

Vectors

Exam questions

Foundation and Higher tiers

Please write clearly in block capitals.

Name

Class

Teacher

Time allowed: 50 minutes

Materials

For this booklet you need a black pen, a pencil, a ruler and a rubber.

Instructions

- Use black ink or black ballpoint pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- You must not use a calculator.
- Do all rough work in this booklet. Cross through any work you do not want marked.

Information

- The marks for each question are shown in brackets.
- The maximum mark for this booklet is 44.

Advice

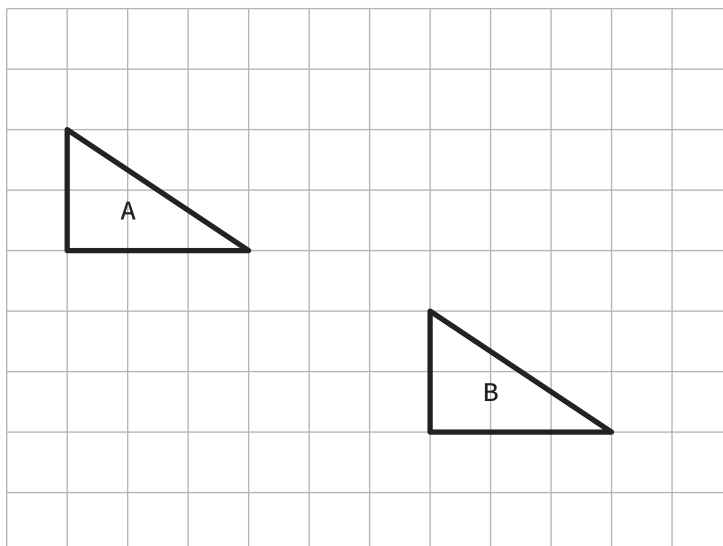
- Read each question carefully.
- In all calculations, show clearly how you work out your answer.

For teacher’s use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
TOTAL	

- 1** Here are two shapes, A and B, on a grid.

Do not
write
outside
the box



- (a)** Write down the column vector for the translation that maps shape A to shape B.

Answer _____

[1 mark]

- (b)** Translate shape A by the vector $\begin{pmatrix} 5 \\ 1 \end{pmatrix}$
Label the new shape C.

[2 marks]

- 2** Shape P is translated by the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and then by the vector $\begin{pmatrix} -5 \\ 4 \end{pmatrix}$

Write down the column vector of the single translation that has the same effect.

Answer _____

[2 marks]

3

$$\mathbf{a} = \begin{pmatrix} 3 \\ -1 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

(a) Work out $3\mathbf{a}$ as a column vector.

Answer _____

[1 mark]

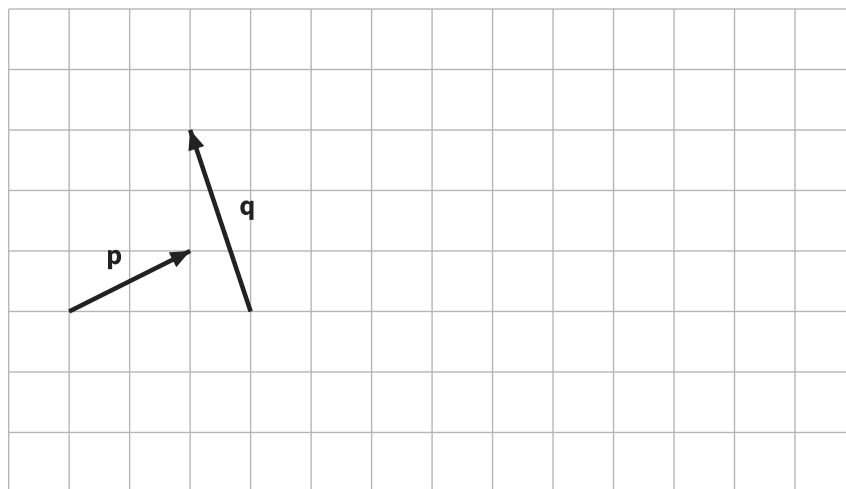
(b) Work out $\mathbf{a} - 2\mathbf{b}$ as a column vector.

