

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) $|\mathbf{4u} + \mathbf{w}|$

Working: (a) $\mathbf{u} + \mathbf{v} = \begin{pmatrix} 2 \\ -1 \end{pmatrix} + \begin{pmatrix} -5 \\ 7 \end{pmatrix} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$

(b) $\mathbf{w} - \mathbf{u} = \begin{pmatrix} -3 \\ -4 \end{pmatrix} - \begin{pmatrix} 2 \\ -1 \end{pmatrix} = \begin{pmatrix} -5 \\ -3 \end{pmatrix}$

(c) $3\mathbf{v} - 2\mathbf{w} = 3 \begin{pmatrix} -5 \\ 7 \end{pmatrix} - 2 \begin{pmatrix} -3 \\ -4 \end{pmatrix} = \begin{pmatrix} -9 \\ 29 \end{pmatrix}$

(d) $4\mathbf{u} + \mathbf{w} = 4 \begin{pmatrix} 2 \\ -1 \end{pmatrix} + \begin{pmatrix} -3 \\ -4 \end{pmatrix} = \begin{pmatrix} 5 \\ -8 \end{pmatrix}$
 $|\mathbf{4u} + \mathbf{w}| = \left| \begin{pmatrix} 5 \\ -8 \end{pmatrix} \right| = \sqrt{89} \approx 9.43$

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 .

Working: Equating **i** components: $p + 3q = 5$
 Equating **j** components: $4p + 5q = 6$
 Solving simultaneously gives: $p = -1, q = 2$

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)