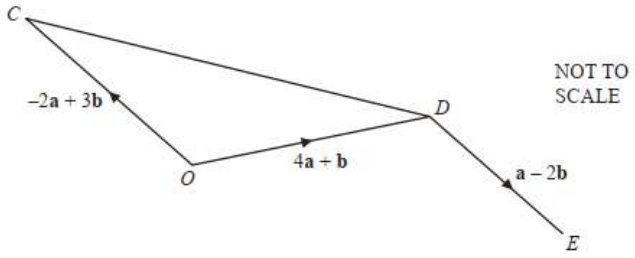
The magnitude of $\overrightarrow{DE}$ is equal to the magnitude of $\overrightarrow{BC}$

Write down a possible column vector for $\overrightarrow{DE}$. [2]

0580/22/F/M/17 Q14)

.

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



(a) Find $\overrightarrow{CD}$, in terms of a and b, in its simplest form. [2]

(b) $\overrightarrow{DE}$ = **a** – 2**b**

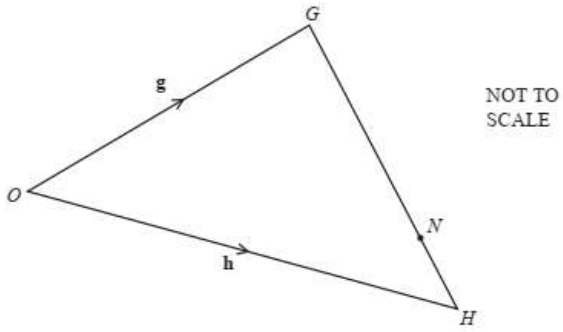
Find the position vector of E, in terms of **a** and **b**, in its simplest form. [2]

0580/22/M/J/18 Q22)

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18. In triangle OGH, the ratio GN : NH = 3 : 1.



$\overrightarrow{OG}$ = **g** and $\overrightarrow{OH}$ = **h**.

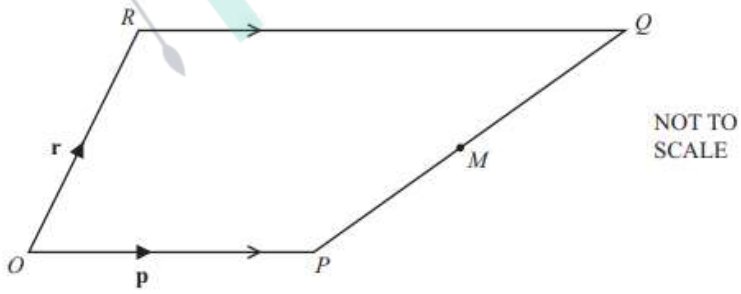
Find the following in terms of **g** and **h**, giving your answers in their simplest form.

(a)$\overrightarrow{HG}$ [1]

(b)$\overrightarrow{ON}$ [2]

0580/23/M/J/10 Q15)

19. OPQR is a trapezium with RQ parallel to OP and RQ = 2OP.



O is the origin, $\overrightarrow{OP}$ = **p** and $\overrightarrow{OR}$ = **r**.

M is the midpoint of PQ.

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

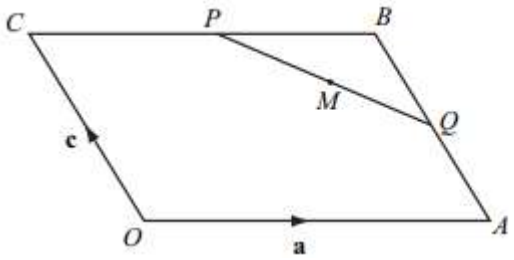
(a) $\overrightarrow{PQ}$ [1]

(b) , the position vector of M. [2]

0580/22/M/J/14 Q14)

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20. O is the origin and OABC is a parallelogram.



NOT TO SCALE

CP = PB and AQ = QB.

