Vector

By .... Kru ชี่

Column vector

Column Vector

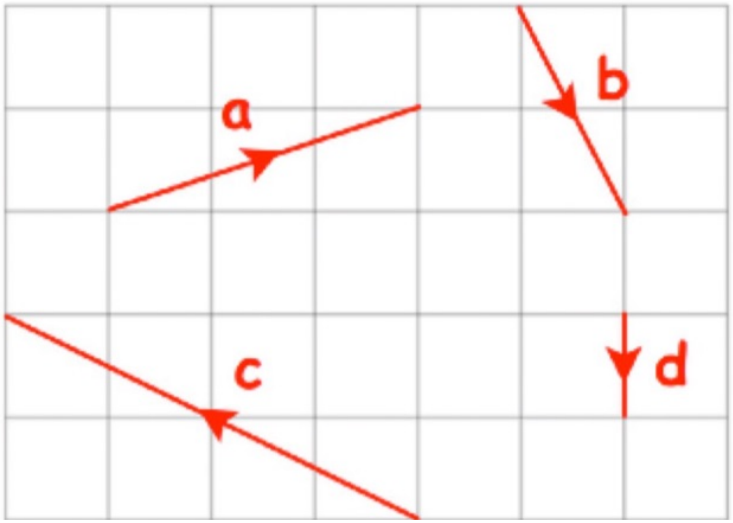
TOP Maths IGCSE

On a grid, draw and label the following vectors.

(a) $\mathbf{a} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ (b) $\mathbf{b} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ (c) $\mathbf{c} = \begin{pmatrix} -3 \\ -7 \end{pmatrix}$ (d) $\mathbf{d} = \begin{pmatrix} 0 \\ -6 \end{pmatrix}$

(e) $\mathbf{e} = \begin{pmatrix} 8 \\ -1 \end{pmatrix}$ (f) $\mathbf{f} = \begin{pmatrix} -4 \\ 0 \end{pmatrix}$

The vectors **a**, **b**, **c** and **d** are shown on the grid.



(a) Write **a** as a column vector

(b) Write **b** as a column vector

(c) Write **c** as a column vector

(d) Write **d** as a column vector

Column Vector

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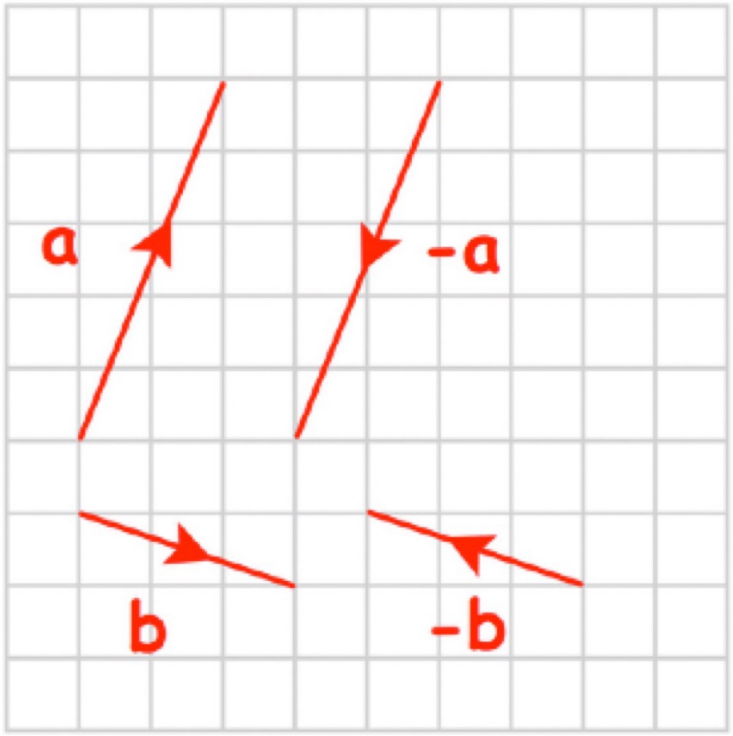


(a) Write **a** as a column vector

(b) Write **−a** as a column vector

(c) Write **b** as a column vector

(d) Write **−b** as a column vector

Multiplying vector with scalar

Given $\mathbf{a} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -9 \\ -7 \end{pmatrix}$

Write the following as column vectors

(a) $3\mathbf{a}$ (b) $2\mathbf{b}$ (c) $5\mathbf{c}$ (d) $\frac{1}{2}\mathbf{a}$ (e) $\frac{1}{4}\mathbf{b}$

Given $\mathbf{a} = \begin{pmatrix} 2 \\ 11 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -8 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -4 \\ -6 \end{pmatrix}$

