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**

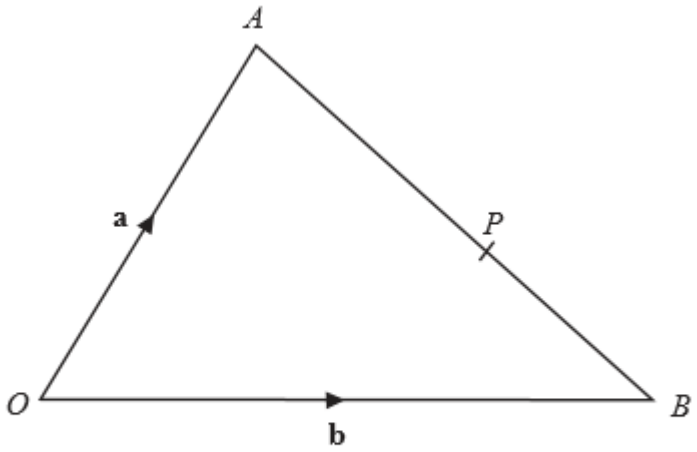
Information

- 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.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

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

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

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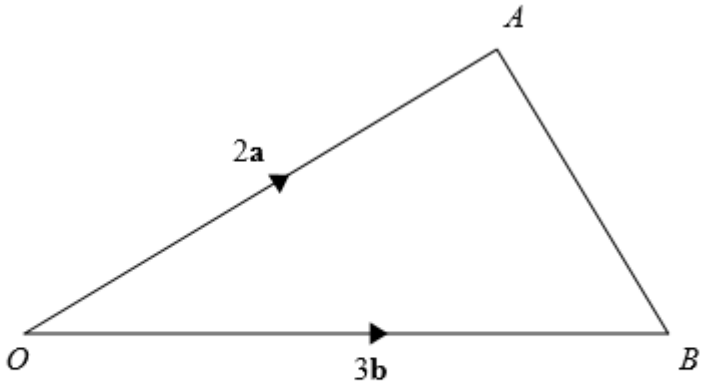
(Total 3 marks)

2.



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

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

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

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

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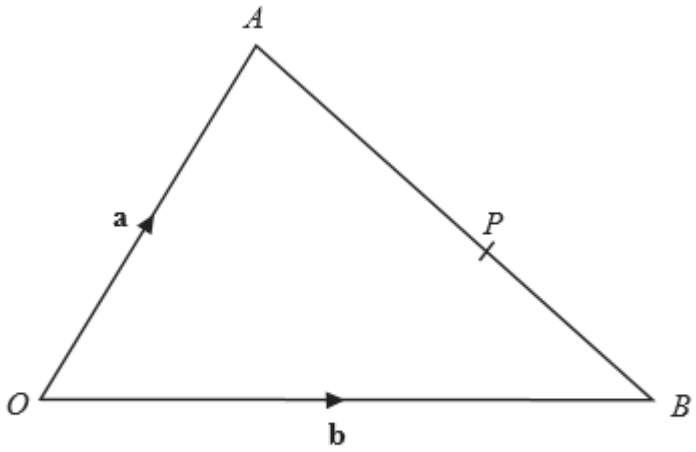
(Total 4 marks)

3.



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

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

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

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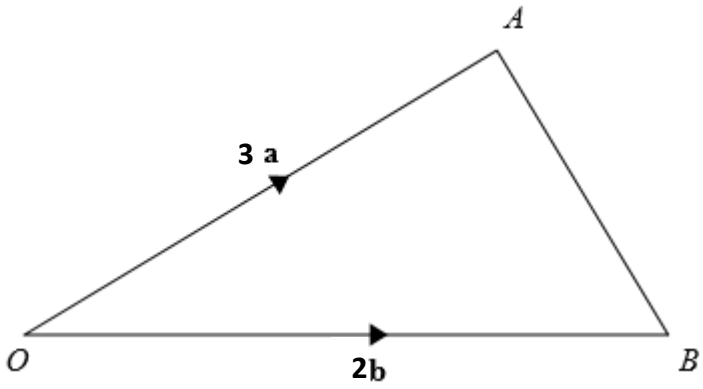
(Total 4 marks)

4.



