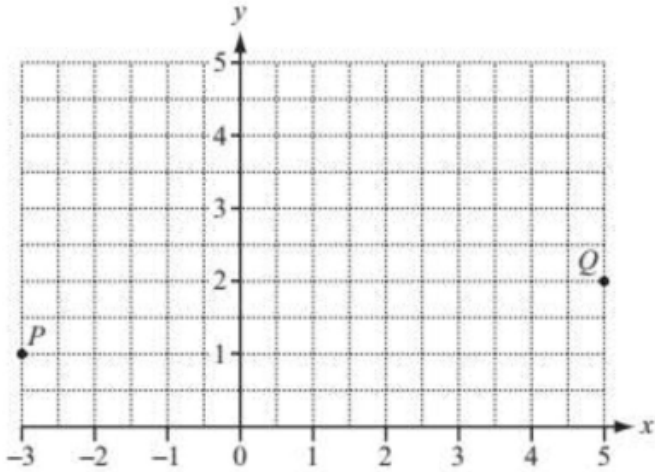




1. (a) The points P and Q have co-ordinates  $(-3, 1)$  and  $(5, 2)$ .



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

(i) Find, as a single column vector,  $\mathbf{p} + 2\mathbf{q}$ . [2]

(ii) Calculate the value of  $|\mathbf{p} + 2\mathbf{q}|$ . [2]

**0580/42/M/J/10 Q2)**



3. Find giving answer in surd form

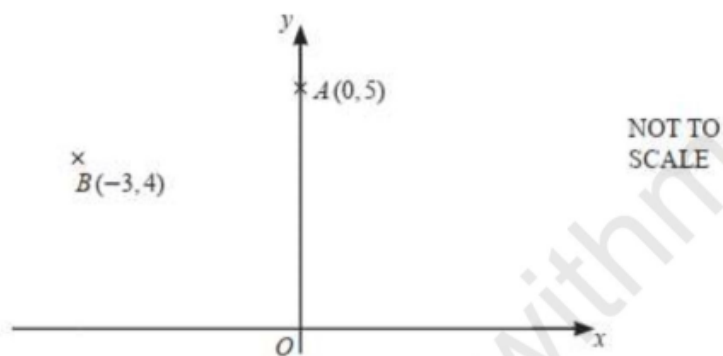
(a) the magnitude of the vector  $\begin{pmatrix} -1 \\ 7 \end{pmatrix}$  [2]

(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)  $|\overrightarrow{BC}|$  in exact form[2]

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



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**



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



10. O is the origin,  $\overrightarrow{OA} = 2x + 3y$  and  $\overrightarrow{BA} = x - 4y$   
Find the position vector of **B**, in terms of  $x$  and  $y$ , 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]

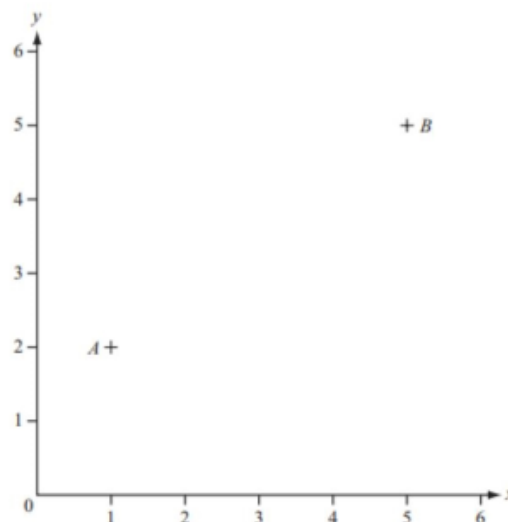
**0580/22/F/M/20**

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**





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  $r = 2p + t(p + q)$ .

(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]

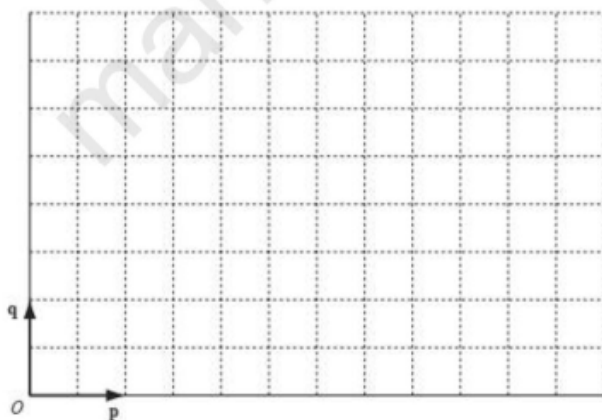
$t$	0	1	2	3
$r$			$4p + 2q$	

(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]

