

Name:.....

Total Marks:.....

# GCSE (9-1) Grade 8/9 Vectors Proof Questions



## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name.
- Answer **all** questions.
- Answer the questions in the spaces provided
  - there may be more space than you need.
- **Show all your working out**

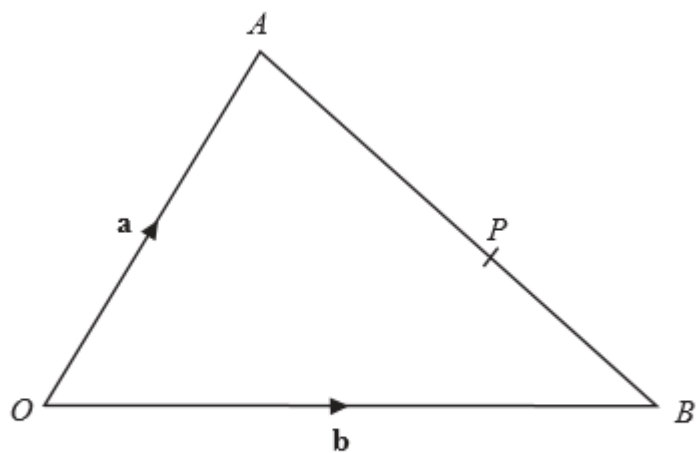
## Information

- The total mark for this paper is 64.
- The marks for **each** question are shown in brackets.
  - use this as a guide as to how much time to spend on each question.
- Questions labelled with an **asterisk** (\*) are ones where the quality of your written communication will be assessed

## Advice

- Read each question carefully before you start to answer it
- Attempt every question
- Check your answers if you have time at the end

1.



$OAB$  is a triangle.

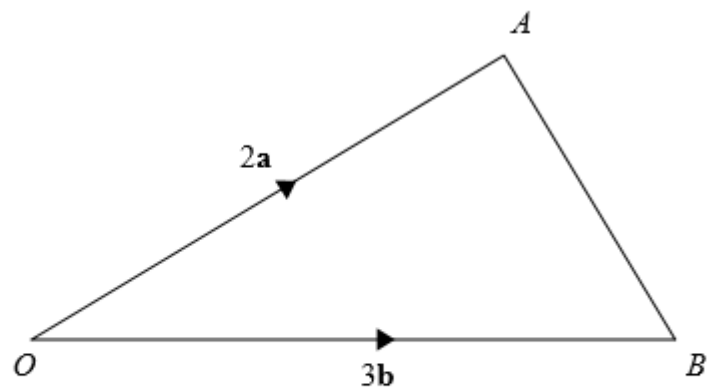
$$\vec{OA} = \mathbf{a}, \quad \vec{OB} = \mathbf{b}$$

$P$  is a point on  $AB$  so that  $AP : PB$  is  $2 : 3$

Show that  $\vec{OP} = \frac{1}{5}(3\mathbf{a} + 2\mathbf{b})$

.....  
(Total 3 marks)

2.



$$\vec{OA} = 2\mathbf{a}$$

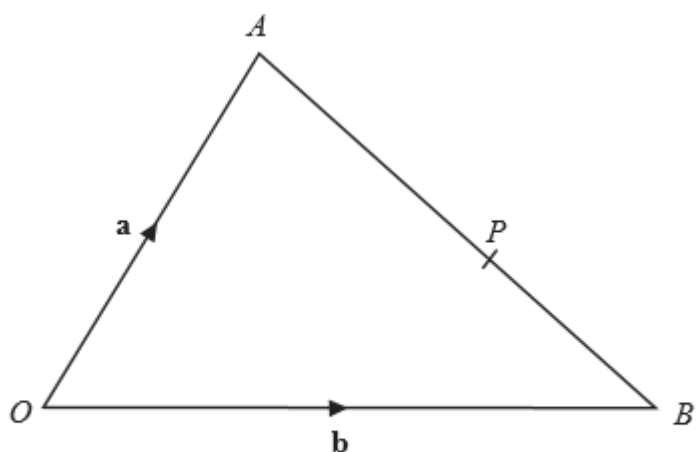
$$\vec{OB} = 3\mathbf{b}$$

P is a point on AB so that AP : PB is 3 : 2

Show that  $\vec{OP} = \frac{1}{5}(4\mathbf{a} + 9\mathbf{b})$

.....  
(Total 4 marks)

3.



$OAB$  is a triangle.

