

Vector arithmetic

Starter

1. **(Review of last lesson)** Find the magnitude of the vector $\begin{pmatrix} 1 \\ -7 \end{pmatrix}$.

Notes

4. Adding/subtracting column vectors

Add/subtract the top and bottom numbers separately.

E.g. $\begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 7 \\ -4 \end{pmatrix} = \begin{pmatrix} 2+7 \\ 3+(-4) \end{pmatrix} = \begin{pmatrix} 9 \\ -1 \end{pmatrix}$

5. Multiplication by a scalar

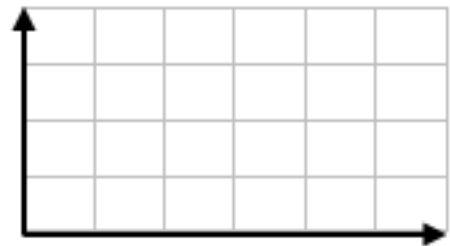
Multiply both numbers in the vector by the scalar

E.g. $5 \begin{pmatrix} 6 \\ -7 \end{pmatrix} = \begin{pmatrix} 5 \times 6 \\ 5 \times -7 \end{pmatrix} = \begin{pmatrix} 30 \\ -35 \end{pmatrix}$

6. The vector connecting 2 points

E.g. 1 Let $A(1, 3)$ and $B(5, 2)$. Draw and label the points on the grid.

Find: (a) \vec{AB} and (b) \vec{BA} .



Finding the vector connecting two points (e.g. \vec{AB}) without a diagram: $\vec{AB} = \mathbf{b} - \mathbf{a}$

E.g. 2 Let $P(7, -4)$ and $Q(-2, 6)$. Find \vec{PQ}

7. Equal vectors – same length, same direction (but they don't need to be in same position)

8. Negative vectors – same length but opposite direction e.g. \mathbf{v} and $-\mathbf{v}$

9. Parallel vectors are multiples of one another.

The following vectors are parallel to \mathbf{v} : $2\mathbf{v}$ $-7\mathbf{v}$ $28\mathbf{v}$ $-4.6\mathbf{v}$

The following vectors are parallel to $\begin{pmatrix} -1 \\ 5 \end{pmatrix}$: $\begin{pmatrix} -2 \\ 10 \end{pmatrix}$ $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$ $\begin{pmatrix} 3 \\ -15 \end{pmatrix}$

N.B. $\mathbf{a} + \mathbf{b}$ is parallel to $5(\mathbf{a} + \mathbf{b})$

10. Adding vectors diagrammatically

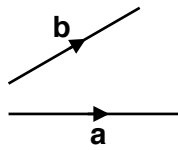
The sum of two vectors is called the resultant vector.

Draw the vectors in a chain, nose-to-tail i.e. where one vector ends, the other one begins. The resultant vector goes in a straight line from the start to the end of the chain of vectors.

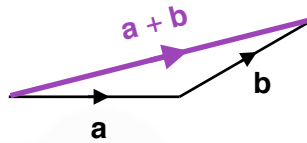
11. **Subtracting vectors diagrammatically**

Add the negative of the second vector

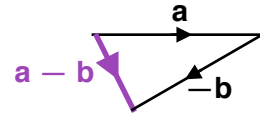
i.e. $\mathbf{a} - \mathbf{b} = \mathbf{a} + (-\mathbf{b})$



Adding vectors
 $\mathbf{a} + \mathbf{b}$



Subtracting vectors
 $\mathbf{a} - \mathbf{b} = \mathbf{a} + (-\mathbf{b})$



The **resultant vectors** are shown.

Video: [Vectors](#)

[Solutions to Starter and E.g.s](#)

Exercise

- 9-1 class textbook: p336 M10.13 Qu 1-5, 13-16
- A*-G class textbook: p299 E10.2 Qu 1-5, 11-15
- 9-1 homework book: p118 M10.13 Qu 1-2, 5, 7
- A*-G homework book: p86 E10.2 Qu 1-2, 5, 7

Summary

Adding/subtracting column vectors — add/subtract the top and bottom numbers separately.

Multiplication by a scalar — multiply both numbers in the vector by the scalar.

Finding the vector connecting two points (e.g. \overrightarrow{AB}) without a diagram: $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

Adding vectors diagrammatically — draw the vectors in a chain, nose-to-tail.

[Homework book answers \(only available during a lockdown\)](#)