Write the following as column vectors

(a) $-\mathbf{a}$ (b) $-\mathbf{b}$ (c) $-\mathbf{c}$ (d) $-2\mathbf{a}$ (e) $-4\mathbf{b}$ (f) $-\frac{1}{2}\mathbf{b}$

Adding or subtracting vectors

nose to tail RULE

$$\mathbf{a} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$$

Adding or subtracting vectors

nose to tail RULE

$$\mathbf{a} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$$

Tip🌟

🌟 For adding and subtracting column vectors

Column Vector

Given $\mathbf{a} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ and $\mathbf{e} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$

(a) $\mathbf{a} + \mathbf{b}$ (b) $\mathbf{b} + \mathbf{c}$ (c) $\mathbf{a} + \mathbf{c}$ (d) $\mathbf{c} + \mathbf{d}$

Given $\mathbf{a} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ and $\mathbf{e} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$

(e) $\mathbf{a} - \mathbf{d}$ (f) $\mathbf{e} - \mathbf{b}$ (g) $\mathbf{e} - \mathbf{d}$ (h) $3\mathbf{a} - \mathbf{b}$

Equivalent vectors

Two vectors are equivalent if they have the same direction and length.

Parallel vectors

True or false ?

$\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ is parallel to $\begin{pmatrix} 9 \\ 3 \end{pmatrix}$

$\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ is parallel to $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$

$\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ is parallel to $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$

Position vector and coordinate

Example 1

Point P is the coordinate (5,8)

Find position vector of P

Example 2

Position vector of M is $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$

Find the coordinate of point M

Example 3

P is the point (5, 6). $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$

Find the co-ordinates of Q.

Example 4

If D has coordinates $(6,2)$ and E has coordinates $(0,5)$, find the column vector for $\overrightarrow{DE}$.

Example 5

Find the column vector $\overrightarrow{XY}$ where X and Y have coordinates (3 , 1) and (2 , -5) respectively.

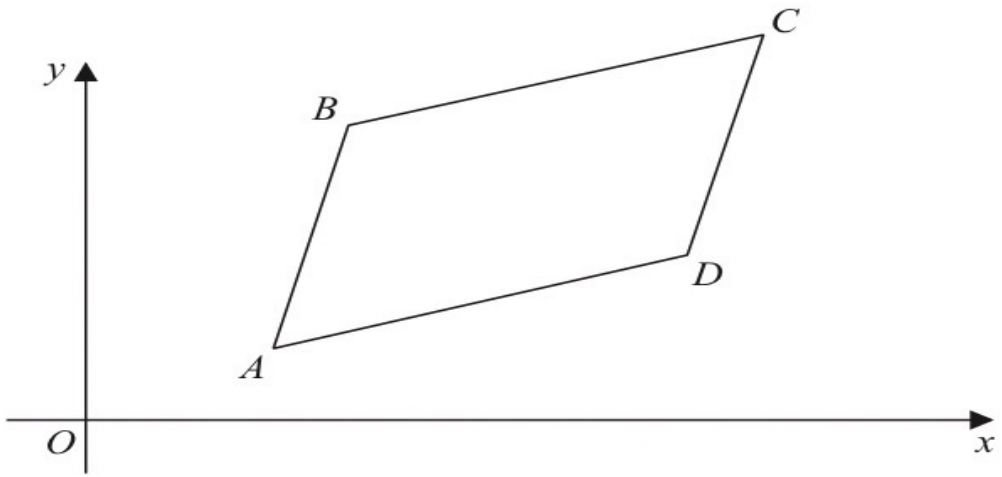
Magnitude or modulus of vector

Find magnitude for each vector

$$\mathbf{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} \qquad \mathbf{b} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \qquad \mathbf{c} = \begin{pmatrix} 5 \\ 12 \end{pmatrix} \qquad \mathbf{d} = \begin{pmatrix} -3 \\ 0 \end{pmatrix}$$

Exam Style Questions

The diagram shows parallelogram $ABCD$.



$\overrightarrow{AB} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$ $\overrightarrow{AC} = \begin{pmatrix} 12 \\ 15 \end{pmatrix}$

The point B has coordinates $(6, 8)$

Work out the coordinates of the point C.

Exam Style Questions

$ABCD$ is a trapezium.