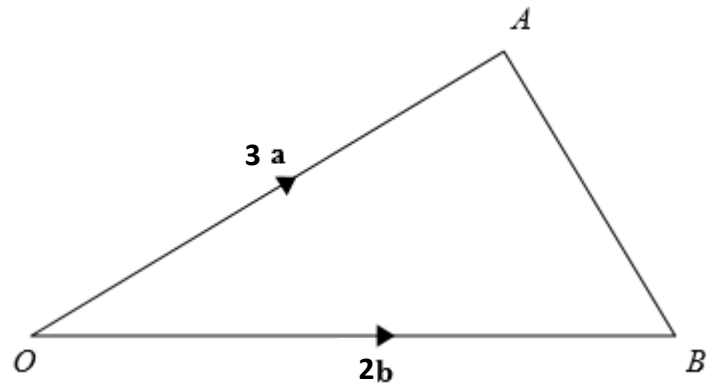
$$\vec{OA} = \mathbf{a}, \quad \vec{OB} = \mathbf{b}$$

$P$  is the point on  $AB$  such that  $AP : PB$  is  $3 : 5$

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

.....  
(Total 4 marks)

4.



$OAB$  is a triangle

$$\overrightarrow{OA} = 3\mathbf{a}$$

$$\overrightarrow{OB} = 2\mathbf{b}$$

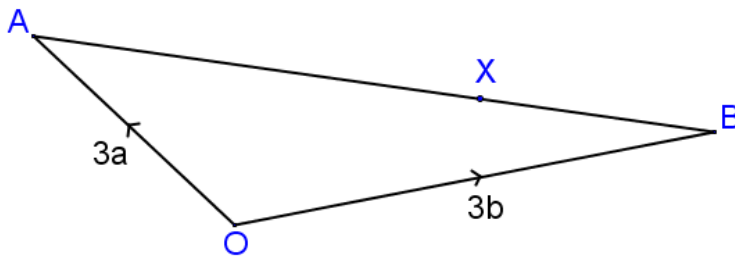
P is a point on  $AB$  so that  $AP : PB$  is  $1 : 3$

Given that  $\overrightarrow{OP} = k(9\mathbf{a} + 2\mathbf{b})$

Find the value of  $k$

.....  
(Total 4 marks)

5.



$$\overrightarrow{OA} = 3\mathbf{a}$$

$$\overrightarrow{OB} = 3\mathbf{b}$$

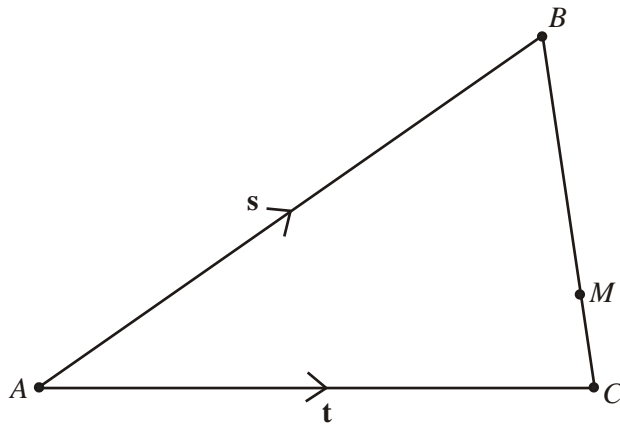
X is the point on AB such that  $AX : XB = 9 : 4$

Find the value of  $k$  if  $\overrightarrow{OX} = k(4\mathbf{a} + 9\mathbf{b})$

.....  
**(Total 4 marks)**

6.

Not drawn accurately



In triangle  $ABC$ ,  $M$  lies on  $BC$  such that  $BM = \frac{3}{4} BC$ .

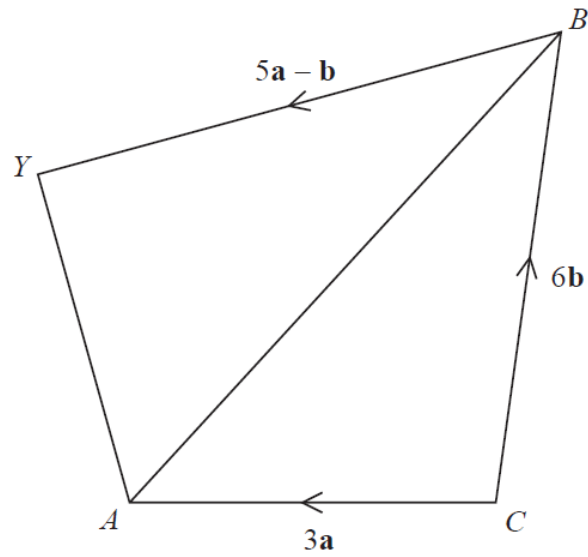
$\vec{AB} = \mathbf{s}$  and  $\vec{AC} = \mathbf{t}$

Find  $\vec{AM}$  in terms of  $\mathbf{s}$  and  $\mathbf{t}$ .