OAB is a triangle
$\overrightarrow{OA}$ = **3a**
$\overrightarrow{OB}$ = **2b**

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

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

Find the value of k

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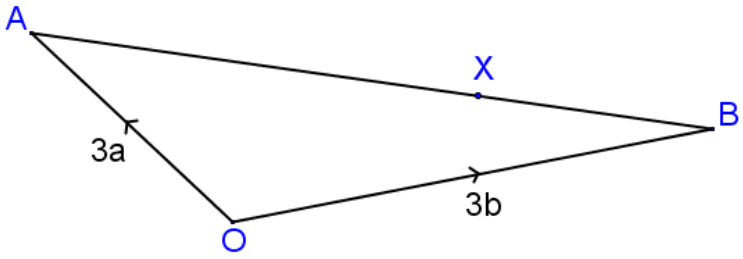
(Total 4 marks)

5.



$\overrightarrow{OA}$ = **3a**
$\overrightarrow{OB}$ = **3b**

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

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

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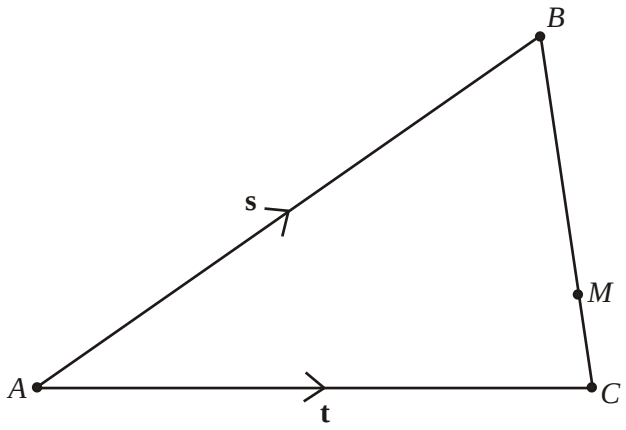
(Total 4 marks)

6.



Not drawn accurately

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

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

Find $\overrightarrow{AM}$ in terms of **s** and **t**.

Give your answer in its simplest form.

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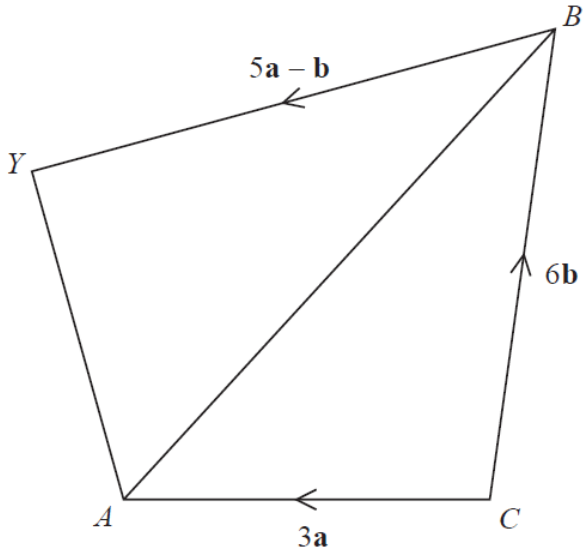
(Total 4 marks)

7.



CAYB is a quadrilateral.

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

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

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

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

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

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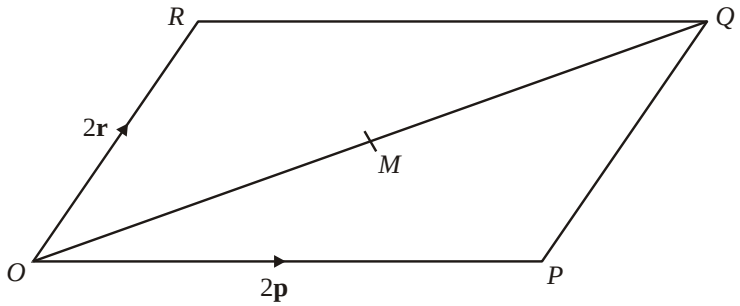
(Total 4 marks)

8.



OPQR is a parallelogram.

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

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

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

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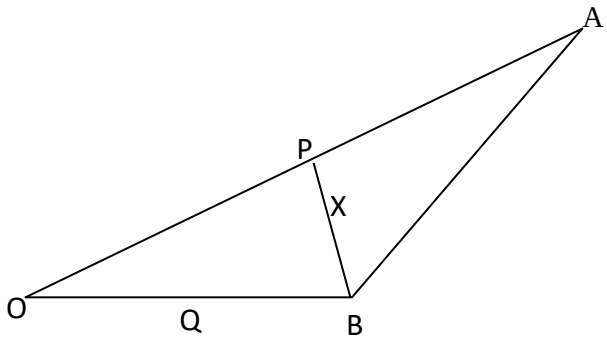
(Total 4 marks)

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 $\overrightarrow{QA}$

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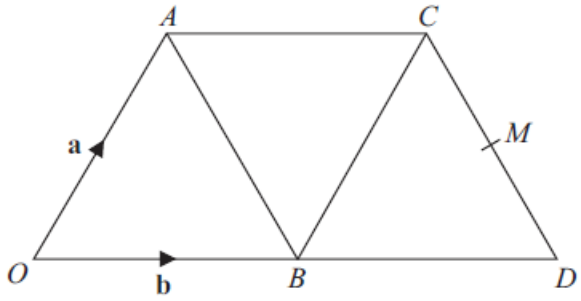
(Total 4 marks)

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

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

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

M is the midpoint of *CD*.