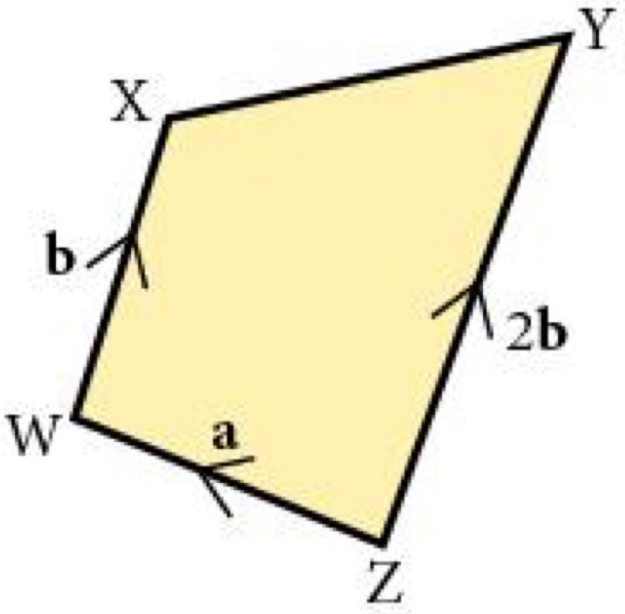
$\overrightarrow{DC} = 3\overrightarrow{AB}$

$\overrightarrow{DA} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ $\overrightarrow{DB} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

Find the exact magnitude of $\overrightarrow{BC}$

Vector Geometry

Q1.



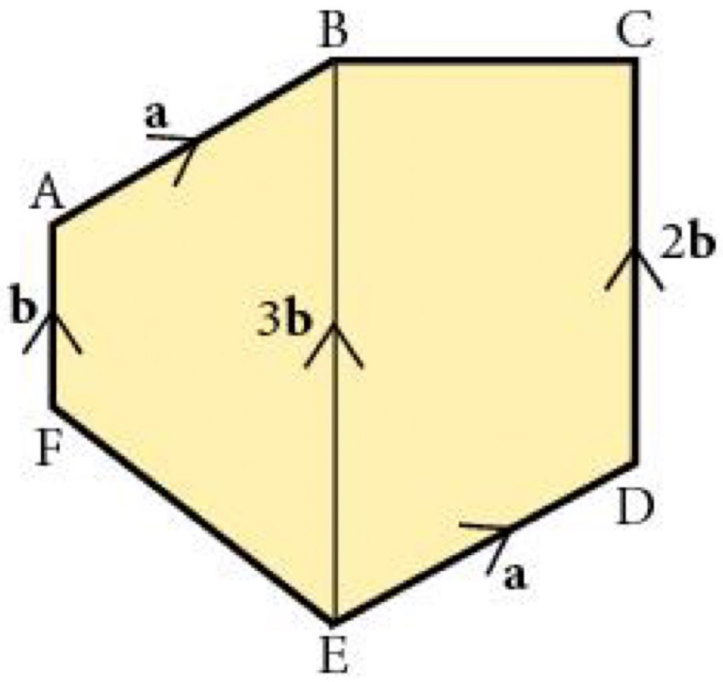
Find in term of a and b

1. $\overrightarrow{XW}$

2. $\overrightarrow{XZ}$

3. $\overrightarrow{XY}$

Q2.



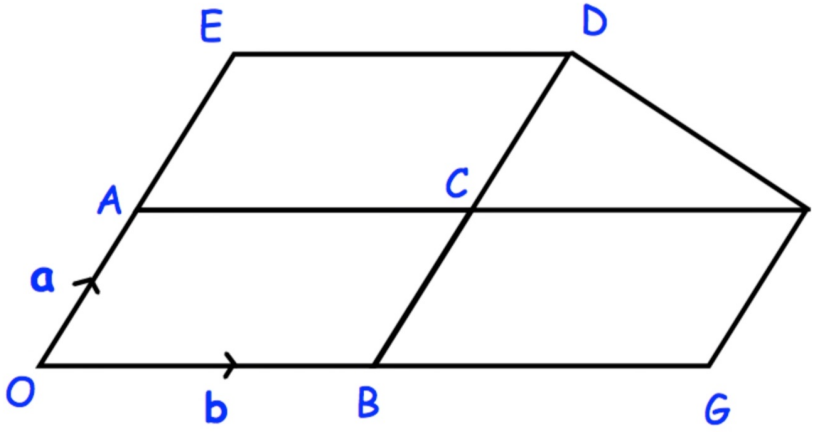
Find in term of a and b

1. $\overrightarrow{BF}$

2. $\overrightarrow{FE}$

3. $\overrightarrow{AD}$

Q3. In diagram OBDE and OAFG are parallelogram
B is the midpoint of OG And A is the midpoint of OE