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

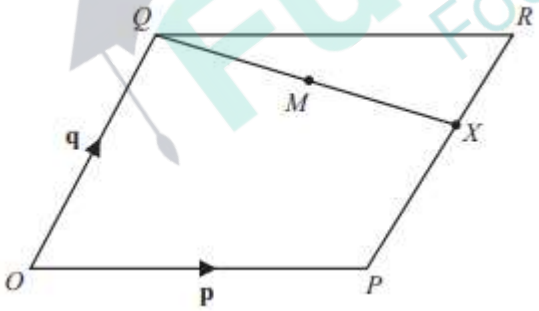
Find in terms of **a** and **c**, in their simplest form,

(a)$\overrightarrow{PQ}$, [2]

(b) the position vector of M, where M is the midpoint of PQ. [2]

0580/22/M/J/11 Q16)

21. O is the origin and OPRQ is a parallelogram.



The position vectors of P and Q are **p** and **q**.

X is on PR so that PX = 2XR.

Find, in terms of **p** and **q**, in their simplest forms

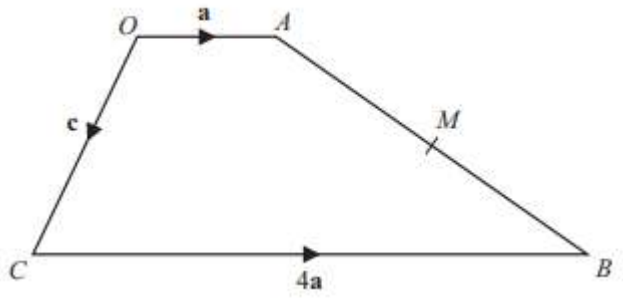
(a) $\overrightarrow{QX}$, [2]

(b) the position vector of M, the midpoint of QX. [2]

0580/23/M/J/12 Q18)

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22. O is the origin, $\overrightarrow{OA}$ = **a**, $\overrightarrow{OC}$ = **c** and $\overrightarrow{CB}$ = 4**a**.



M is the midpoint of AB.

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

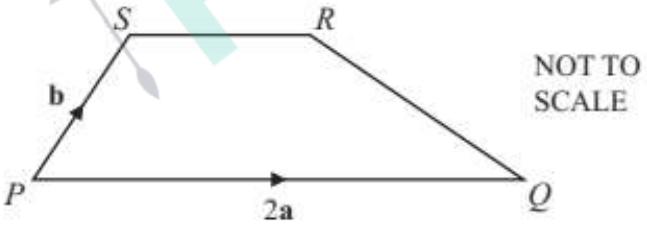
(i) the vector $\overrightarrow{AB}$, [2]

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

(b) Mark the point D on the diagram where $\overrightarrow{OD}$ = 3**a** + **c**. [2]

0580/22/O/N/11 Q17)

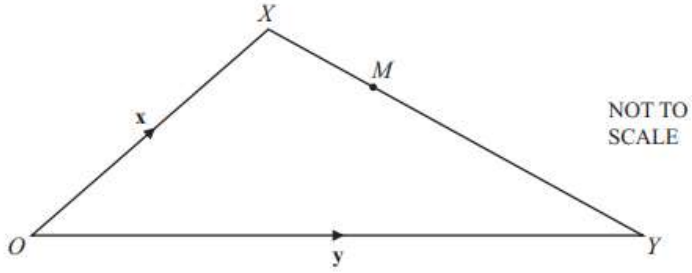
23. (a) PQRS is a trapezium with PQ = 2SR.



$\overrightarrow{PQ}$= 2**a** and $\overrightarrow{PS}$= **b**.

Find $\overrightarrow{QR}$ in terms of **a** and **b** in its simplest form. [2]

(b) $\overrightarrow{OX}$ = $\boldsymbol{x}$ and $\overrightarrow{OY}$ = $\boldsymbol{y}$.



M is a point on XY such that XM : MY = 3: 5.

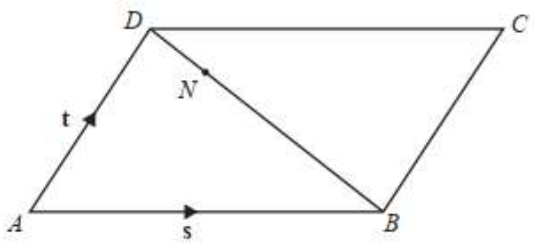
Find $\overrightarrow{OM}$ in terms of $\boldsymbol{x}$ and $\boldsymbol{y}$ in its simplest form. [2]

0580/22/F/M/15 Q17

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24. ABCD is a parallelogram.



