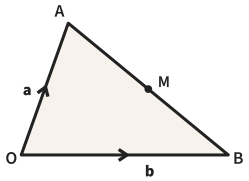
Vectors and ratio

ANSWERS

1

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. M is the midpoint of AB. Find $\overrightarrow{OM}$ in terms of **a** and **b**.



$\overrightarrow{AB} = -\mathbf{a}+\mathbf{b}$

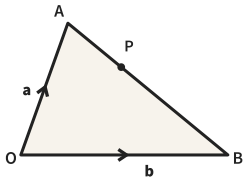
$\overrightarrow{AM} = \frac{1}{2} \times \overrightarrow{AB} = -\frac{1}{2}\mathbf{a}+\frac{1}{2}\mathbf{b}$

$\overrightarrow{OM} = \mathbf{a} + \overrightarrow{AM} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$

Answer $\overrightarrow{OM} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$

2

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. P is on AB with AP : PB = 1 : 2. Find $\overrightarrow{OP}$ in terms of **a** and **b**.



$\overrightarrow{AB} = -\mathbf{a}+\mathbf{b}$

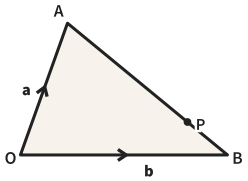
$\overrightarrow{AP} = \frac{1}{3} \times \overrightarrow{AB} = -\frac{1}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$

$\overrightarrow{OP} = \mathbf{a} + \overrightarrow{AP} = \frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$

Answer $\overrightarrow{OP} = \frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$

3

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. P is on AB with AP : PB = 3 : 1. Find $\overrightarrow{OP}$ in terms of **a** and **b**.



$\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$

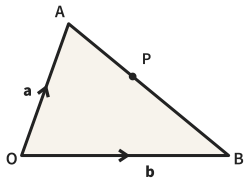
$\overrightarrow{AP} = \frac{3}{4} \times \overrightarrow{AB} = -\frac{3}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$

$\overrightarrow{OP} = \mathbf{a} + \overrightarrow{AP} = \frac{1}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$

Answer $\overrightarrow{OP} = \frac{1}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$

4

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. P is on AB with AP : PB = 2 : 3. Find $\overrightarrow{OP}$ in terms of **a** and **b**.

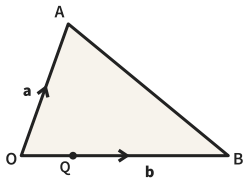


$\overrightarrow{OP} = \mathbf{a} + \overrightarrow{AP} = \frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$

Answer $\overrightarrow{OP} = \frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$

5

Q is on OB with OQ : QB = 1 : 3. Find $\overrightarrow{AQ}$ in terms of **a** and **b**.

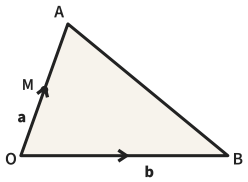


$\overrightarrow{AQ} = \overrightarrow{AO} + \overrightarrow{OQ} = -\mathbf{a} + \frac{1}{4}\mathbf{b}$

Answer $\overrightarrow{AQ} = -\mathbf{a} + \frac{1}{4}\mathbf{b}$

6

M is the midpoint of OA. Find $\overrightarrow{BM}$ in terms of **a** and **b**.

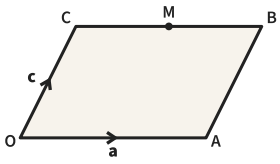


$\overrightarrow{BO} + \overrightarrow{OM} = -\mathbf{b} + \frac{1}{2}\mathbf{a}$

Answer $\overrightarrow{BM} = \frac{1}{2}\mathbf{a} - \mathbf{b}$

7

OABC is a parallelogram with $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. M is the midpoint of CB. Find $\overrightarrow{OM}$.

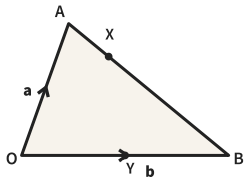


$\overrightarrow{OC} + \frac{1}{2}\overrightarrow{CB}$

Answer $\overrightarrow{OM} = \frac{1}{2}\mathbf{a} + \mathbf{c}$

8

X is on AB with AX : XB = 1 : 3. Y is the midpoint of OB. Find $\overrightarrow{XY}$ in terms of **a** and **b**.