Give your answer in its simplest form.

.....  
**(Total 4 marks)**

7.



$CAYB$  is a quadrilateral.

$\vec{CA} = 3\mathbf{a}$

$\vec{CB} = 6\mathbf{b}$

$\vec{BY} = 5\mathbf{a} - \mathbf{b}$

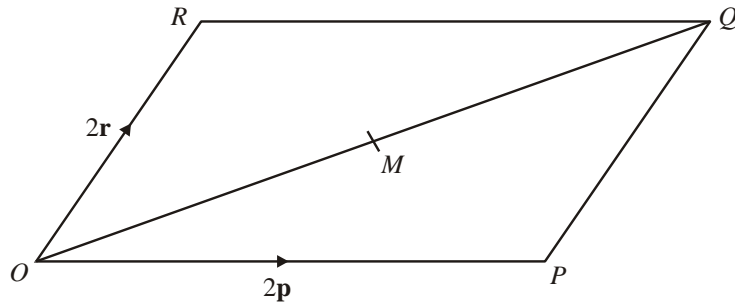
$X$  is the point on  $AB$  such that  $AX : XB = 1 : 2$

Prove that  $\vec{CX} = \frac{2}{5} \vec{CY}$

.....  
(Total 4 marks)



8.



$OPQR$  is a parallelogram.

$M$  is the mid-point of the diagonal  $OQ$ .

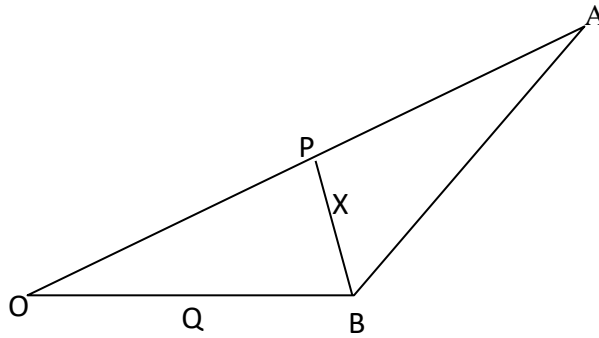
$$\vec{OP} = 2\mathbf{p} \text{ and } \vec{OR} = 2\mathbf{r}$$

Use vectors to prove that  $M$  is also the mid-point of  $PR$ .

.....  
(Total 4 marks)

9. OAB is a triangle. P and Q are the midpoints of OA and OB respectively.

The point X lies on the line PB, and  $PX:XB$  is in the ratio 1:2.



Show that  $\overrightarrow{QX}$  is parallel to  $\overrightarrow{QA}$

.....

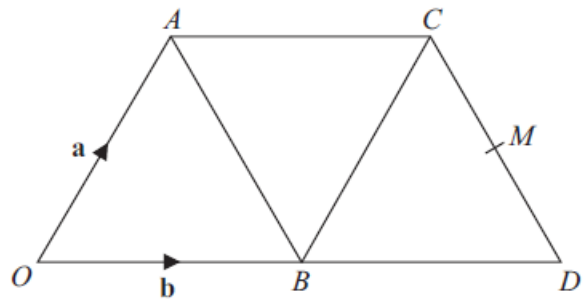
**(Total 4 marks)**

10.  $OACD$  is a trapezium made from three equilateral triangles.

$$\overrightarrow{OA} = \mathbf{a}$$

$$\overrightarrow{OB} = \mathbf{b}$$

$M$  is the midpoint of  $CD$ .



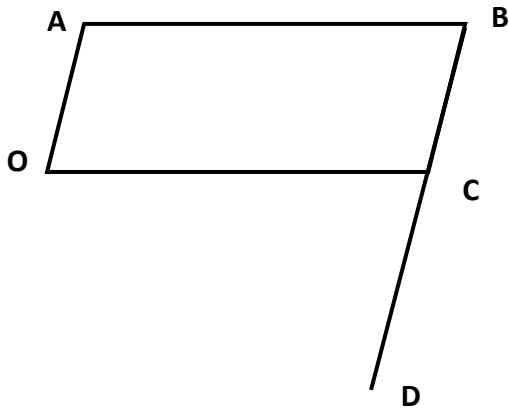
(a) Write  $\overrightarrow{AB}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

.....  
(1 mark)

(b) Show that  $\overrightarrow{OC}$  is parallel to  $\overrightarrow{BM}$ .

