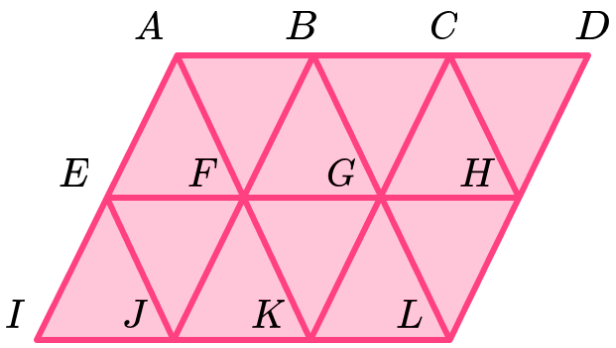
Simple Vectors - Worksheet

Skill

Group A – Finding equivalent vectors

The shape below is made from a lattice of identical triangles.



$\vec{AB} = \vec{EF} = \vec{BC}$ and $\vec{AE} = \vec{EI} = \vec{BF}$

Use the arrow notation as above to list all the vectors equivalent to the following.

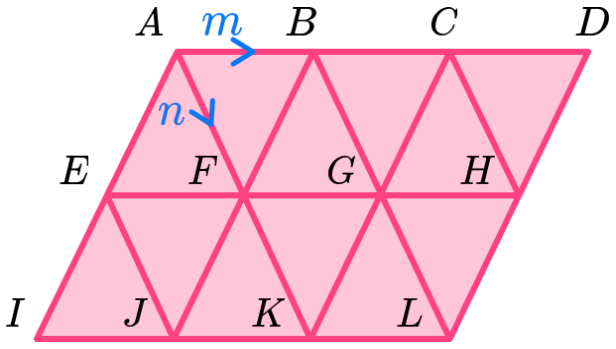
1) $\vec{AG}$ **2)** $\vec{BD}$ **3)** $\vec{BE}$

4) $\vec{AJ}$ **5)** $\vec{IB}$ **6)** $\vec{AK}$

7) $\vec{CI}$ **8)** $\vec{LE}$ **9)** $\vec{DE}$

Group B – Using vector notation to find routes

The shape below is made from a lattice of identical triangles. $\vec{AB} = m$ and $\vec{AF} = n$



Write the following vectors in terms of m and n.

1) $\vec{CD}$ **2)** $\vec{HG}$ **3)** $\vec{EJ}$

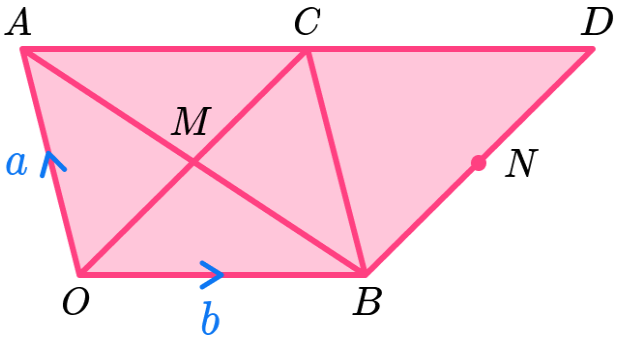
4) $\vec{LB}$ **5)** $\vec{AG}$ **6)** $\vec{EL}$

7) $\vec{CG}$ **8)** $\vec{HJ}$ **9)** $\vec{DI}$

Group C – Finding routes using vectors

In the diagram $OACB$ is a parallelogram.
C is the midpoint of AD.
M is the midpoint of OC.
N is the midpoint of BD.

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



Find the following vectors in terms of a and b.

1) $\vec{AC}$

2) $\vec{OC}$

3) $\vec{AD}$

4) $\vec{CB}$

5) $\vec{BA}$

6) $\vec{OM}$

7) $\vec{ON}$

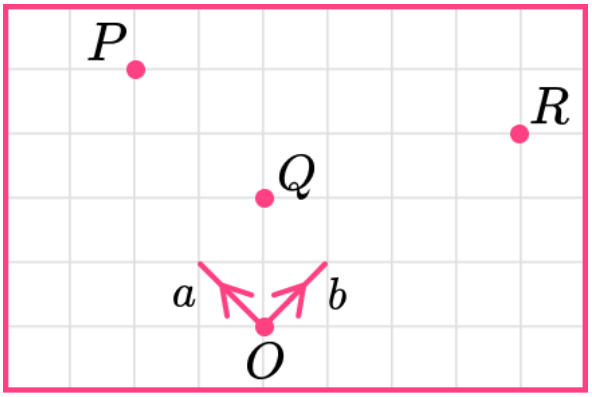
8) $\vec{MN}$

9) $\vec{NA}$

Simple Vectors - Worksheet

Applied

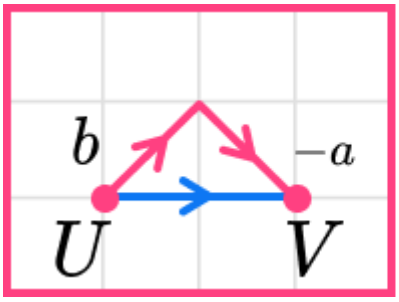
1) A drone is being used to deliver packages.
The drone base is at point O.
The drone is programmed to fly to its destination by using multiples of the vectors a and b.