N is the point on BD such that BN : ND = 4 : 1.

$\overrightarrow{AB}$ = **s** and $\overrightarrow{AD}$ = **t**.

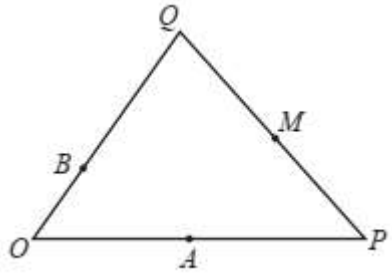
Find, in terms of **s** and **t**, an expression in its simplest form for

(a) $\overrightarrow{BD}$, [1]

(b) $\overrightarrow{CN}$. [3]

0580/23/M/J/19 Q22)

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



$\overrightarrow{OP}$ = **p** and $\overrightarrow{OQ}$ = **q**.

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

(a) $\overrightarrow{BA}$, [2]

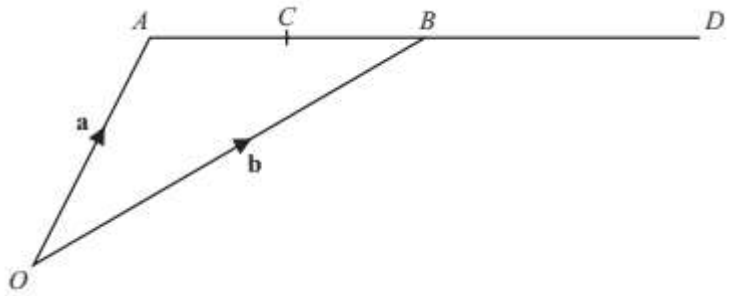
(b) the position vector of M. [2]

0580/21/O/N/19 Q25)

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26. A and B have position vectors a and b relative to the origin O.



C is the midpoint of AB and B is the midpoint of AD.

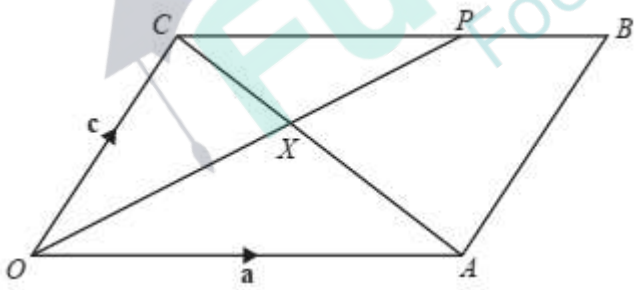
Find, in terms of a and b, in their simplest form

(a) the position vector of C, [2]

(b) the vector $\overrightarrow{CD}$. [2]

0580/21/O/N/11 Q13)

27. In the diagram, OABC is a parallelogram.



OP and CA intersect at X and CP : PB = 2 : 1.

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

(a) Find OP, in terms of **a** and **c**, in its simplest form. [2]

(b) CX : XA = 2 : 3

(i) Find OX , in terms of **a** and **c**, in its simplest form. [2]

(ii) Find OX : XP. [2]

0580/23/O/N/18 Q26)

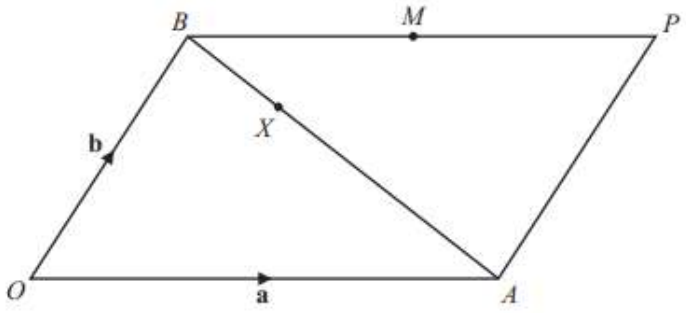
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28. OAPB is a parallelogram.

O is the origin, $\overrightarrow{OA}$ = **a** and $\overrightarrow{OB}$ = **b**.

M is the midpoint of BP.



