



**CAMBRIDGE**  
International Examinations

**MATHEMATICS (EXTENDED) 0580**  
**IGCSE MAY/JUNE 2020**

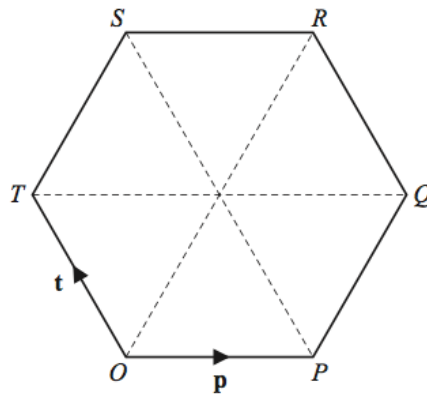
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**REVISION 13**  
**VECTORS**

## NOTES:

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1.



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

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

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

(a)  $\overrightarrow{PT}$

Answer: ..... [1]

(b)  $\overrightarrow{PR}$

Answer: ..... [2]

(c) the position vector of R.

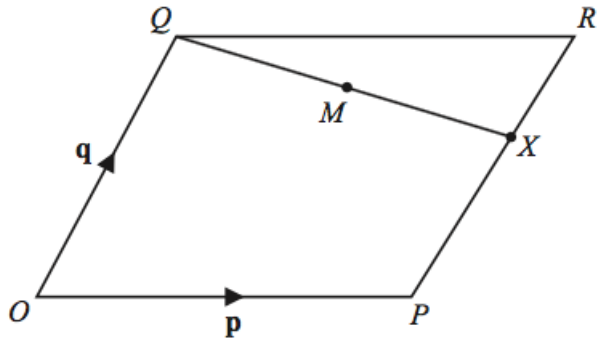
Answer: ..... [2]

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

Write down the co-ordinates of Q.

Answer: ..... [2]

3.



NOT TO  
SCALE

$O$  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,

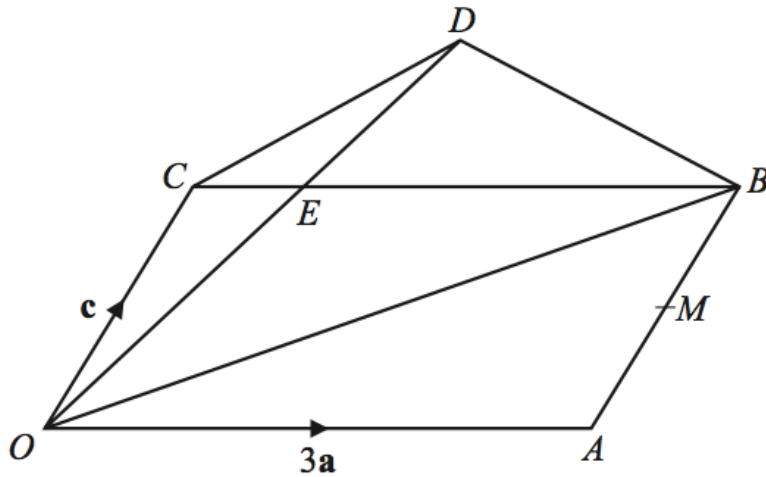
(a)  $\overrightarrow{QX}$

Answer: ..... [2]

(b) the position vector of  $M$ , the midpoint of  $QX$ .

Answer: ..... [2]

4.



NOT TO SCALE

$O$  is origin and  $OACB$  is a parallelogram.  
 $M$  is the midpoint of  $AB$ .

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

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

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

(i)  $\vec{OB}$

Answer: ..... [1]

(ii) the position vector of  $M$

Answer: ..... [2]

(iii)  $\vec{OE}$

Answer: ..... [1]

(iv)  $\vec{CD}$

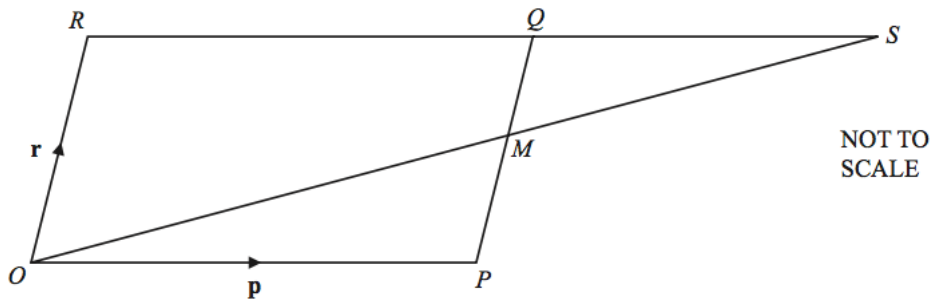
Answer: ..... [2]

(c) Write down two facts about the lines  $CD$  and  $OB$ .