Drone base

(a) What vectors must be used to deliver packages to
(i) point Q
(ii) point P

(b) The drone can be programmed to travel between U and V using the following instruction.



$$\overrightarrow{UV} = b - a$$

Use this to find the program required to deliver to point R from the drone base.

2) The map shows a simple tram network connecting six areas of a town.
Cakeville is halfway between Aberville and Dinaton

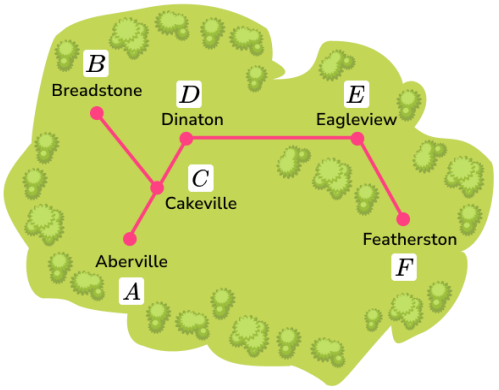
Train codes

$\overrightarrow{AD} = a$

$\overrightarrow{DE} = d$

$\overrightarrow{EF} = e$

$\overrightarrow{BC} = b$

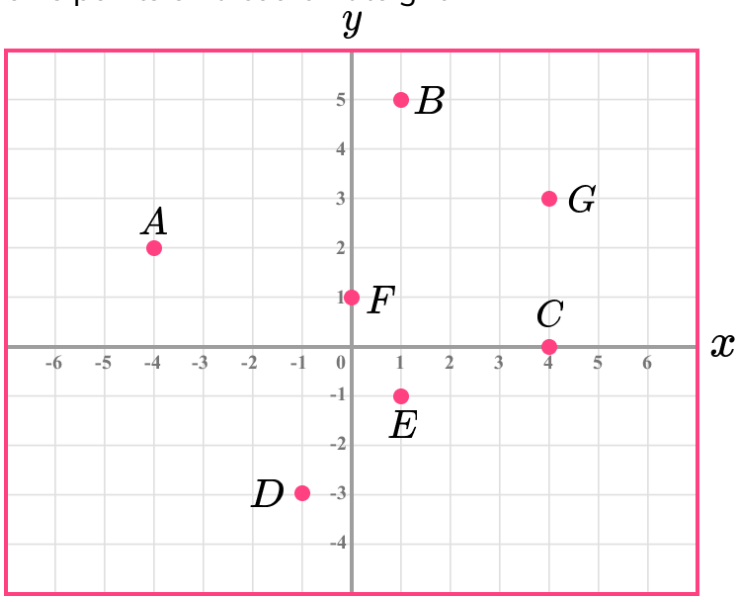


The trams can be treated as vectors using the labels a, b, c and d, and the codes above.

(a) Write the vector required to travel from Aberville to Eagleview.

(b) Write the vector required to travel from Featherston to Breadstone.

3) The diagram shows points on a coordinate grid.



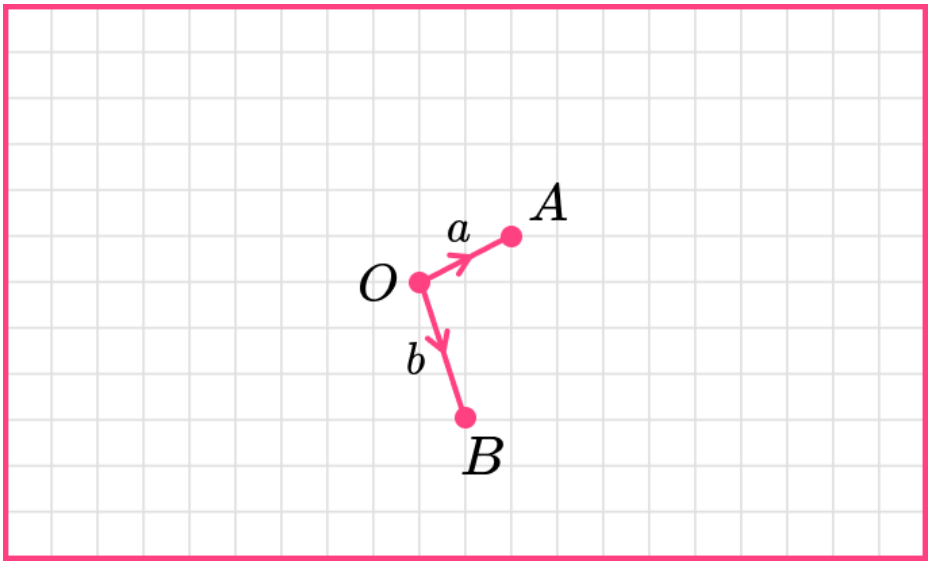
(a) Use the points to find a vector equivalent to $\vec{BA}$

