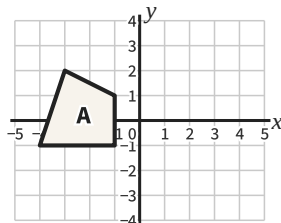


1 Translating shapes

- a) A is translated by $\begin{pmatrix} 2t \\ 1-t \end{pmatrix}$.

One vertex of the image is (3, -2). Find t and the other vertices.

- b) The line $y = 2x$ is translated by $\begin{pmatrix} 1 \\ 3 \end{pmatrix}$. Find the equation of the image.



a) $(-1, -1)$ moves there: $t = 2$; $(0, -2)$, $(3, 0)$, $(1, 1)$

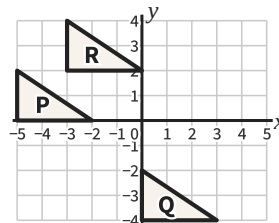
b) $y - 3 = 2(x - 1)$, $y = 2x + 1$

2 Describing translations

- a) Show that no vector

$\begin{pmatrix} t \\ t+3 \end{pmatrix}$ translates P onto Q.

- b) $\begin{pmatrix} t+1 \\ 2t \end{pmatrix}$ translates P onto R. Find t .



a) P to Q: $t = 5$, but then $t + 3 = 8$, not -4

b) P to R: $t + 1 = 2$ and $2t = 2$, $t = 1$

3 Calculating with vectors

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

- a) Find m and n so that $m\mathbf{a} + n\mathbf{b} = \begin{pmatrix} 11 \\ -7 \end{pmatrix}$.

- b) Find the vector $\mathbf{x}$ so that $2(\mathbf{x} - \mathbf{a}) = \mathbf{b} + \mathbf{x}$.

a) $3m - 2n = 11$, $-m + 4n = -7$: $m = 3$, $n = -1$

b) $\mathbf{x} = 2\mathbf{a} + \frac{\mathbf{b}}{2} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$

4 Vectors: magnitude

- a) The vector $\begin{pmatrix} k \\ k+1 \end{pmatrix}$ has magnitude 5. Find the two possible values of k .

- b) $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$. Find the exact magnitude of $2\mathbf{a} - 3\mathbf{b}$.

a) $2k^2 + 2k - 24 = 0$, $(k+4)(k-3) = 0$: $k = 3$ or -4

b) $\begin{pmatrix} 5 \\ -5 \end{pmatrix}$, $\sqrt{50} = 5\sqrt{2}$

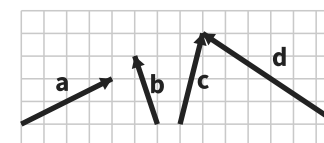
Vectors

revision mat answers

5 Vectors on a grid

- a) Write $\mathbf{c}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

- b) Write $\mathbf{d}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.



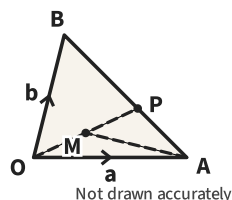
a) $\mathbf{c} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \frac{1}{2}\mathbf{a} + \mathbf{b}$

b) $\mathbf{d} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} = \mathbf{a} - 2\mathbf{b}$

6 Vector paths

OA = $\mathbf{a}$ and OB = $\mathbf{b}$. P is on AB so that AP : PB = 2 : 3. M is the midpoint of OP.

- a) Write OP in terms of $\mathbf{a}$ and $\mathbf{b}$.
b) Write AM in terms of $\mathbf{a}$ and $\mathbf{b}$.



a) $OP = \mathbf{a} + \frac{2}{5}(\mathbf{b} - \mathbf{a}) = \frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$

b) $AM = \frac{3}{10}\mathbf{a} + \frac{1}{5}\mathbf{b} - \frac{1}{2}\mathbf{a} = -\frac{1}{10}\mathbf{a} + \frac{1}{5}\mathbf{b}$

7 Parallel vectors

- a) $\mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$. Find k so that $\mathbf{a} + k\mathbf{b}$ is parallel to $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$.

- b) $\mathbf{p} = 3\mathbf{a} - 2\mathbf{b}$ and $\mathbf{q} = 4\mathbf{b} - 6\mathbf{a}$. Show that $\mathbf{p}$ and $\mathbf{q}$ are parallel. Compare their lengths.

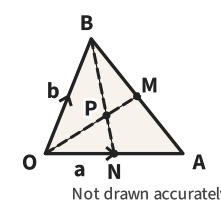
a) $\begin{pmatrix} 2+k \\ 1-3k \end{pmatrix}$: $2(2+k) = 1-3k$, $k = -\frac{3}{5}$

b) $\mathbf{q} = -2\mathbf{p}$: opposite ways, $\mathbf{q}$ twice as long

8 Vector proof

OA = $\mathbf{a}$, OB = $\mathbf{b}$. M and N are the midpoints of AB and OA. P is on OM with OP : PM = 2 : 1.

- a) Write OP in terms of $\mathbf{a}$ and $\mathbf{b}$.
b) Prove that B, P and N lie on a straight line.



a) $OP = \frac{2}{3} \times \frac{1}{2}(\mathbf{a} + \mathbf{b}) = \frac{1}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$

b) $BP = \frac{1}{3}\mathbf{a} - \frac{2}{3}\mathbf{b} = \frac{2}{3}(\frac{1}{2}\mathbf{a} - \mathbf{b}) = \frac{2}{3}BN$