Answer _____

[2 marks]

4

The vectors $\mathbf{p}$ and $\mathbf{q}$ are drawn on the grid.



On the grid, draw and label the vector $2\mathbf{p} - \mathbf{q}$

[2 marks]

5

Which vector is parallel to $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$?

Circle your answer.

$$\begin{pmatrix} -3 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 4 \\ -6 \end{pmatrix}$$

$$\begin{pmatrix} 6 \\ 9 \end{pmatrix}$$

$$\begin{pmatrix} -2 \\ -3 \end{pmatrix}$$

[1 mark]

6

$$2 \begin{pmatrix} 3 \\ k \end{pmatrix} + \begin{pmatrix} m \\ -5 \end{pmatrix} = \begin{pmatrix} 1 \\ 7 \end{pmatrix}$$

Work out the value of k and the value of m .

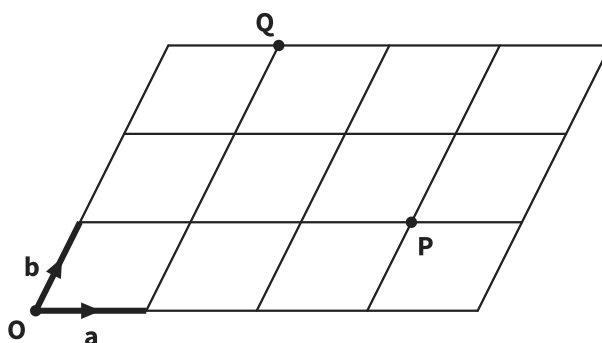
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Answer _____

[3 marks]

7

The diagram shows a grid of congruent parallelograms. The vectors **a** and **b** are shown on the grid.



- (a) Write $\vec{OP}$ in terms of **a** and **b**.

Answer _____

[1 mark]

- (b) Write $\vec{PQ}$ in terms of **a** and **b**.

Answer _____

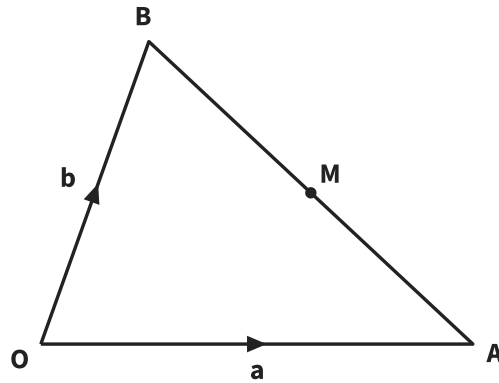
[2 marks]

8

OAB is a triangle.

$\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$

M is the midpoint of AB.



Not drawn accurately

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

Answer _____

[1 mark]

- (b) Show that $\vec{OM} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

[2 marks]

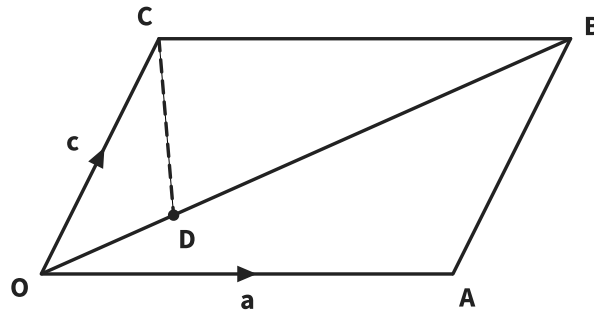
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9

OABC is a parallelogram.

$\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$

D is the point on OB such that $OD : DB = 1 : 3$



Not drawn accurately

Write $\vec{CD}$ in terms of $\mathbf{a}$ and $\mathbf{c}$.

Give your answer in its simplest form.

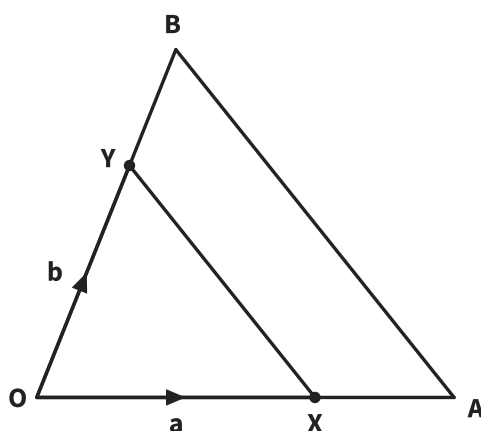
Answer _____

[3 marks]

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10

OAB is a triangle.