(b) $\overrightarrow{AF} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

Write column vectors to represent $\vec{FE}$, $\vec{EG}$ and $\vec{AG}$, and use them to show that $\vec{AF} + \vec{FE} + \vec{EG} = \vec{AG}$.

4) The grid shows vectors represented by arrows.

$$\overrightarrow{OA} = \mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, \quad \overrightarrow{OB} = \mathbf{b} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$$

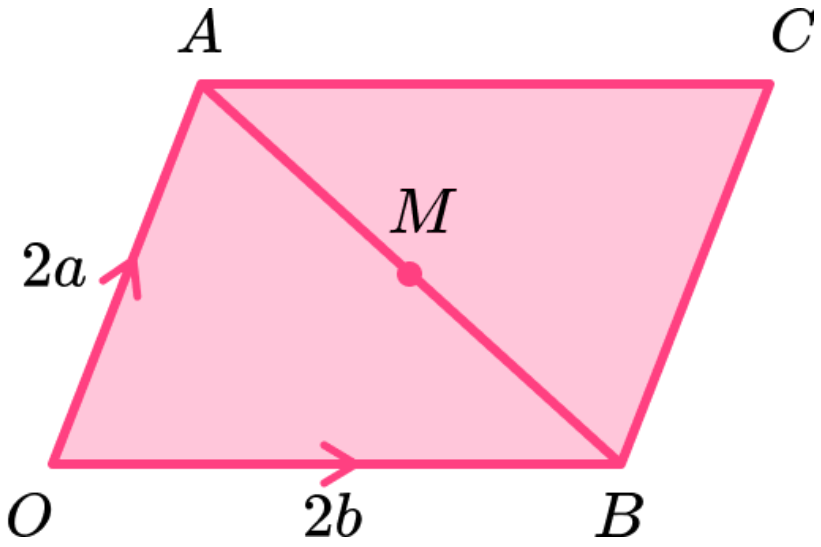


(a) On a copy of the grid label points C and D to represent so that $\vec{OC} = 2a + b$

(b) On a copy of the grid label points C and D to represent so that $\vec{BD} = -2a - 3b$

Simple Vectors - Exam Questions

1)



The diagram shows the parallelogram $OACB$.

$\vec{OA} = 2a$

$\vec{OB} = 2b$

M is the midpoint of AB.

Find in terms of a and b:

(a) $\vec{AB}$ .....

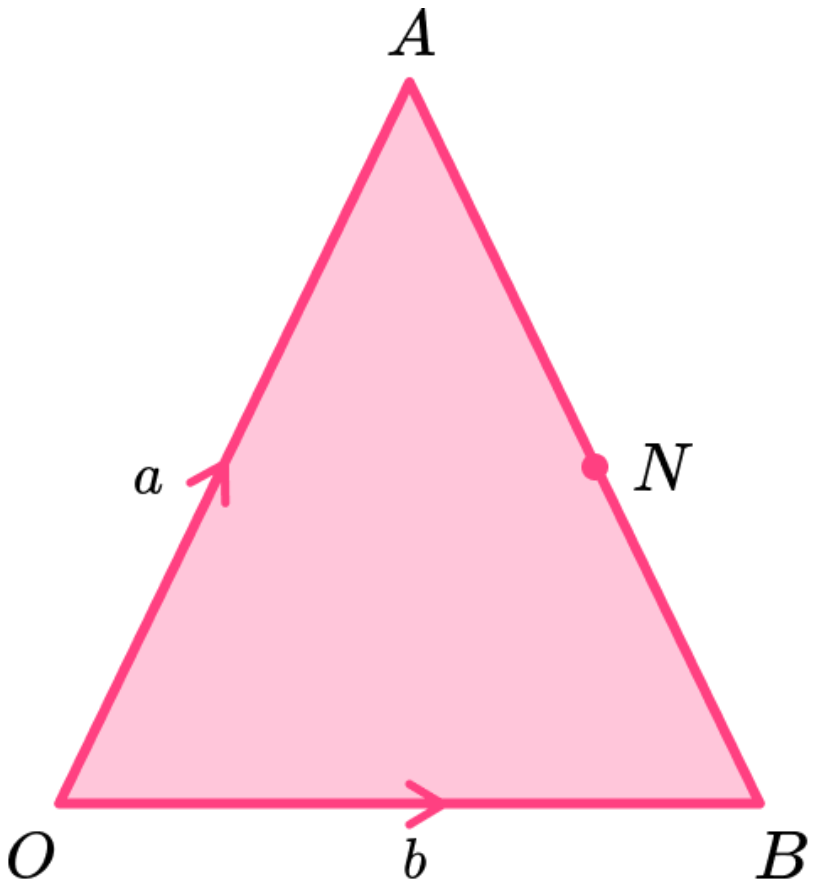
(1)