NOT TO SCALE

(a) Find, in terms of **a** and **b**, giving your answer in its simplest form,

(i) $\overrightarrow{BA}$, [1]

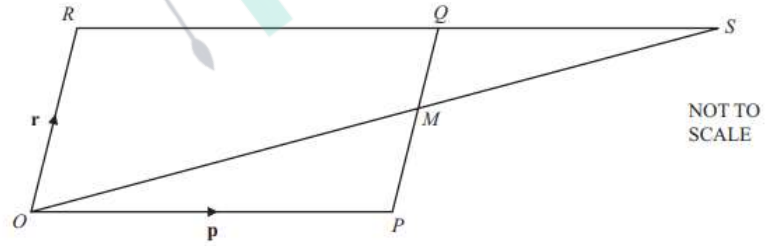
(ii) the position vector of M. [1]

(b) X is on BA so that BX: XA = 1 : 2.

Show that X lies on OM. [4]

0580/23/M/J/15 Q19)

29. OPQR is a parallelogram, with O the origin.



NOT TO SCALE

M is the midpoint of PQ.

OM and RQ are extended to meet at S.

$\overrightarrow{OP}$ = **p** and $\overrightarrow{OR}$ = **r**.

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

(i) $\overrightarrow{OM}$, [1]

(ii) the position vector of S. [1]

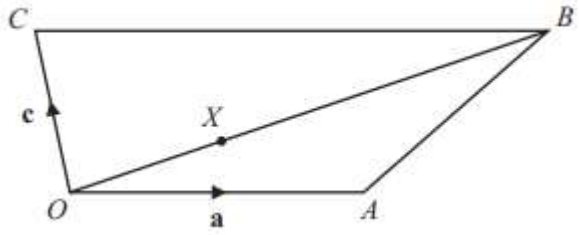
(b) When $\overrightarrow{PT} = -\frac{1}{2}$ **p** + **r** , what can you write down about the position of T ? [1]

0580/21/M/J/13 Q20)

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30. The diagram shows a quadrilateral OABC.



$\overrightarrow{OA}$ = **a**, $\overrightarrow{OC}$ = **c** and $\overrightarrow{CB}$ = **2a**.

X is a point on OB such that OX : XB = 1 : 2.

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

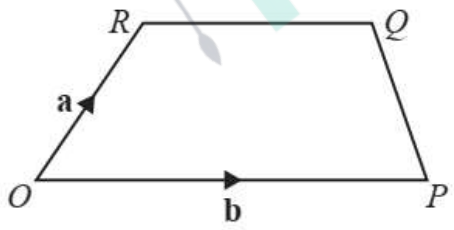
(i) $\overrightarrow{AC}$, [1]

(ii) $\overrightarrow{AX}$ [3]

(b) Explain why the vectors $\overrightarrow{AC}$ and $\overrightarrow{AX}$ show that C, X and A lie on a straight line. [2]

0580/22/O/N/14 Q19)

31. 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 PQ in terms of a and b in its simplest form. [2]

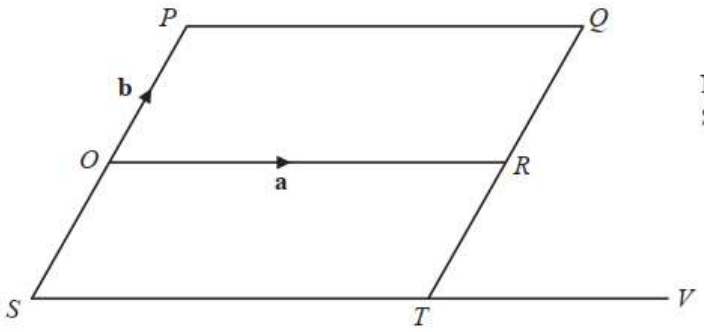
(b) When PQ and OR are extended, they intersect at W.

Find the position vector of W. [2]

0580/22/F/M/22 Q22)

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



NOT TO SCALE

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.