$\overrightarrow{XO} + \overrightarrow{OY} = -(\frac{3}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}) + \frac{1}{2}\mathbf{b}$

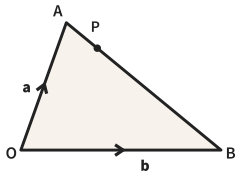
Answer $\overrightarrow{XY} = -\frac{3}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$

Vectors and ratio *further practice*

ANSWERS

9

P is on AB with AP : PB = 1 : 4. Find $\overrightarrow{OP}$ in terms of **a** and **b**.



$\mathbf{a} + \frac{1}{5}(-\mathbf{a} + \mathbf{b})$

Answer $\overrightarrow{OP} = \frac{4}{5}\mathbf{a} + \frac{1}{5}\mathbf{b}$

10

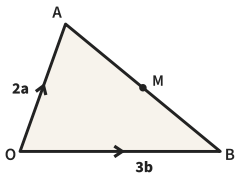
A is (1, 2) and B is (9, 6). P is on AB with AP : PB = 1 : 3. Find the coordinates of P.

$\overrightarrow{AB}$ is 8 across and 4 up; a quarter of it is 2 and 1

Answer (3, 3)

11

$\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$. M is the midpoint of AB. Find $\overrightarrow{OM}$.

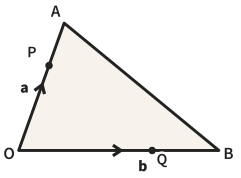


$2\mathbf{a} + \frac{1}{2}(3\mathbf{b} - 2\mathbf{a})$

Answer $\overrightarrow{OM} = \mathbf{a} + \frac{3}{2}\mathbf{b}$

12

P is on OA with OP : PA = 2 : 1. Q is on OB with OQ : QB = 2 : 1. Show that PQ is parallel to AB.

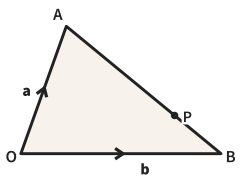


$\overrightarrow{PQ} = \frac{2}{3}\mathbf{b} - \frac{2}{3}\mathbf{a} = \frac{2}{3}(-\mathbf{a} + \mathbf{b})$

Answer $\overrightarrow{PQ} = \frac{2}{3}\overrightarrow{AB}$

13

P is on AB and $\overrightarrow{OP} = 0.3\mathbf{a} + 0.7\mathbf{b}$. Find the ratio AP : PB.

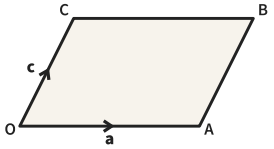


$\mathbf{a} + 0.7(-\mathbf{a} + \mathbf{b}) = 0.3\mathbf{a} + 0.7\mathbf{b}$

Answer 7 : 3

14

OABC is a parallelogram with $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. Show that the midpoint of OB is also the midpoint of AC.



$\frac{1}{2}(\mathbf{a} + \mathbf{c})$ and $\mathbf{a} + \frac{1}{2}(\mathbf{c} - \mathbf{a})$

Answer both are $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$

15

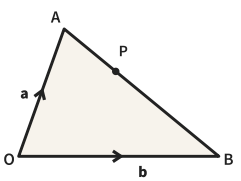
$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = 3\mathbf{b} - 2\mathbf{a}$. Show that A, B and C lie on a straight line.

$\overrightarrow{AC} = 3\mathbf{b} - 3\mathbf{a} = 3(-\mathbf{a} + \mathbf{b})$

Answer $\overrightarrow{AC} = 3\overrightarrow{AB}$

16

Leo says AP : PB = 1 : 2 means $\overrightarrow{AP} = \frac{1}{2}\overrightarrow{AB}$. Explain his mistake.



1 part out of 1 + 2 = 3 parts

Answer $\overrightarrow{AP} = \frac{1}{3}\overrightarrow{AB}$