(b) $\vec{OM}$ .....

(2)

(3 marks)

2)



The diagram shows the triangle OAB.

$\vec{OA} = a$

$\vec{OB} = b$

N is a point on the line AB such that $AN : NB = 1 : 2$.

Find in terms of a and b:

(a) $\vec{BA}$ .....

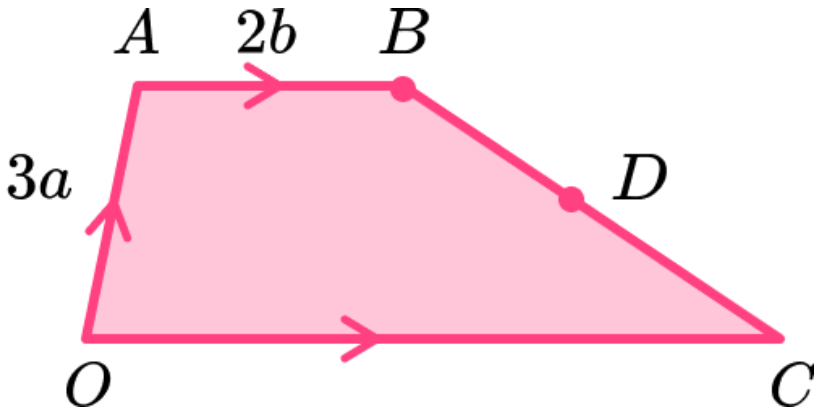
(1)

(b) $\vec{ON}$ .....

(3)

(4 marks)

3)



The diagram shows the trapezium $OABC$.

$\vec{OA} = 3a$

$\vec{AB} = 2b$

$\vec{OC} = 2\vec{AB}$

D is the midpoint of BC.

Find in terms of a and b:

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

(2)

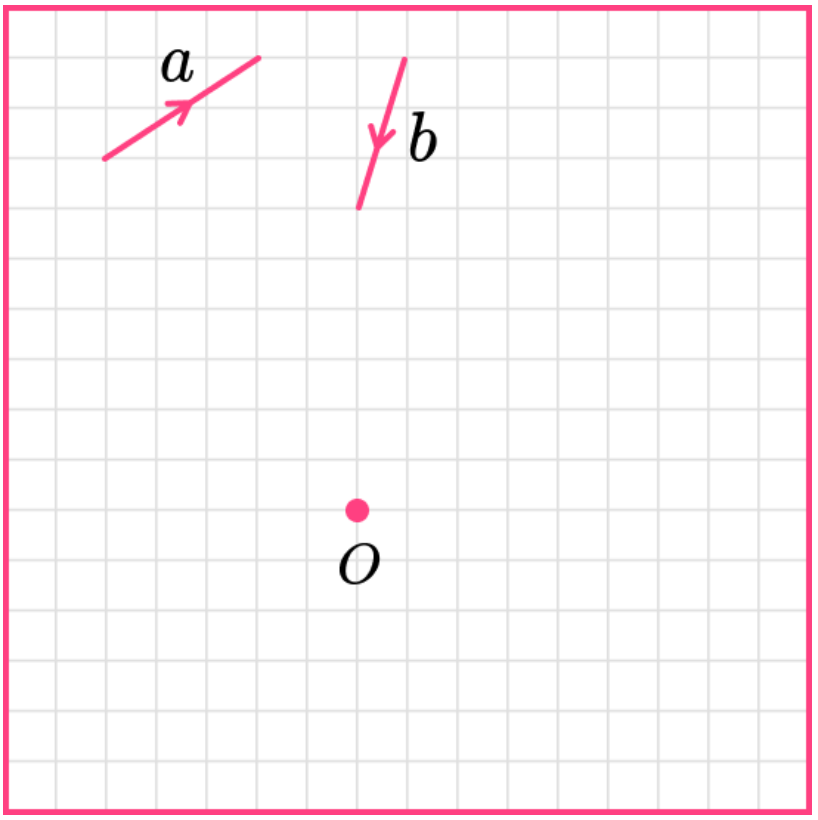
(b) $\vec{OD}$ .....