Answer: .....

..... [1]

5.



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

$M$  is the midpoint of  $PQ$ .

$OM$  and  $RQ$  are extended to meet at  $S$ .

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

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

(i)  $\vec{OM}$

Answer: ..... [1]

(ii) the position vector of  $S$

Answer: ..... [1]

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

Answer: ..... [1]

6.  $OABCDE$  is a regular polygon.

(a)  $O$  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)  $\vec{BC}$

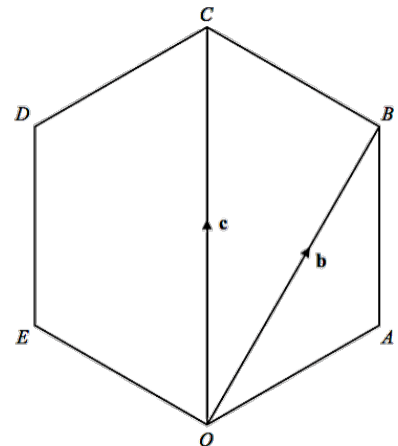
Answer: ..... [1]

(ii)  $\vec{OA}$

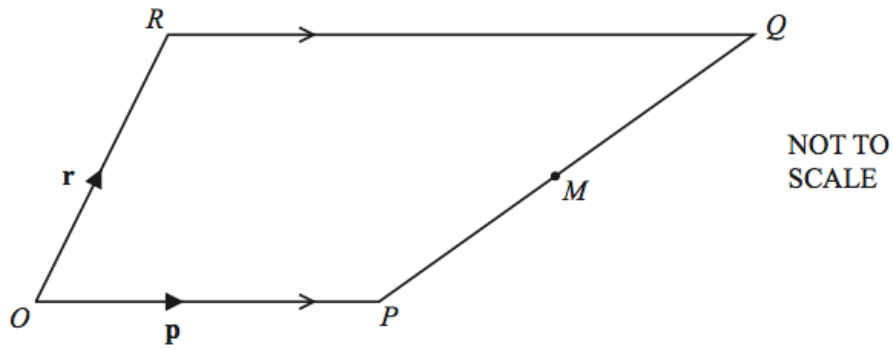
Answer: ..... [2]

(iii) the position vector of  $E$ .

Answer: ..... [1]



7.



$OPQR$  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 their simplest form

(a)  $\overrightarrow{PQ}$

Answer: ..... [1]

(b)  $\overrightarrow{OM}$ , the position vector of  $M$ .

Answer: ..... [2]

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

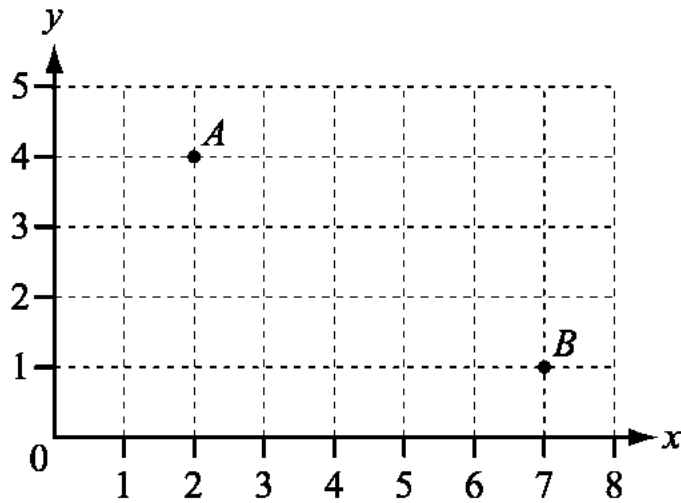
(i)  $P$  is the point  $(-2, 3)$ .  
 Write down the co-ordinates of  $Q$ .

Answer: ..... [1]

(ii) Work out  $|\overrightarrow{PQ}|$ , the magnitude of  $\overrightarrow{PQ}$ .

Answer: ..... [2]

9.



(i) Write down the position vector of  $A$ .

*Answer:* ..... [1]

(ii) Work out  $|\overrightarrow{AB}|$ , the magnitude of  $\overrightarrow{AB}$ .

*Answer:* ..... [2]

10.  $\overrightarrow{PQ} = \begin{pmatrix} 5 \\ -8 \end{pmatrix}$ .

(i)  $Q$  is the point  $(-2, 3)$ .  
Write down the co-ordinates of  $P$ .