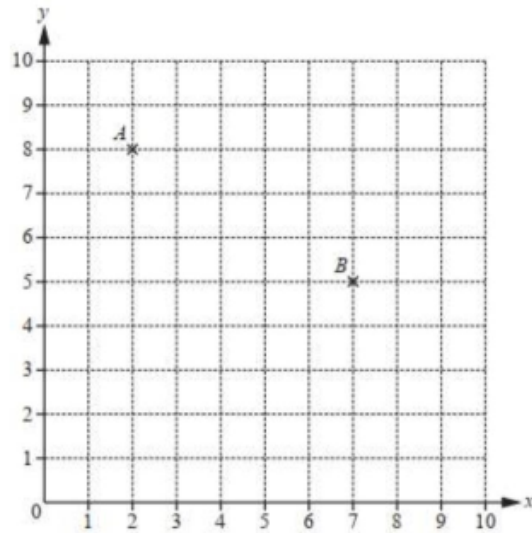
(ii) What can you say about these four points? [1]



**0580/21/M/J/10 Q19)**



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]

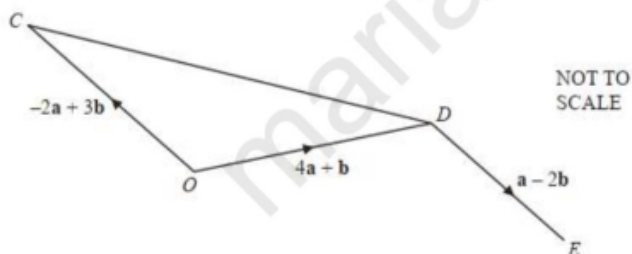
(c)  $\overrightarrow{DE}$  is a vector that is perpendicular to  $\overrightarrow{BC}$ .

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,  $\overrightarrow{OC} = -2\mathbf{a} + 3\mathbf{b}$  and  $\overrightarrow{OD} = 4\mathbf{a} + \mathbf{b}$ .



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

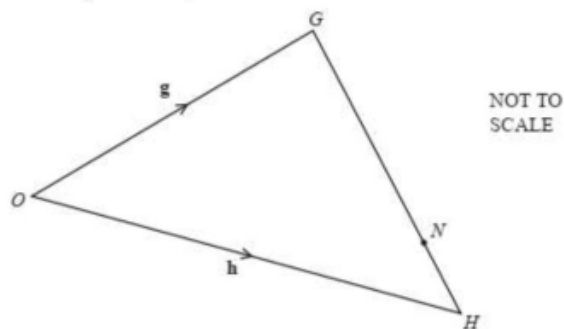
(b)  $\overrightarrow{DE} = \mathbf{a} - 2\mathbf{b}$

Find the position vector of E, in terms of  $\mathbf{a}$  and  $\mathbf{b}$ , in its simplest form. [2]

**0580/22/M/J/18 Q22)**



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



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

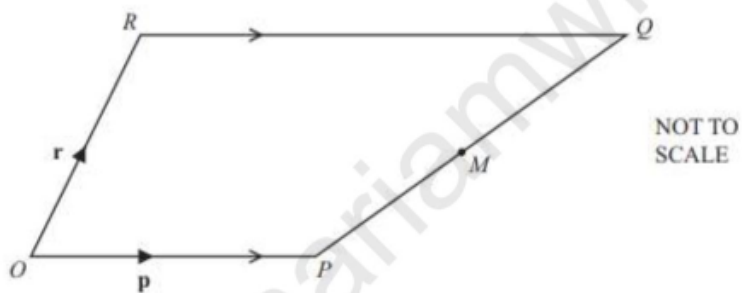
Find the following in terms of  $\mathbf{g}$  and  $\mathbf{h}$ , giving your answers in their simplest form.

(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,  $\overrightarrow{OP} = \mathbf{p}$  and  $\overrightarrow{OR} = \mathbf{r}$ .

M is the midpoint of PQ.

Find, in terms of  $\mathbf{p}$  and  $\mathbf{r}$ , in its simplest form

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

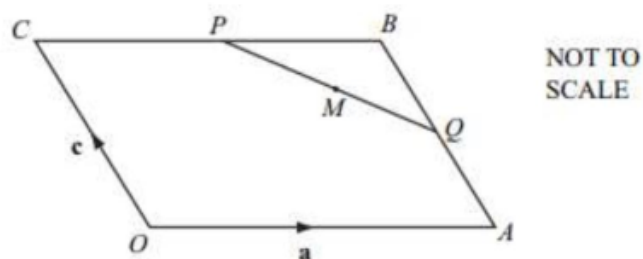
(b) , the position vector of M. [2]

0580/22/M/J/14 Q14)





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



$CP = PB$  and  $AQ = QB$ .