(3)

(5 marks)

4) The diagram shows the vectors

$\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -1 \\ -3 \end{pmatrix}$ and the point O.



On a copy of the grid, draw arrows to represent the vectors:

(a) $\vec{OP} = -2a$

.....

(2)

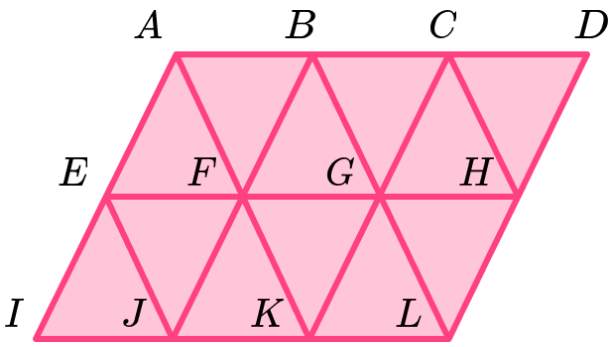
(b) $\vec{OQ} = 2a + b$

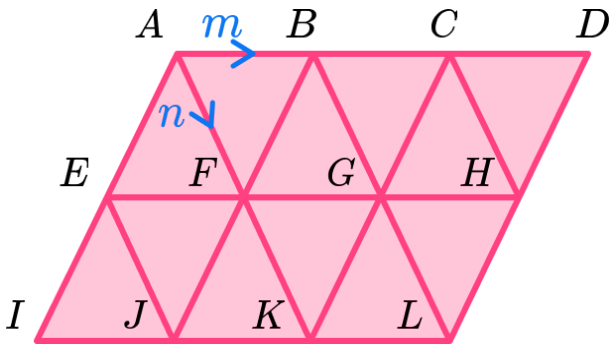
.....

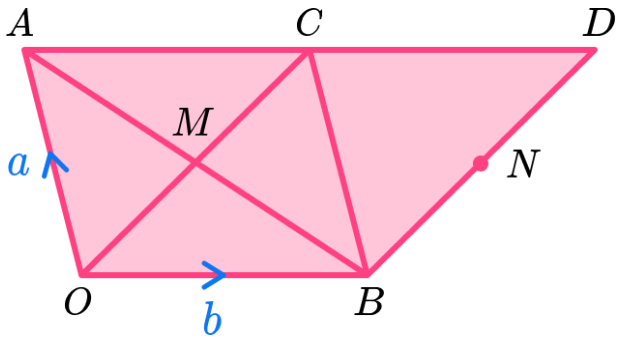
(3)

(5 marks)

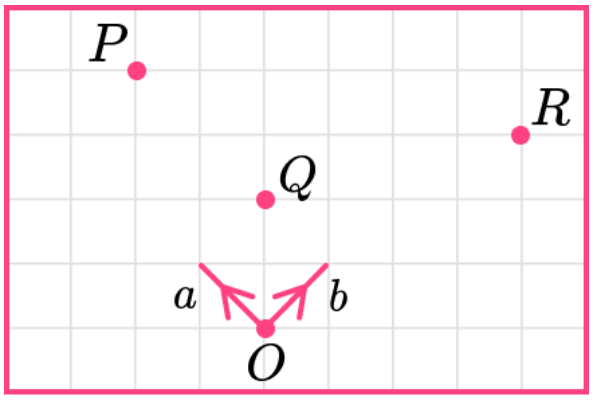
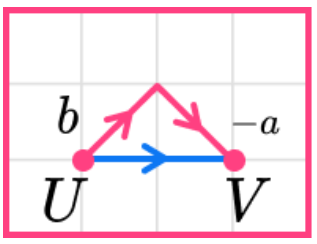
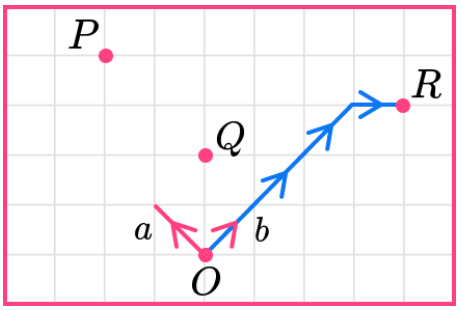
Simple Vectors - Answers