 $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$ X is the point on OA such that $OX : XA = 2 : 1$ Y is the point on OB such that $OY : YB = 2 : 1$ 

Not drawn accurately

Prove that XY is parallel to AB.

[3 marks]**11**

$$\mathbf{a} = \begin{pmatrix} 2 \\ -1 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$$

 $k\mathbf{a} + \mathbf{b}$ is parallel to the vector $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$
Work out the value of k .

$$k = \underline{\hspace{2cm}}$$

[3 marks]

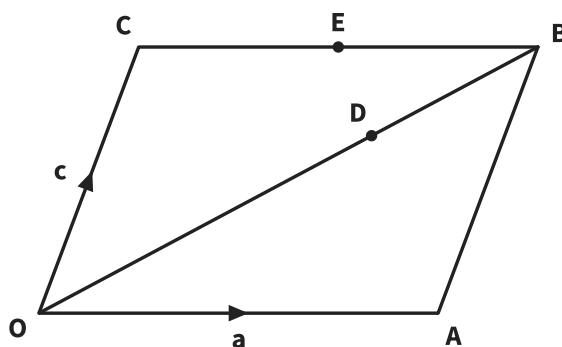
12

OABC is a parallelogram.

$\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$

D is the point on OB such that $OD : DB = 2 : 1$

E is the midpoint of CB.



Not drawn accurately

(a) Prove that A, D and E lie on a straight line.

[4 marks]

(b) Write down the ratio AD : DE

[1 mark]

Answer _____

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outside
the box

13

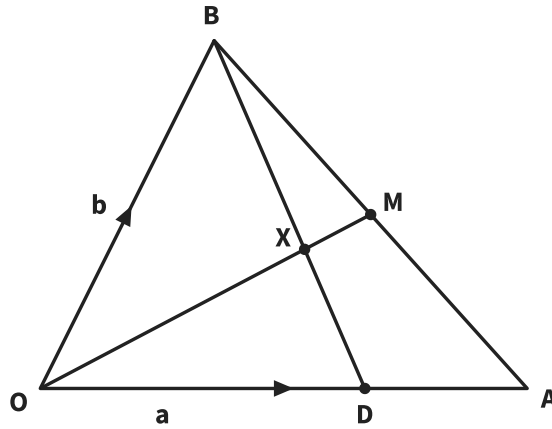
OAB is a triangle.

$\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$

M is the midpoint of AB.

D is the point on OA such that $OD : DA = 2 : 1$

OM and BD meet at X.



Not drawn accurately

Work out the ratio $OX : XM$

Answer _____

[5 marks]

Do not
write
outside
the box

14

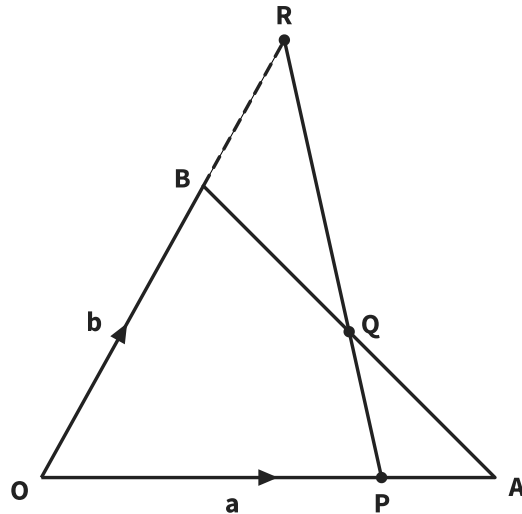
OAB is a triangle.

$\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$

P is the point on OA such that $OP : PA = 3 : 1$

Q is the midpoint of AB.

R is the point on OB extended such that P, Q and R lie on a straight line.



Not drawn accurately

Work out the ratio $OB : BR$

Answer _____

[5 marks]

END OF QUESTIONS