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

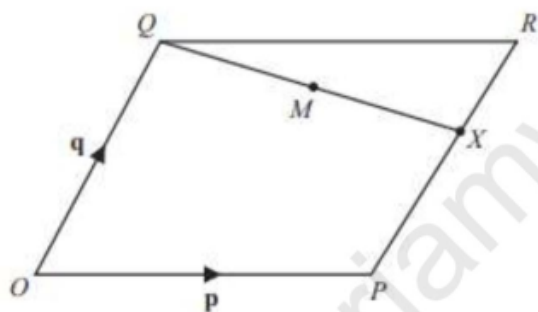
Find in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , in their simplest form,

(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  $\mathbf{p}$  and  $\mathbf{q}$ .

X is on PR so that  $PX = 2XR$ .

Find, in terms of  $\mathbf{p}$  and  $\mathbf{q}$ , in their simplest forms

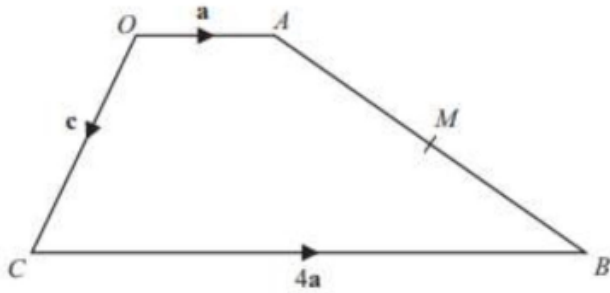
(a)  $\overrightarrow{QX}$ , [2]

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

0580/23/M/J/12 Q18)



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



M is the midpoint of AB.

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

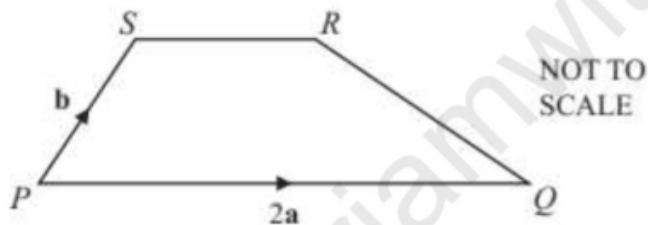
(i) the vector  $\overrightarrow{AB}$ , [2]

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

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

**0580/22/O/N/11 Q17)**

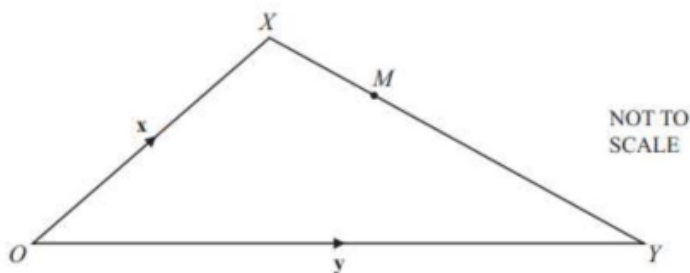
23. (a) PQRS is a trapezium with  $PQ = 2SR$ .



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

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

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



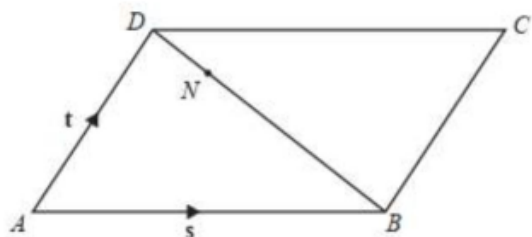
M is a point on XY such that  $XM : MY = 3 : 5$ .

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

**0580/22/F/M/15 Q17**



24. ABCD is a parallelogram.



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

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

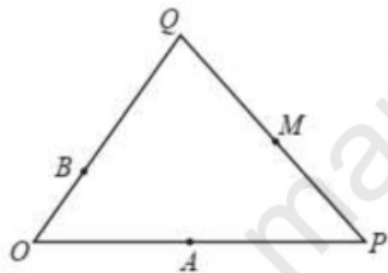
Find, in terms of  $\mathbf{s}$  and  $\mathbf{t}$ , an expression in its simplest form for

(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  $\overrightarrow{PM} = \overrightarrow{MQ}$ .