	Question	Answer
	Skill Questions	
Group A	The shape below is made from a lattice of identical triangles.  $\vec{AB} = \vec{EF} = \vec{BC}$ and $\vec{AE} = \vec{EI} = \vec{BF}$ Use the arrow notation as above to list all the vectors equivalent to the following. **1)** $\vec{AG}$ **2)** $\vec{BD}$ **3)** $\vec{BE}$ **4)** $\vec{AJ}$ **5)** $\vec{IB}$ **6)** $\vec{AK}$ **7)** $\vec{CI}$ **8)** $\vec{LE}$ **9)** $\vec{DE}$	**1)** $\vec{EK}, \vec{BH}, \vec{FL}$ **2)** $\vec{AC}, \vec{EG}, \vec{FH}, \vec{IK}, \vec{JL}$ **3)** $\vec{CF}, \vec{DG}, \vec{FI}, \vec{GJ}, \vec{HK}$ **4)** $\vec{BK}, \vec{CL}$ **5)** $\vec{JC}, \vec{KD}$ **6)** $\vec{BL}$ **7)** $\vec{DJ}$ **8)** $\vec{HA}$ **9)** $\vec{HI}$

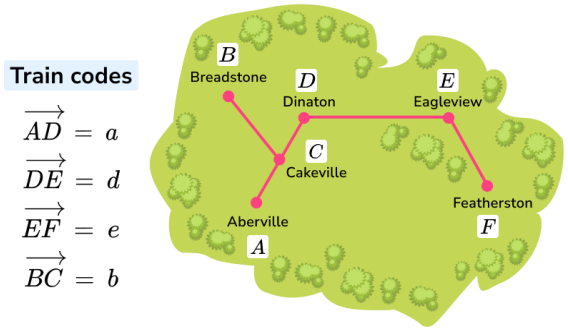
Group B	The shape below is made from a lattice of identical triangles. $\vec{AB} = m$ and $\vec{AF} = n$  Write the following vectors in terms of m and n. **1)** $\vec{CD}$ **2)** $\vec{HG}$ **3)** $\vec{EJ}$ **4)** $\vec{LB}$ **5)** $\vec{AG}$ **6)** $\vec{EL}$ **7)** $\vec{CG}$ **8)** $\vec{HJ}$ **9)** $\vec{DI}$	**1)** m **2)** $-m$ **3)** n **4)** $-2n$ **5)** $m + n$ **6)** $2m + n$ **7)** $n - m$ **8)** $n - 3m$ **9)** $2n - 5m$

Group C	In the diagram $OACB$ is a parallelogram. C is the midpoint of AD. M is the midpoint of OC. N is the midpoint of BD. $\vec{OA} = a$ and $\vec{OB} = b$  Find the following vectors in terms of a and b. **1)** $\vec{AC}$ **2)** $\vec{OC}$ **3)** $\vec{AD}$ **4)** $\vec{CB}$ **5)** $\vec{BA}$ **6)** $\vec{OM}$ **7)** $\vec{ON}$ **8)** $\vec{MN}$ **9)** $\vec{NA}$	**1)** b **2)** $a + b$ **3)** $2b$ **4)** $-a$ **5)** $a - b$ **6)** $\frac{1}{2}a + \frac{1}{2}b$ **7)** $\frac{1}{2}a + \frac{3}{2}b$ **8)** b **9)** $\frac{1}{2}a - \frac{3}{2}b$

Simple Vectors - Answers

	Question	Answer
	Applied Questions	
1)	A drone is being used to deliver packages. The drone base is at point O. The drone is programmed to fly to its destination by using multiples of the vectors a and b.  **Drone base**	
	a) What vectors must be used to deliver packages to (i) point Q (ii) point P	**a)** (i) $a + b$ (ii) $3a + b$
	b) The drone can be programmed to travel between U and V using the following instruction.  $\overrightarrow{UV} = b - a$ Use this to find the program required to deliver to point R from the drone base.	**b)**  **Drone base** $3b + \frac{1}{2}(b - a) = \frac{7}{2}b - \frac{1}{2}a$

2) The map shows a simple tram network connecting six areas of a town.



The trams can be treated as vectors using the labels a, b, c and d, and the codes above.

