

A*
A
B
C
D

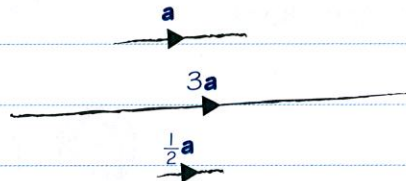
Vectors

A vector has a **MAGNITUDE** (or size) and a **DIRECTION**.

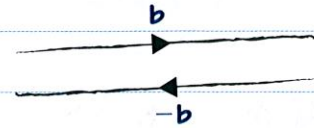
This vector can be written as \vec{a} , \overrightarrow{AB} or $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$.



You can multiply a vector by a number. The new vector has a different length but the same direction.

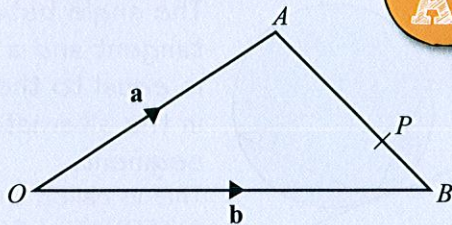


If \mathbf{b} is a vector then $-\mathbf{b}$ is a vector with the same length but opposite direction.



Worked example

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OAB is a triangle.

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

(a) Find the vector \vec{AB} in terms of \mathbf{a} and \mathbf{b} .

$$\begin{aligned} \vec{AB} &= \vec{AO} + \vec{OB} \\ &= -\mathbf{a} + \mathbf{b} \end{aligned}$$

P is the point on AB so that $AP : PB = 2 : 1$

(b) Find the vector \vec{OP} in terms of \mathbf{a} and \mathbf{b} .

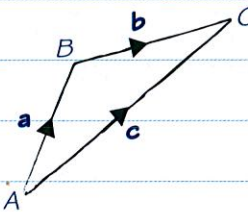
Give your answer in its simplest form.

$$\begin{aligned} \vec{AP} &= \frac{2}{3}\vec{AB} \\ &= \frac{2}{3}(-\mathbf{a} + \mathbf{b}) \end{aligned}$$

$$\begin{aligned} \vec{OP} &= \vec{OA} + \vec{AP} \\ &= \mathbf{a} + \frac{2}{3}(-\mathbf{a} + \mathbf{b}) \\ &= \mathbf{a} - \frac{2}{3}\mathbf{a} + \frac{2}{3}\mathbf{b} \\ &= \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b} \end{aligned}$$

Adding vectors

You can add vectors using the **TRIANGLE LAW**. You trace a path along the added vectors to find the new vector.



$$\mathbf{a} + \mathbf{b} = \mathbf{c}$$

\mathbf{c} is the resultant vector of \mathbf{a} and \mathbf{b} .

$A \rightarrow B \rightarrow C$ is the same as $A \rightarrow C$

EXAM ALERT!

Nearly three-quarters of students got no marks on this question.

$AP : PB = 2 : 1$. There are $2 + 1 = 3$ parts in this ratio. So P is $\frac{2}{3}$ of the way along AB . This means that $\vec{AP} = \frac{2}{3}\vec{AB}$. Use the expression for \vec{AB} from part (a) to write \vec{AP} in terms of \mathbf{a} and \mathbf{b} .

Be careful: $\frac{2}{3}\vec{AB} \neq \frac{2}{3}(-\mathbf{a} + \mathbf{b})$.

To write your expression in its simplest form, multiply out the brackets and collect any like terms.

This was a real exam question that caught students out – **be prepared!**

ResultsPlus

Now try this

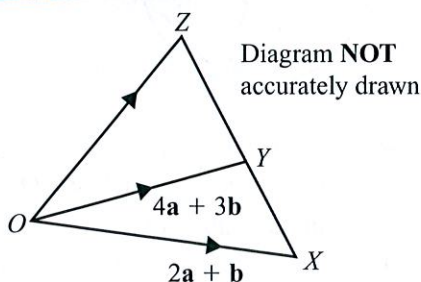


Diagram **NOT** accurately drawn

XYZ is a straight line.

$XY : YZ = 2 : 3$

- Express the vector \vec{XY} in terms of \mathbf{a} and \mathbf{b} .
Give your answer in its simplest form. (2 marks)
- Express the vector \vec{OZ} in terms of \mathbf{a} and \mathbf{b} .
Give your answer in its simplest form. (3 marks)

grade A*

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