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

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

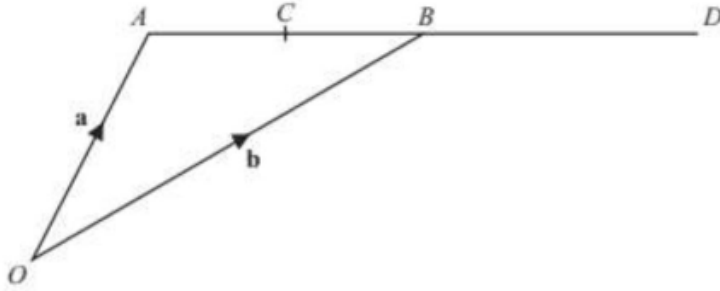
(a)  $\overrightarrow{BA}$ , [2]

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

0580/21/O/N/19 Q25)



26. A and B have position vectors  $\mathbf{a}$  and  $\mathbf{b}$  relative to the origin O.



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

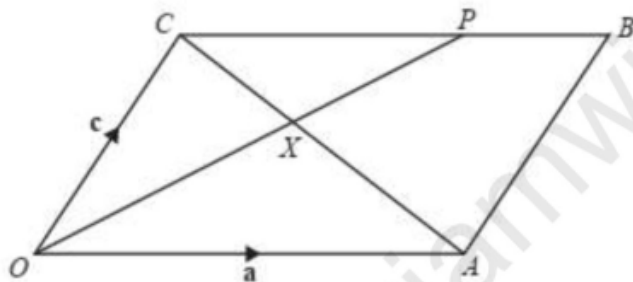
Find, in terms of  $\mathbf{a}$  and  $\mathbf{b}$ , in their simplest form

(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  $CP : PB = 2 : 1$ .

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

(a) Find OP, in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , in its simplest form. [2]

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

(i) Find OX, in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , in its simplest form. [2]

(ii) Find OX : XP. [2]

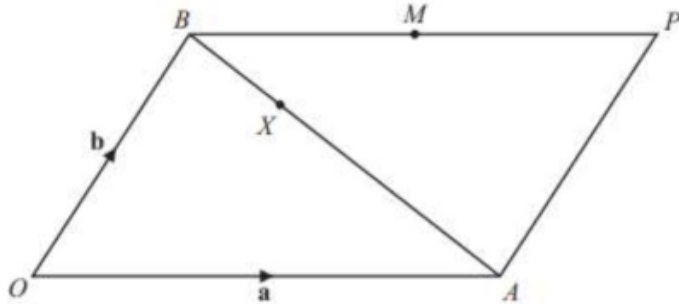
**0580/23/O/N/18 Q26)**



28. OAPB is a parallelogram.

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

M is the midpoint of BP.



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

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

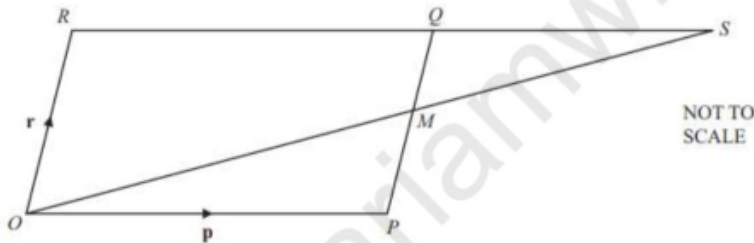
(ii) the position vector of M. [1]

(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.



M is the midpoint of PQ.

OM and RQ are extended to meet at S.

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

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

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

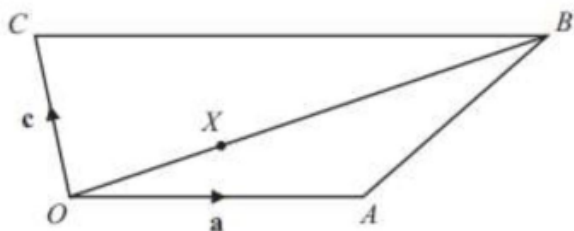
(ii) the position vector of S. [1]

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

**0580/21/M/J/13 Q20)**



30. The diagram shows a quadrilateral OABC.



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

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

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

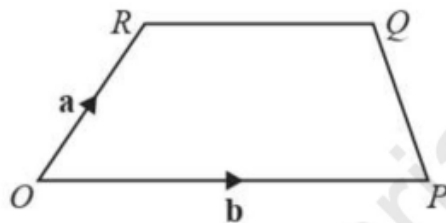
(i)  $\overrightarrow{AC}$ , [1]

(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  $\overrightarrow{PQ}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$  in its simplest form. [2]