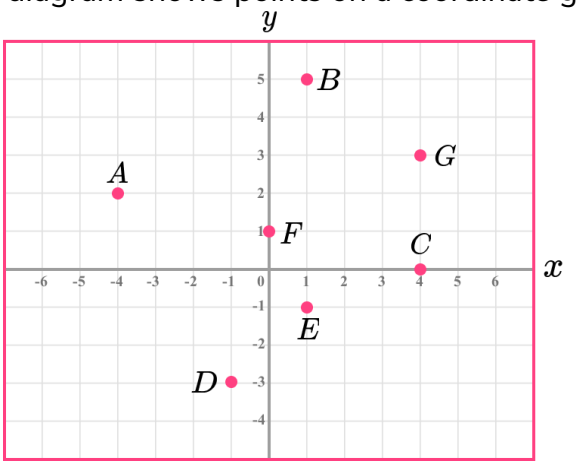
a) Write the vector required to travel from Aberville to Eagleview.

a) $a + d$

b) Write the vector required to travel from Featherston to Breadstone.

b) $-e - d - \frac{1}{2}a - b$

3) The diagram shows points on a coordinate grid.



a) Use the points to find a vector equivalent to $\vec{BA}$

a) $\vec{CD}$

b) $\overrightarrow{AF} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

Write column vectors to represent $\vec{FE}$, $\vec{EG}$, and $\vec{AG}$, and use them to show that $\vec{AF} + \vec{FE} + \vec{EG} = \vec{AG}$.

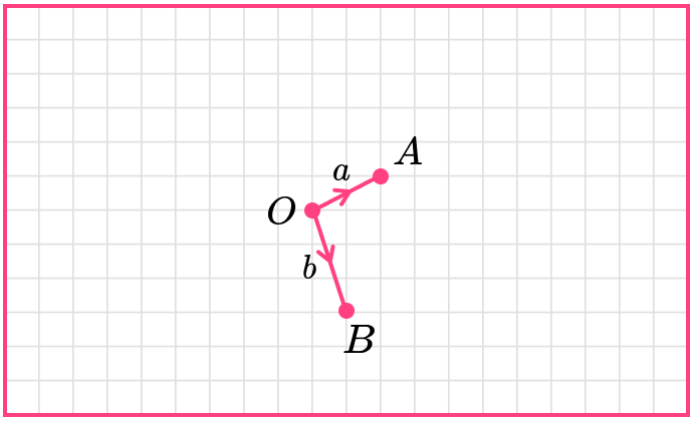
b) $\overrightarrow{FE} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$ $\overrightarrow{EG} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$

$\overrightarrow{AG} = \begin{pmatrix} 8 \\ 1 \end{pmatrix}$

$\begin{pmatrix} 4 \\ -1 \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix} = \begin{pmatrix} 4+1+3 \\ -1-2+4 \end{pmatrix} = \begin{pmatrix} 8 \\ 1 \end{pmatrix}$

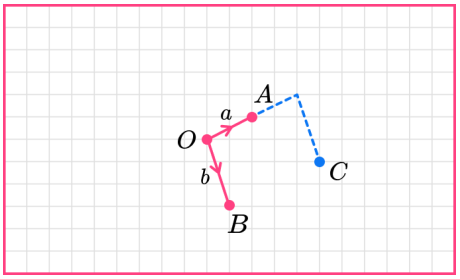
4) The grid shows vectors represented by arrows.

$\overrightarrow{OA} = \mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$, $\overrightarrow{OB} = \mathbf{b} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$



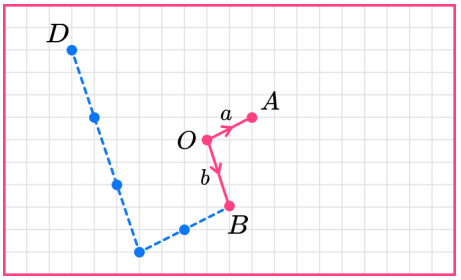
a) On a copy of the grid label points C and D to represent so that $\vec{OC} = 2a + b$

a)

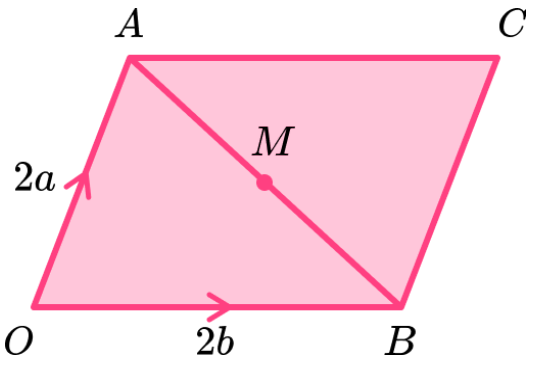


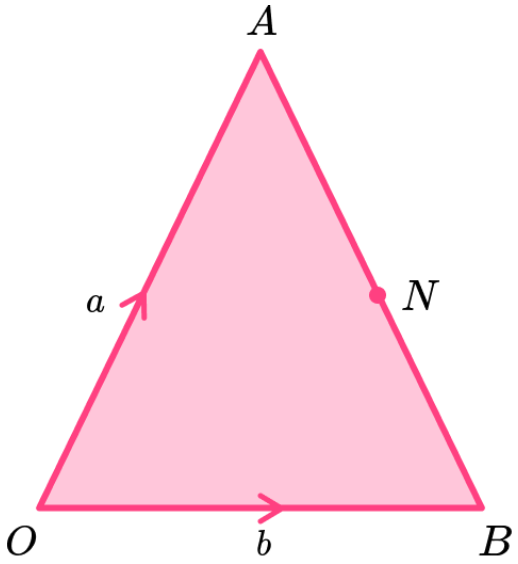
b) On a copy of the grid label points C and D to represent so that $\vec{BD} = -2a - 3b$