Find in term of a and b

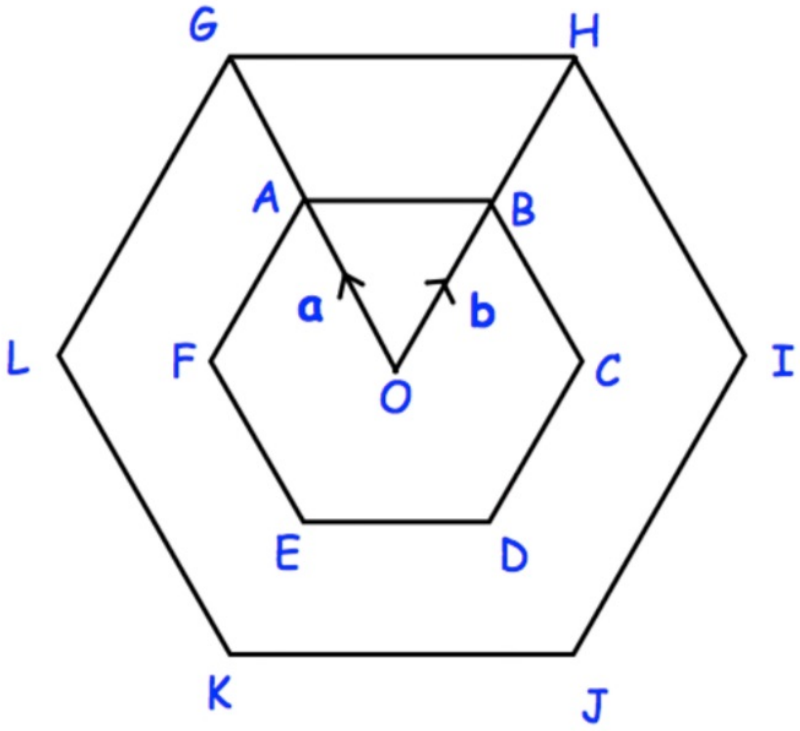
1. $\overrightarrow{OC}$

2. $\overrightarrow{BA}$

3. $\overrightarrow{DF}$

4. Show that $\overrightarrow{EG}$ and $\overrightarrow{DF}$ are parallel

Q4.



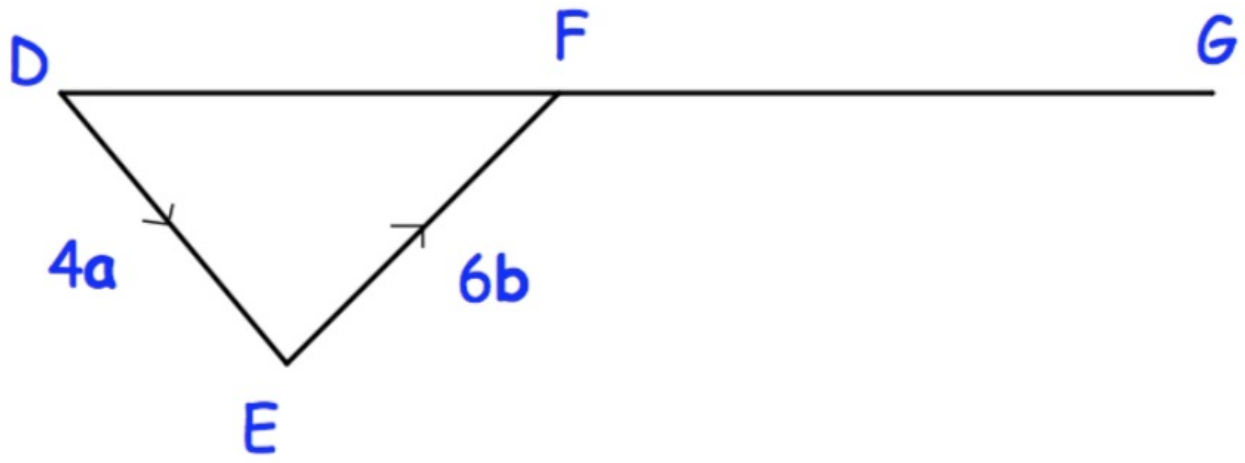
ABCDEF and GHIJKL are regular hexagons with centre O.
GHIJKL is an enlargement of ABCDEF, with scale factor 2.

Find in term of a and b

1. $\overrightarrow{AB}$
2. $\overrightarrow{OG}$
3. $\overrightarrow{OE}$
4. $\overrightarrow{FC}$
5. $\overrightarrow{IK}$

Q5. DFG is a straight line.