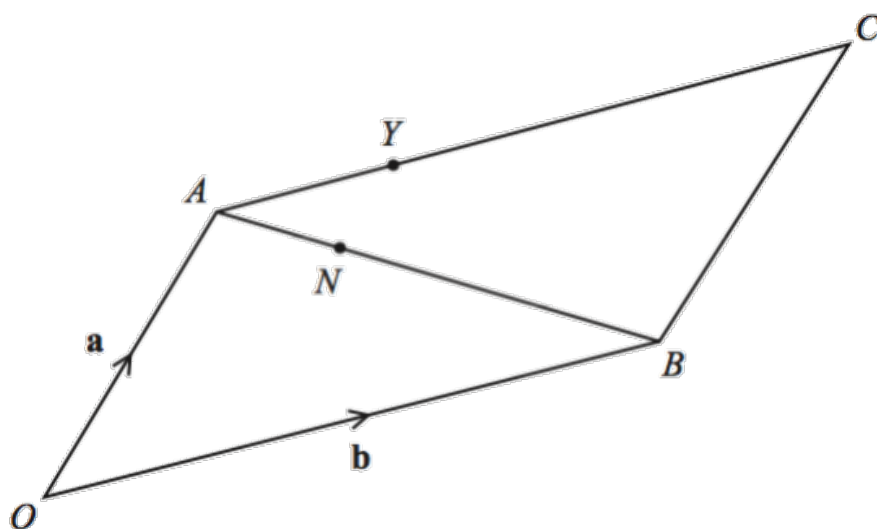
*Answer:* ..... [1]

(ii) Work out  $|\overrightarrow{PQ}|$ , the magnitude of  $\overrightarrow{PQ}$ .

*Answer:* ..... [2]



11.



$OACB$  is a parallelogram.  $\overrightarrow{OA} = \mathbf{a}$  and  $\overrightarrow{OB} = \mathbf{b}$ .  
 $AN : NB = 2 : 3$  and  $AY = \frac{2}{5} AC$ .

(i) Write each of the following in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

(a)  $\overrightarrow{ON}$

Answer: ..... [2]

(b)  $\overrightarrow{NY}$

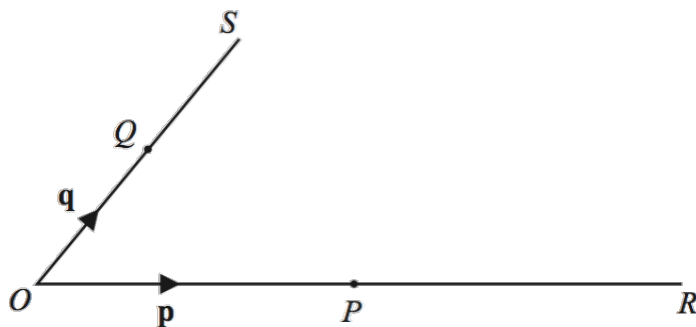
Answer: ..... [2]

(ii) Write down two conclusions you can make about the line segments  $NY = BC$ .

Answer: ..... [2]

12.

$O$  is the origin,  $\overrightarrow{OP} = \mathbf{p}$  and  $\overrightarrow{OQ} = \mathbf{q}$ .  
 $OP$  is extended to  $R$  so that  $OP = PR$ .  
 $OQ$  is extended to  $S$  so that  $OQ = QS$ .



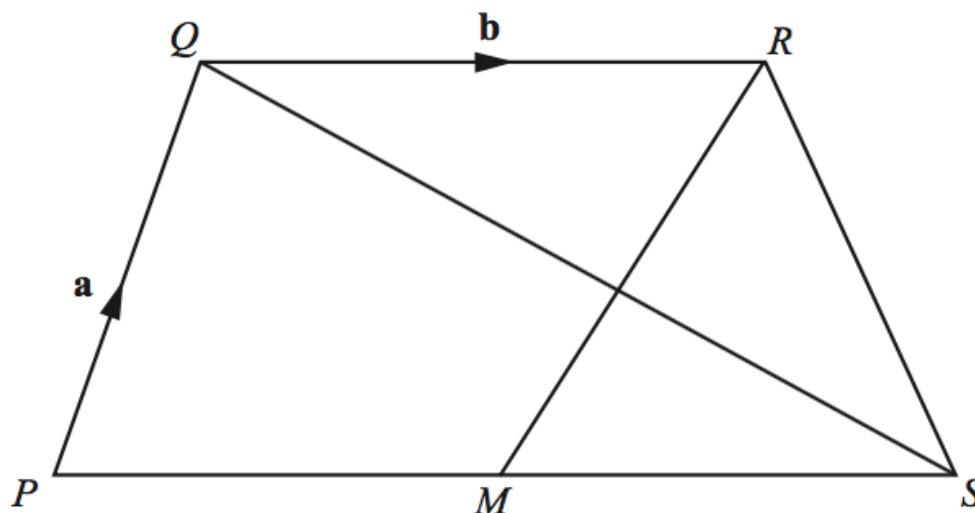
(i) Write down  $\overrightarrow{RQ}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ .