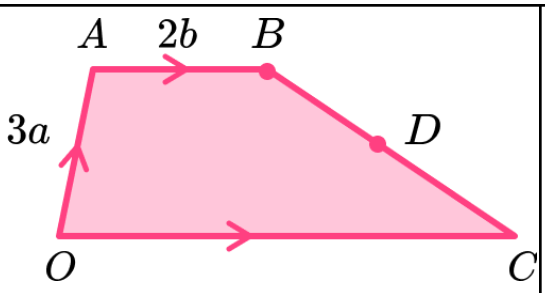
b)

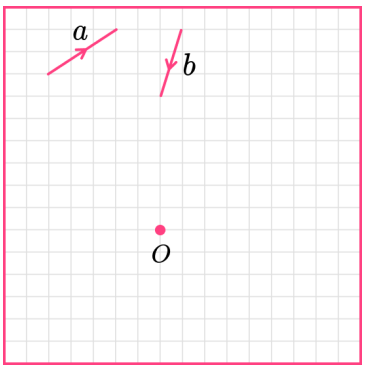
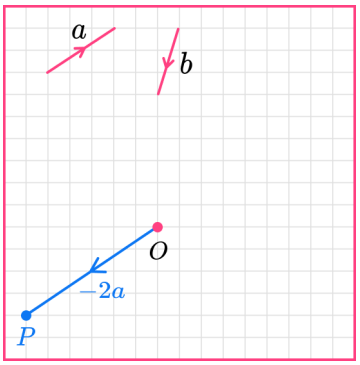
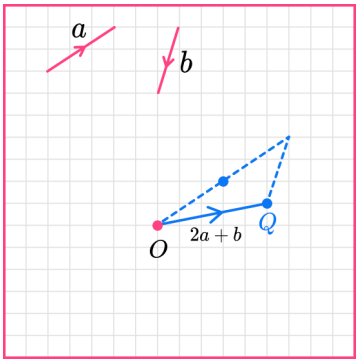


Simple Vectors - Mark Scheme

		Question			
		Exam Questions			
1)		 The diagram shows the parallelogram $OACB$. $\vec{OA} = 2a$ $\vec{OB} = 2b$ M is the midpoint of AB. Find in terms of a and b:			
	(a)	$\vec{AB}$	(a)	$2b - 2a$ **(1)**	**(1)**
	(b)	$\vec{OM}$	(b)	Using half of $\vec{AB}$ **(1)** $a + b$ **(1)**	**(2)**

2)		 The diagram shows the triangle OAB. $\vec{OA} = a$ $\vec{OB} = b$ N is a point on the line AB such that $AN : NB = 1 : 2$. Find in terms of a and b:			
	(a)	$\vec{BA}$	**(a)**	$a - b$ **(1)**	**(1)**
	(b)	$\vec{ON}$	**(b)**	Ratio of 1: 2 used correctly **(1)** Use of $\vec{OB} + \frac{2}{3}\vec{BA}$ **(1)** $\frac{2}{3}a + \frac{1}{3}b$ **(1)**	**(3)**

3)		 The diagram shows the trapezium $OABC$. $\vec{OA} = 3a$ $\vec{AB} = 2b$ $\vec{OC} = 2\vec{AB}$ D is the midpoint of BC. Find in terms of a and b:			
	(a)	$\vec{BC}$	**(a)**	$-2b-3a+4b$ seen **(1)** $2b-3a$ **(1)**	**(2)**
	(b)	$\vec{OD}$	**(b)**	Use of $3a+2b+\frac{1}{2}\vec{BC}$ **(1)** $3a-2b+\frac{1}{2}(2b-3a)$ seen **(1)** $\frac{2}{3}a+3b$ **(1)**	**(3)**

4)		The diagram shows the vectors $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -1 \\ -3 \end{pmatrix}$, and the point O.  On a copy of the grid, draw arrows to represent the vectors:			
	(a)	$\vec{OP} = -2a$	**(a)**	 Line correct length and direction **(1)** Correct position **(1)**	**(2)**
	(b)	$\vec{OQ} = 2a + b$	**(b)**	 Evidence of using $2a + b$ **(1)** Line correct length and direction **(1)** Correct position **(1)**	**(3)**