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

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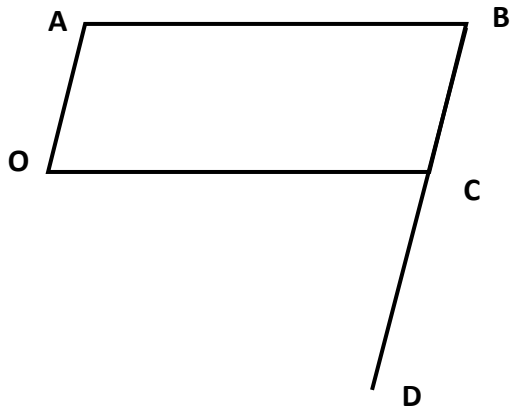
(1 mark)

(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 $OX = \frac{1}{3} OC$

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

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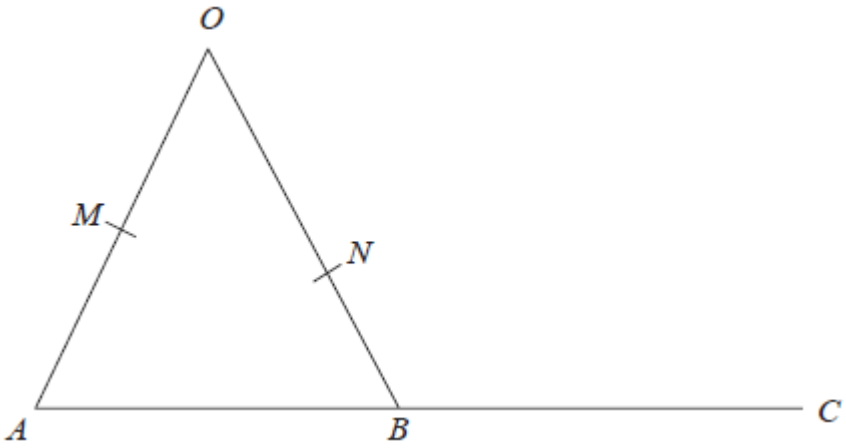
(Total 5 marks)

12.



OMA, ONB and *ABC* are straight lines.
M is the midpoint of *OA.*
B is the midpoint of *AC.*

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

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

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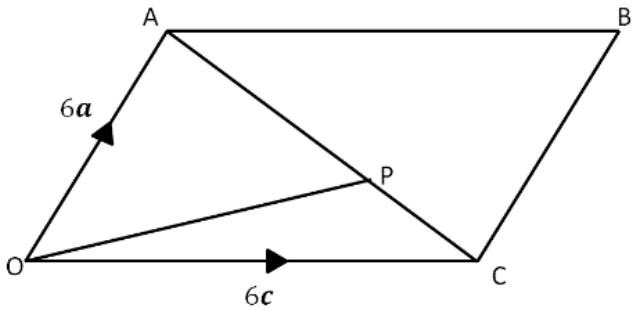
(Total 5 marks)

13.



$OABC$ 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 $\boldsymbol{a}$ and $\boldsymbol{c}$.

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(Total 2 marks)

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

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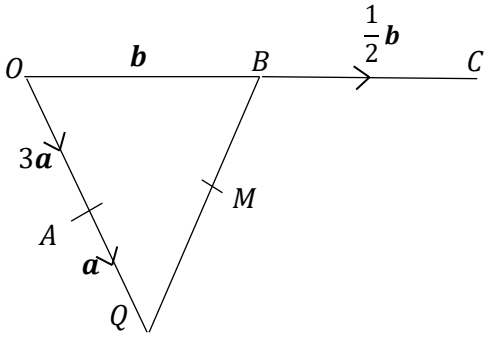
(Total 3 marks)

14.



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

M is the midpoint of QB.

Prove that AMC is a straight line.

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(Total 5 marks)

TOTAL FOR PAPER: 64 MARKS