

Calculating with Vectors

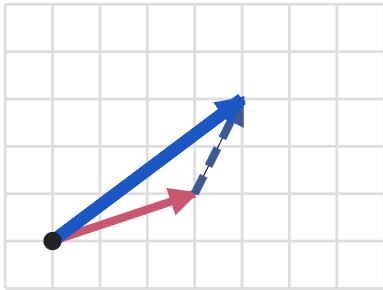
ANSWERS

1

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

Work out $\mathbf{a} + \mathbf{b}$ as a column vector.

$$\begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$$



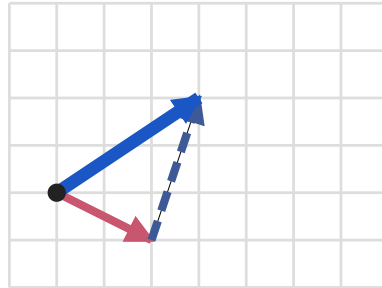
Draw the arrows nose to tail. The answer goes from the start to the end.

2

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

Work out $\mathbf{a} + \mathbf{b}$ as a column vector.

$$\begin{pmatrix} 2 \\ -1 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

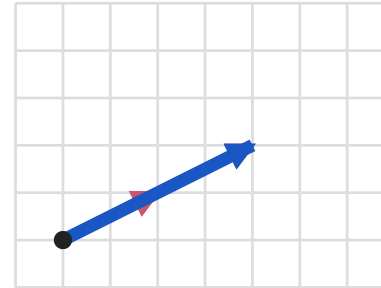


3

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

Work out $2\mathbf{a}$ as a column vector.

$$\begin{pmatrix} 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$$

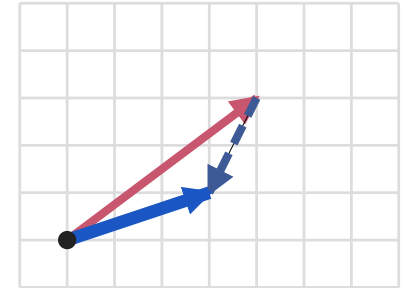


4

$$\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

Work out $\mathbf{a} - \mathbf{b}$ as a column vector.

$$\begin{pmatrix} 4 \\ 3 \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

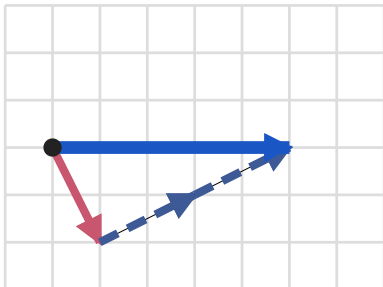


5

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

Work out $\mathbf{a} + 2\mathbf{b}$ as a column vector.

$$\begin{pmatrix} 1 \\ -2 \end{pmatrix} + \begin{pmatrix} 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$$

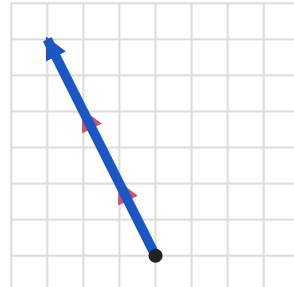


6

$$\mathbf{a} = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

Work out $3\mathbf{a}$ as a column vector.

$$\begin{pmatrix} -3 \\ 6 \end{pmatrix} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$$



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$$\mathbf{a} = \begin{pmatrix} 3 \\ -1 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$$

Work out $2\mathbf{a} - \mathbf{b}$ as a column vector.

$$\begin{pmatrix} 6 \\ -2 \end{pmatrix} - \begin{pmatrix} 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$

8

$$\mathbf{a} = \begin{pmatrix} -2 \\ 1 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$$

Work out $3\mathbf{a} + 2\mathbf{b}$ as a column vector.

$$\begin{pmatrix} -6 \\ 3 \end{pmatrix} + \begin{pmatrix} 6 \\ -8 \end{pmatrix} = \begin{pmatrix} 0 \\ -5 \end{pmatrix}$$

Calculating with Vectors *further practice*

ANSWERS

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$$\mathbf{a} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$$

Work out $3\mathbf{a} - 2\mathbf{b}$ as a column vector.

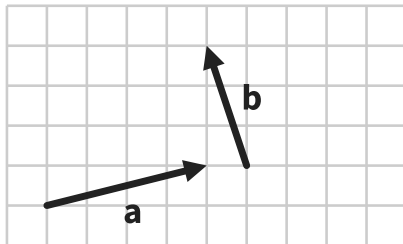
$$\begin{pmatrix} 9 \\ -6 \end{pmatrix} - \begin{pmatrix} -2 \\ 8 \end{pmatrix}$$

$$\text{Answer } \begin{pmatrix} 11 \\ -14 \end{pmatrix}$$

10



Write $\mathbf{a}$ and $\mathbf{b}$ as column vectors.
Then work out $\mathbf{a} + \mathbf{b}$.



$$\mathbf{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} 0 \\ 3 \end{pmatrix}$$

$$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

11



Find the vector $\mathbf{p}$.

$$\begin{pmatrix} 2 \\ 5 \end{pmatrix} + \mathbf{p} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$$

$$\begin{pmatrix} -1 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

$$\mathbf{p} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$$

12



$$\mathbf{a} = \begin{pmatrix} 3 \\ k \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$$

$$\mathbf{a} + 2\mathbf{b} = \begin{pmatrix} 1 \\ 14 \end{pmatrix}. \text{ Find } k.$$

$$k + 8 = 14$$

$$k = 6$$

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A robot makes three moves: $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$, then $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$, then $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$. What single vector takes it straight back to where it started?

$$\text{total move } \begin{pmatrix} 7 \\ 3 \end{pmatrix}$$

$$\text{Answer } \begin{pmatrix} -7 \\ -3 \end{pmatrix}$$

14



P is the point (2, 1). $\mathbf{v} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$.
The vector from P to Q is $3\mathbf{v}$.
Find the coordinates of Q.

$$3\mathbf{v} = \begin{pmatrix} 6 \\ -3 \end{pmatrix}$$

$$\mathbf{Q} = (8, -2)$$

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

A treasure map says: from the tree, walk $2\mathbf{a} + \mathbf{b}$, then walk $\mathbf{a} - 3\mathbf{b}$.
Write the single vector from the tree to the treasure in terms of $\mathbf{a}$ and $\mathbf{b}$, then as a column vector.

$$3\mathbf{a} - 2\mathbf{b}$$

$$\text{Answer } 3\mathbf{a} - 2\mathbf{b} = \begin{pmatrix} 11 \\ -1 \end{pmatrix}$$

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

Ella says $\mathbf{a} - \mathbf{b}$ is the same as $\mathbf{b} - \mathbf{a}$.
Is Ella right? Explain.

$$\mathbf{a} - \mathbf{b} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}, \quad \mathbf{b} - \mathbf{a} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$$

they point in opposite directions

$$\text{Answer } \text{No}$$