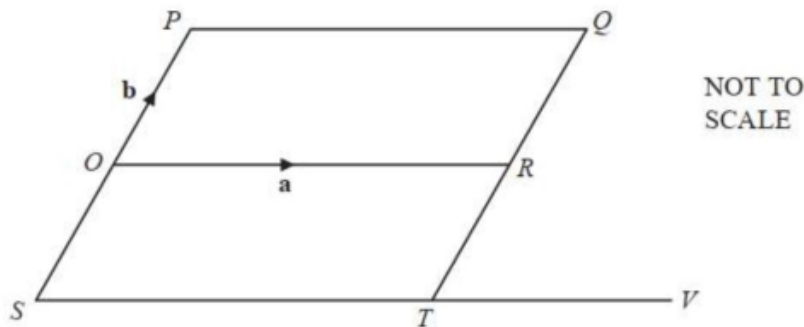
(b) When  $PQ$  and  $OR$  are extended, they intersect at  $W$ .

Find the position vector of  $W$ . [2]

**0580/22/F/M/22 Q22)**



32. 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  $ST : TV = 2 : 1$ .

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

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

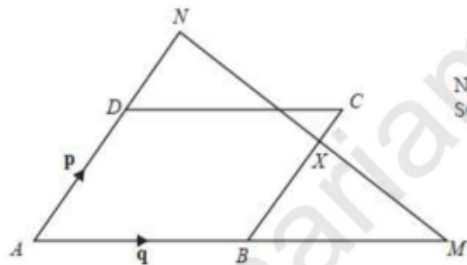
(i) the position vector of T, [2]

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

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

0580/23/M/J/20 Q21

33. ABCD is a parallelogram with  $\overrightarrow{AB} = \mathbf{q}$  and  $\overrightarrow{AD} = \mathbf{p}$ .



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  $\mathbf{p}$  and  $\mathbf{q}$ , in its simplest form. [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. [2]

0580/22/M/J/19 Q23)



34. O is the origin.

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

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

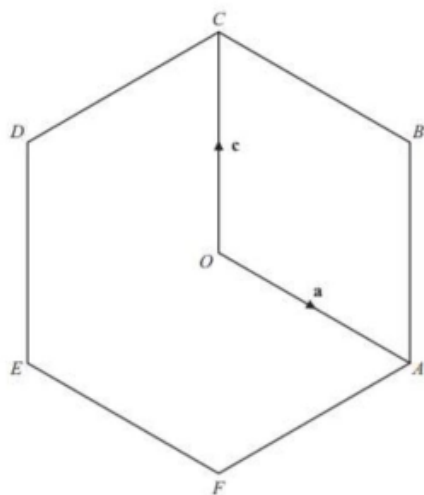
Find, in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , in  
their simplest form

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

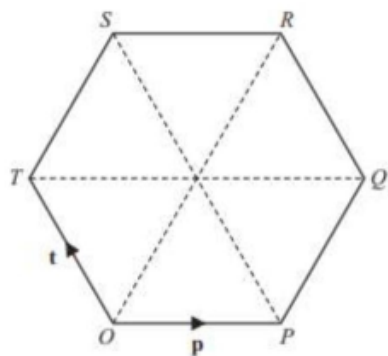
(b)  $\overrightarrow{DB}$  [2]

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

0580/22/O/N/13 Q19)



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



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

Find, in terms of  $\mathbf{p}$  and  $\mathbf{t}$ , in their simplest forms,

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

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

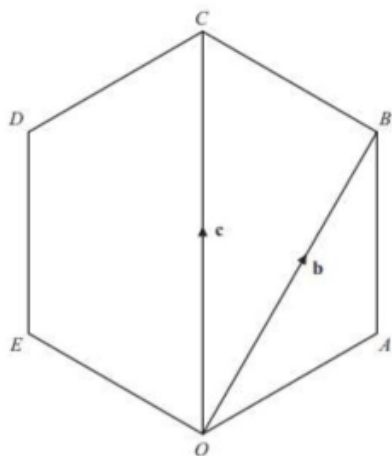
(c) the position vector of R. [2]

0580/21/M/J/12 Q19)





36. OABCDE is a regular polygon.



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

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

Find, in terms of  $\mathbf{b}$  and  $\mathbf{c}$ , in their simplest form,

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

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

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

0580/23/M/J/13 Q19)

## 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 $\overline{OM} = b + \frac{1}{2}a$ or $\overline{OX} = \frac{2}{3}(b + \frac{1}{2}a)$ or $\overline{OX} = \frac{2}{3}\overline{OM}$
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) $\overline{AC}$ is a multiple of $\overline{AX}$ 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) $\overline{PT} = a - 2b$ , so $\overline{PT} = 2\overline{RV}$
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 $\frac{3}{4}$ 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) $-b + c$