

Transformations and vectors

Cambridge IGCSE Maths (0580) · Knowledge organiser

KEY DEFINITIONS

Translation

Slides a shape without turning it; described by a column vector.

Enlargement

Changes the size by a scale factor from a centre of enlargement.

Column vector

Shows a movement: the top number across, the bottom number up.

Magnitude

The length of a vector: $\sqrt{x^2 + y^2}$.

KEY FORMULAS

Vectors: add and subtract column vectors component by component; $k \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} kx \\ ky \end{pmatrix}$

Magnitude; position vectors $\left| \begin{pmatrix} x \\ y \end{pmatrix} \right| = \sqrt{x^2 + y^2}$, $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

WORKED EXAMPLE

$\mathbf{a} = (3, -1)$ and $\mathbf{b} = (2, 5)$, as column vectors. Find $2\mathbf{a} - \mathbf{b}$ and its magnitude.

1. $2\mathbf{a} = (6, -2)$

2. $2\mathbf{a} - \mathbf{b} = (6 - 2, -2 - 5) = (4, -7)$

3. $|2\mathbf{a} - \mathbf{b}| = \sqrt{16 + 49}$

Answer: $2\mathbf{a} - \mathbf{b} = (4, -7)$, magnitude $\sqrt{65} = 8.06$ (3 s.f.)

YOU SHOULD BE ABLE TO...

- Reflect shapes in given lines and rotate them about a centre through multiples of 90° , describing each transformation fully.
- Enlarge shapes by fractional and negative scale factors from a given centre, and describe such enlargements fully.
- Recognise and fully describe single transformations, giving the mirror line, centre and angle, column vector or scale factor and centre as needed.
- Calculate the magnitude of a column vector using Pythagoras' theorem, giving answers exactly as surds or to a set accuracy.
- Express vectors in terms of given vectors such as $\mathbf{a}$ and $\mathbf{b}$ by following routes through a diagram, including points dividing lines in a ratio.
- Reflect shapes in the lines $y = x$ and $y = -x$, and describe such reflections fully, including within combined transformations.

COMMON MISTAKES

- ✗ Describing a transformation without all its details, such as the centre, angle and direction of a rotation
- ✗ Reading a column vector the wrong way round: the top number is across