

Operations with Vectors

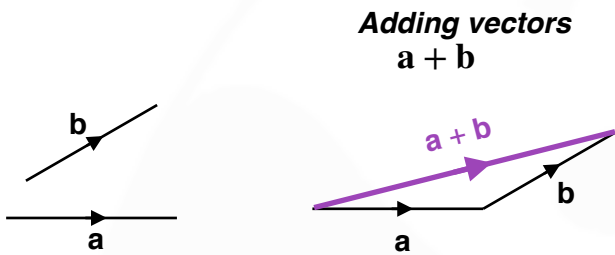
Starter

1. **(Review of GCSE material)** Let $\mathbf{u} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$, $\mathbf{v} = \begin{pmatrix} -5 \\ 7 \end{pmatrix}$ and $\mathbf{w} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$. Find:
- (a) $\mathbf{u} + \mathbf{v}$ (b) $\mathbf{w} - \mathbf{u}$ (c) $3\mathbf{v} - 2\mathbf{w}$ (d) $|4\mathbf{u} + \mathbf{w}|$

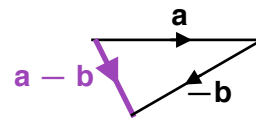
Notes

Adding vectors: when adding vectors make sure they are *nose to tail*.

Subtracting vectors: when subtracting vectors we *add the negative vector* $\mathbf{a} - \mathbf{b} = \mathbf{a} + (-\mathbf{b})$

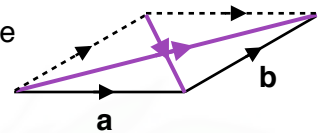


Subtracting vectors
 $\mathbf{a} - \mathbf{b} = \mathbf{a} + (-\mathbf{b})$



The *resultant vectors* are shown.

In short, think of the addition of the two vectors as the longer diagonal in the parallelogram and the subtraction as the shorter of the diagonal in the parallelogram.



Equal vectors are equal in length and direction

Zero vector - $\begin{pmatrix} 0 \\ 0 \end{pmatrix} = 0\mathbf{i} + 0\mathbf{j}$

E.g. 1 Given that $a \begin{pmatrix} 5 \\ 3 \end{pmatrix} - \begin{pmatrix} 8 \\ b \end{pmatrix} = \begin{pmatrix} 12 \\ 6 \end{pmatrix}$, find the values of a and b .

Working: Equating **i** components: $5a - 8 = 12$
 $a = 4$
 Equating **j** components: $3a - b = 6$
 $12 - b = 6$
 $b = 6$

E.g. 2 Given that $p \begin{pmatrix} 1 \\ 4 \end{pmatrix} + q \begin{pmatrix} 3 \\ 5 \end{pmatrix} = \begin{pmatrix} 5 \\ 6 \end{pmatrix}$ find the values of p and q .

Video: [Multiplying a vector by a scalar](#)
Video: [Addition and subtraction of vectors](#)

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

Exercise

p221 12B (not needed)

Summary

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Zero vector: $\begin{pmatrix} 0 \\ 0 \end{pmatrix} = 0\mathbf{i} + 0\mathbf{j}$