.....  
(3 marks)

11.



D is the point on  $BC$  extended such that  $BC : CD = 1 : 2$

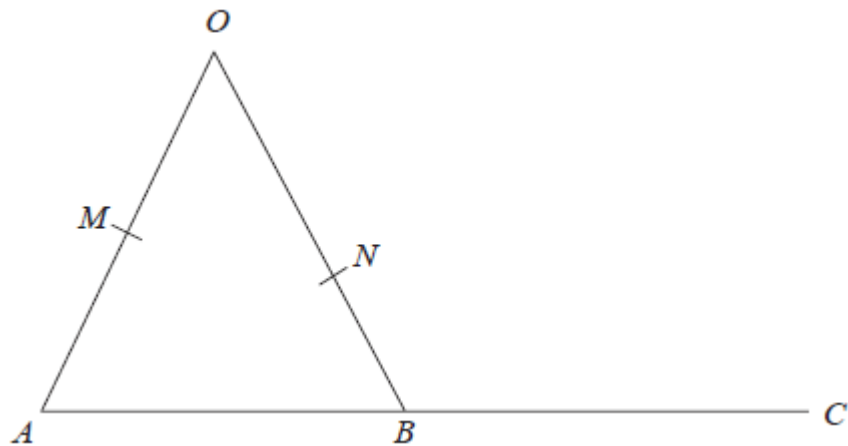
X is a point on  $OC$  such that  $OC = \frac{1}{3} OX$

Show that A, B and D lie on the same straight line

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(Total 5 marks)

12.



$OMA$ ,  $ONB$  and  $ABC$  are straight lines.

$M$  is the midpoint of  $OA$ .

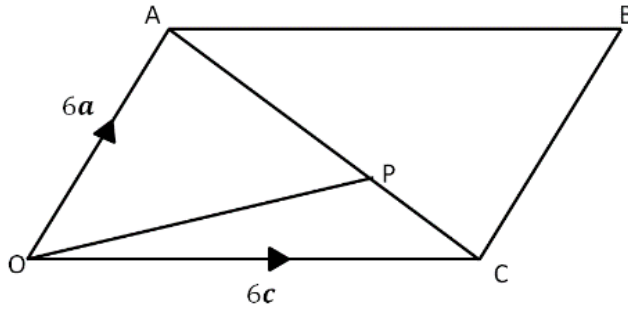
$B$  is the midpoint of  $AC$ .

$\vec{OA} = 6\mathbf{a}$      $\vec{OB} = 6\mathbf{b}$      $\vec{ON} = k\mathbf{b}$  where  $k$  is a scalar quantity.

Given that  $MNC$  is a straight line, find the value of  $k$ .

.....  
(Total 5 marks)

13.



$OACB$  is a parallelogram.  $P$  is the point on  $AC$  such that  $AP = \frac{2}{3}AC$ .

a) Find the vector  $\overrightarrow{OP}$ . Give your answer in terms of  $\mathbf{a}$  and  $\mathbf{c}$ .

.....

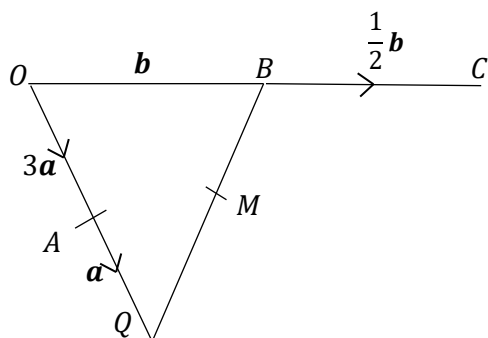
**(Total 2 marks)**

b) Given that the midpoint of  $CB$  is  $M$ , prove that  $OPM$  is a straight line.

.....

**(Total 3 marks)**

14.



$$\overrightarrow{OA} = 3\mathbf{a} \quad \overrightarrow{AQ} = \mathbf{a} \quad \overrightarrow{OB} = \mathbf{b} \quad \overrightarrow{BC} = \frac{1}{2}\mathbf{b}.$$

$M$  is the midpoint of  $QB$ .

Prove that  $AMC$  is a straight line.

.....  
(Total 5 marks)

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**TOTAL FOR PAPER: 64 MARKS**