Answer: ..... [1]

(ii)  $PS$  and  $RQ$  intersect at  $M$  and  $RM = 2MQ$ .  
Use vectors to find the ratio of  $PM : PS$ , showing all your working.

Answer: ..... [4]

13.



NOT TO  
SCALE

$PQRS$  is a quadrilateral and  $M$  is the midpoint of  $PS$ .

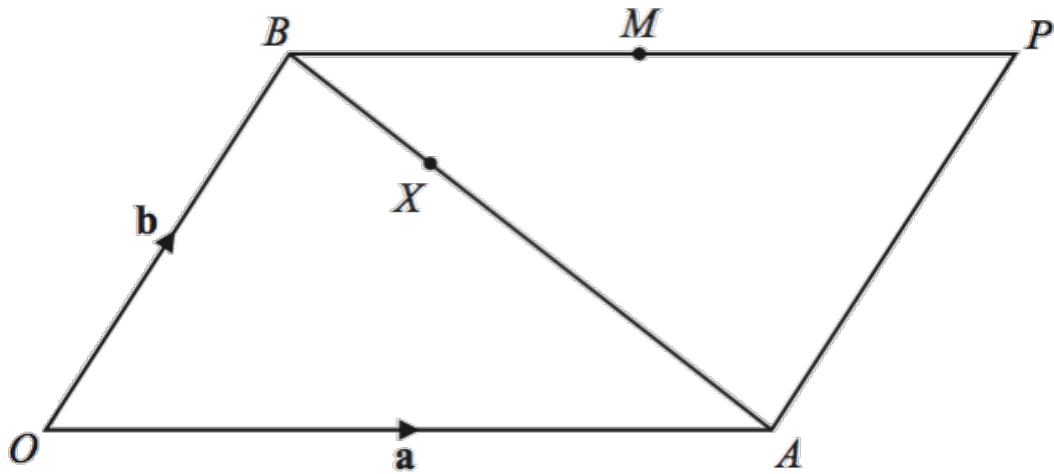
$$\vec{PQ} = \mathbf{a}, \vec{QR} = \mathbf{b} \text{ and } \vec{SQ} = \mathbf{a} - 2\mathbf{b}.$$

(a) Show that  $\vec{PS} = 2\mathbf{b}$ . [1]

(b) Write down the mathematical name for the quadrilateral  $PQRM$ , giving reasons for your answer.

Answer: ..... because .....  
..... [2]

14.



$OAPB$  is a parallelogram.

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

$M$  is the midpoint of  $BP$ .

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

(i)  $\vec{BA}$

Answer: ..... [1]

(ii) the position vector of  $M$

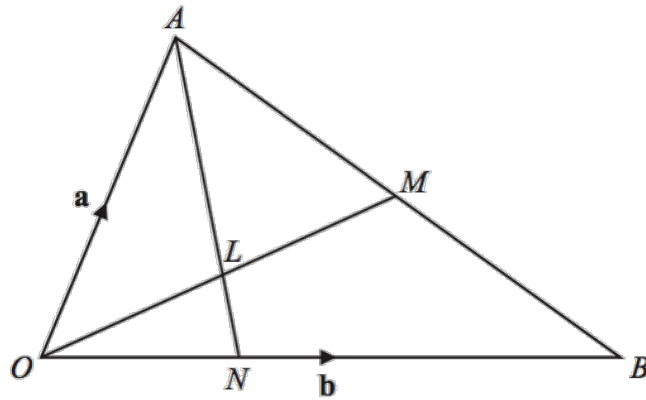
Answer: ..... [1]

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

Show that  $X$  lies on  $OM$ .

[4]

15.



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  $ON = \frac{1}{3} OB$ .

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

(a)  $\overrightarrow{OM}$

Answer: ..... [2]

(b)  $\overrightarrow{OL}$

Answer: ..... [1]

(c)  $\overrightarrow{AL}$

Answer: ..... [2]

(ii) Find the ratio of  $AL : AN$  in its simple form.

Answer: ..... [3]