

## Transformations & Vectors

IGCSE Mathematics ■ Topic 7

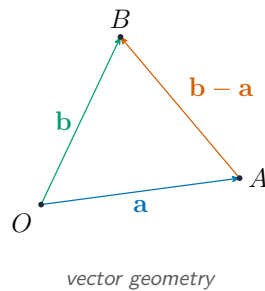
IGCSE Mathematics



Transformations & Vectors

### What we will cover

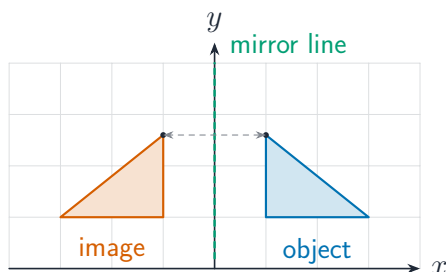
- 1 Reflection
- 2 Rotation
- 3 Enlargement
- 4 Translation
- 5 Vectors
- 6 Magnitude



# 1

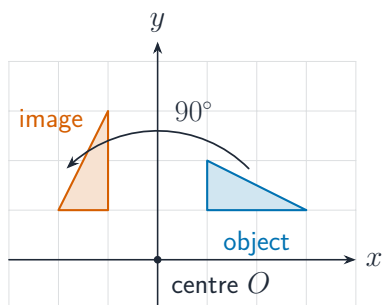
## Transformations

## Reflection



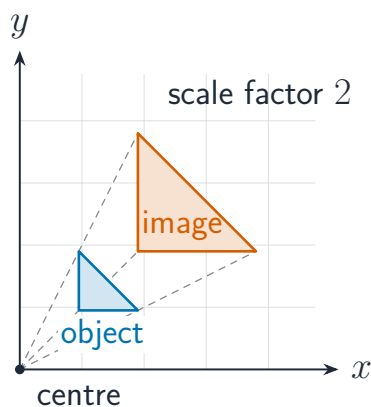
- To describe it, give the **equation of the mirror line** (for Core, a horizontal or vertical line; Extended allows any line such as  $y = x$ ).

## Rotation



- To describe it, give the centre, the angle, and the direction (clockwise or anticlockwise).

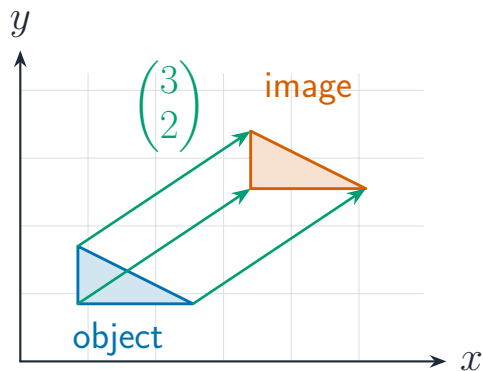
## Enlargement



An **enlargement** 放大 scales every distance from a centre by  $k$ .

Give the **centre** & the **scale factor**  $k$  ( $k$  may be fractional or negative).

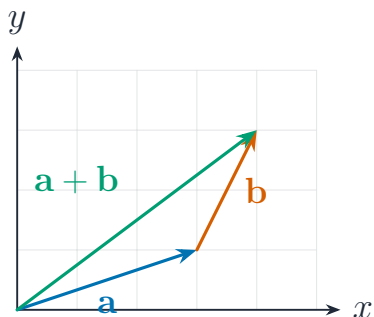
## Translation



A **translation** 平移 slides the shape with no turning, by a **column vector** 列向量  $\begin{pmatrix} x \\ y \end{pmatrix}$  ( $x$  across,  $y$  up).

# 2 Vectors

## Vectors

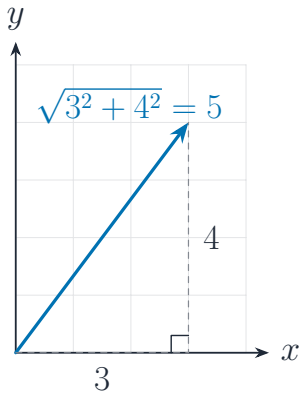


A **vector** 向量 has size & direction.

- add/subtract top & bottom separately
- $\times$  a **scalar** 标量: multiply both

$$\begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ -4 \end{pmatrix} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}.$$

## Magnitude



The **magnitude** 模 (length) uses Pythagoras:

$$\left| \begin{pmatrix} x \\ y \end{pmatrix} \right| = \sqrt{x^2 + y^2}$$

# 3

## Recap

## Worked example – reflections

Reflect the point  $(3, 2)$  in the  $y$ -axis, then in the  $x$ -axis.

- In the  $y$ -axis (the vertical one): only the sign of  $x$  changes.
- $(3, 2) \rightarrow (-3, 2)$
- In the  $x$ -axis (the horizontal one): only the sign of  $y$  changes.
- $(3, 2) \rightarrow (3, -2)$

Reflecting in the  $y$ -axis flips  $x$ ; in the  $x$ -axis flips  $y$  – the opposite letter to the axis named. Points on the mirror line never move.

## Topic 7 – key takeaways

### 1 Reflection

flip over a mirror line

### 2 Rotation

centre, angle & direction

### 3 Enlargement

centre & scale factor  $k$

### 4 Vectors

add componentwise;  $|v| = \sqrt{x^2 + y^2}$

## Check yourself

1 What must you give to describe a reflection?

2 What three things describe a rotation?

3 What kind of transformation is a slide?

4 Find  $\left| \begin{pmatrix} 3 \\ 4 \end{pmatrix} \right|$ .



**Answers** 1. the equation of the mirror line 2. centre, angle, direction 3. a translation  
4.  $\sqrt{9 + 16} = 5$