$\overrightarrow{OR}$ = **a** and $\overrightarrow{OP}$ = **b**

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

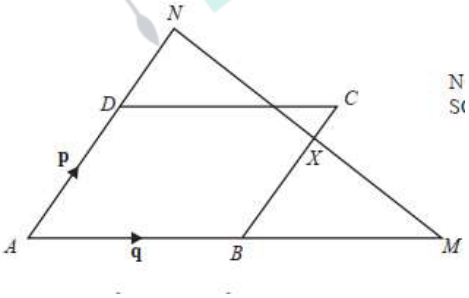
(i) the position vector of T, [2]

(ii) $\overrightarrow{RV}$. [1]

(b) Show that PT is parallel to RV.[2]

0580/23/M/J/20 Q21

33. 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. [2]

(b) The straight line NM cuts BC at X.

X is the midpoint of MN.

$\overrightarrow{BX}$ = k**p**

Find the value of k. [2]

0580/22/M/J/19 Q23)

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34. O is the origin.

ABCDEF is a regular hexagon and O is the midpoint of AD.

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

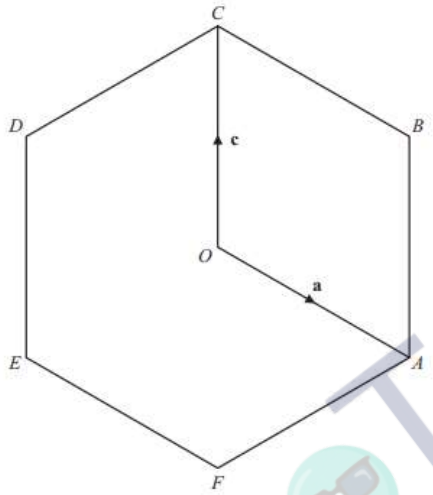
Find, in terms of a and c, in their simplest form

(a) $\overrightarrow{BE}$, [2]

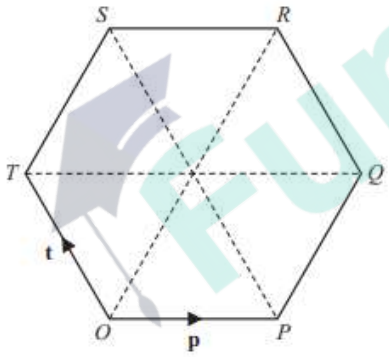
(b) $\overrightarrow{DB}$ [2]

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

0580/22/O/N/13 Q19)



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



$\overrightarrow{OP}$ = **p** and $\overrightarrow{OT}$ = **t**.

Find, in terms of **p** and **t**, in their simplest forms,

(a) $\overrightarrow{PT}$, [1]

(b) $\overrightarrow{PR}$, [2]

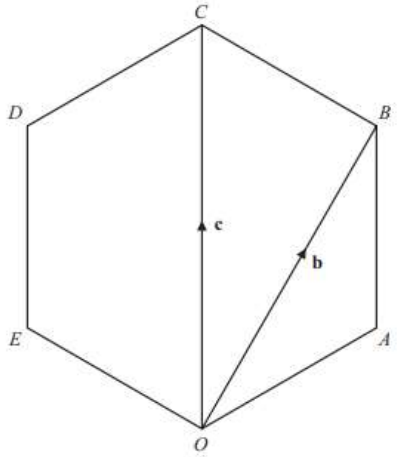
(c) the position vector of R. [2]

0580/21/M/J/12 Q19)

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36. OABCDE is a regular polygon.



(a) Write down the geometrical name for this polygon. [1]

(b) O is the origin. $\overrightarrow{OB}$ = **b** and $\overrightarrow{OC}$ = **c**.

Find, in terms of **b** and **c**, in their simplest form,

(i) $\overrightarrow{BC}$, [1]

(ii) $\overrightarrow{OA}$, [2]

(iii) the position vector of E. [1]

0580/23/M/J/13 Q19)