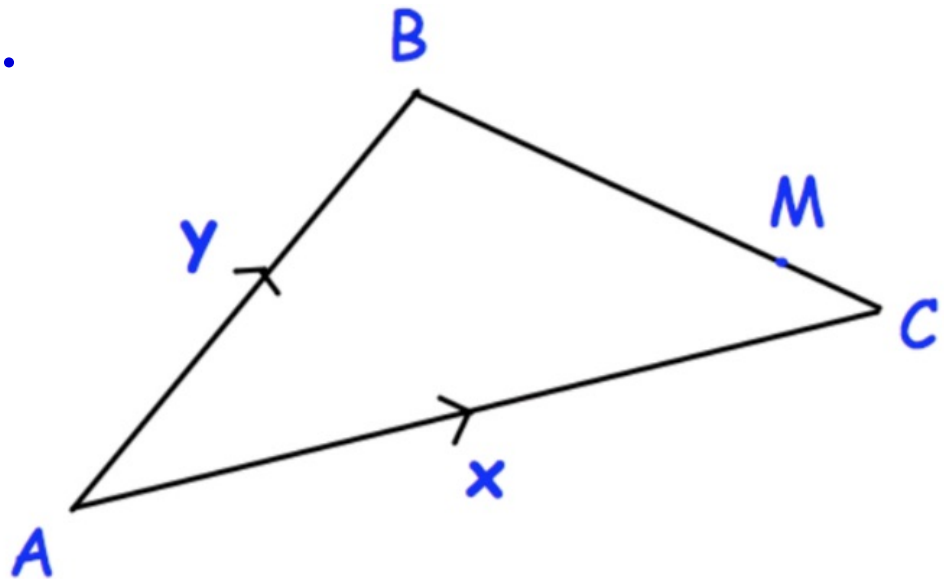
$\overrightarrow{DE} = 4a$ and $\overrightarrow{EF} = 6b$



1. Find $\overrightarrow{DF}$ in term of a and b

2. Given that $\overrightarrow{DF} : \overrightarrow{FG} = 2 : 3.$, Find $\overrightarrow{DG}$

Q6.



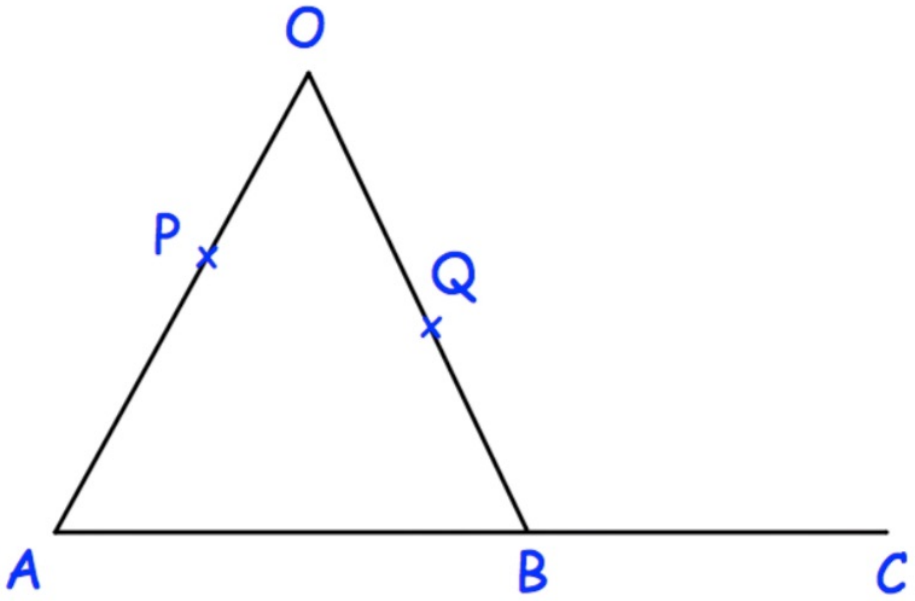
ABC is a triangle, M lies on BC such that BM = 5/6 BC

Find in term of x and y

1. $\overrightarrow{BC}$
2. $\overrightarrow{BM}$
3. $\overrightarrow{AM}$

How to shows 3 points lie on the same straight line

Q7.



AOB is a triangle.
P is a point on AO.

$\overrightarrow{AB} = 2a$ $\overrightarrow{AO} = 6b$ AP:PO = 2:1

Find in term of a and b

1. OB

2. Q is the midpoint of OB and B is the midpoint of AC
Show that PQC is a straight line

Q8. OAB is a triangle. OA = 4a and OB = 2b . M is the mid point of AB.
P is the point on OB such that OP : PB = 2 : 1
Q is the point on AP such that OQM is a straight line.

Find the ratio of OQ : QM