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Answers

1) (a) (i) $\begin{pmatrix}8\\1\end{pmatrix}$(ii) Point (3, 4) indicated (iii) $\begin{pmatrix}-3\\1\end{pmatrix}$	13) (a) (3, 3½) (b)$\begin{pmatrix}4\\3\end{pmatrix}$	25) (a)$-\frac{1}{3}q+\frac{1}{2}p$ (b) $\frac{1}{2}q+\frac{1}{2}p$
2) 30) (a) (i) $\begin{pmatrix}15\\8\end{pmatrix}$ (ii) 17	14) (a) $\begin{pmatrix}9\\6\end{pmatrix}$ (b) 10.8 (c) (17, 13)	26) (a)$\frac{1}{2}a+\frac{1}{2}b$ (b) $-1\frac{1}{2}a+1\frac{1}{2}b$
3) (a) $5\sqrt{2}$ (b) $4\sqrt{5}$	15) (a) 2p , 3p + q , 5p + 3q (b) (i) all 4 plotted correctly ft (ii) a (straight) line	27) $(a)c+\frac{2}{3}a$ (b)(i) $\frac{2}{5}a+\frac{3}{5}c$ (ii) 3 : 2
4) (i)$\begin{pmatrix}0\\5\end{pmatrix}$ (b)(ii) $\begin{pmatrix}-3\\-1\end{pmatrix}$	16) (a) Point at (3, 5) (b)$\begin{pmatrix}1\\-3\end{pmatrix}$ (c) $\begin{pmatrix}0\\4\end{pmatrix}$ or $\begin{pmatrix}0\\-4\end{pmatrix}$	28) (a) (i) –b + a (ii) b + $\frac{1}{2}a$ (b) [OX =] b + $\frac{1}{3}(-b+a)$ oe, 2 statements from $\overrightarrow{OM}=b+\frac{1}{2}a$ or $\overrightarrow{OX}=\frac{2}{3}(b+\frac{1}{2}a)$ or $\overrightarrow{OX}=\frac{2}{3}\overrightarrow{OM}$
5) (i) $\begin{pmatrix}4\\4\end{pmatrix}$ (ii) $\begin{pmatrix}-4\\8\end{pmatrix}$ (iii) $\sqrt{29}$	17) (a) 6a – 2b (b) 5a – b	29) (a) (i) p + $\frac{1}{2}$ r (ii) 2p + r (b) Midpoint of RQ
6) (a)(i) $\begin{pmatrix}-3\\3\end{pmatrix}$ (ii)$\begin{pmatrix}3\\2\end{pmatrix}$ (iii) 13(b)$(6,1)$	18) (a) g – h (b) $\frac{1}{4}g+\frac{3}{4}h$	30) (a) (i) c – a (ii)$-\frac{1}{3}a+\frac{1}{3}c$ (b) $\overrightarrow{AC}$ is a multiple of $\overrightarrow{AX}$ And they share a common point [A]
7) (a) $\begin{pmatrix}5\\-13\end{pmatrix}$ (b) $\begin{pmatrix}-4\\11\end{pmatrix}$ (c)(i) 29 (ii) 8 , -32	19) (a) p + r (b)$\frac{3}{2}p+\frac{1}{2}r$	31) (a) $a-\frac{2}{5}b$ (b)$\frac{5}{2}a$
8)	20) (a) $\frac{1}{2}$ a – $\frac{1}{2}$ c (b) $\frac{3}{4}a+\frac{3}{4}c$	32) (a) (i) a – b (a) (ii)$\frac{1}{2}a-b$ (b)$\overrightarrow{PT}$ = a – 2b , so $\overrightarrow{PT}$ = $2\overrightarrow{RV}$
9) $\begin{pmatrix}-4\\3\end{pmatrix}$	21) (a)$p-\frac{1}{3}q$ [2] (b)$\frac{1}{2}p+\frac{5}{6}q$ [2]	33) (a)$\frac{5}{3}p-2q$ (b)5/6
10) $x + 7y$	22) (a) (i) 3a + c (ii) $2\frac{1}{2}a+\frac{1}{2}c$ (b) D marked ¾ way along CB	34) (a) –2a – 2c (b) (b) 2a + c (c) –a – c
11) $[\pm]21$	23) (a) b – a (b) $\frac{5}{8}x+\frac{3}{8}y$	35) (a) −p + t (b) p + 2t(c) 2(p + t)
12) Q21 X, Y and Z are collinear X is the midpoint of ZY oe (Allow e.g. ZY = 2XY , ZX = XY)	24) (a) – s + t (b)- $\frac{4}{5}s$ - $\frac{1}{5}t$	36)(a) hexagon (b)(i)-b + c (ii)b - $\frac{1}{2}c$ (iii)-b + c

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