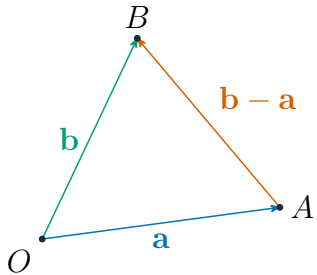
Transformations & Vectors

IGCSE Mathematics ▪ Topic 7

IGCSE Mathematics

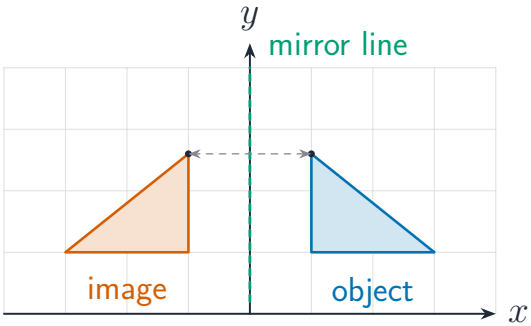
What we will cover

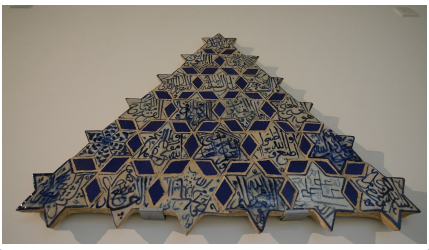
1. Reflection
2. Rotation
3. Enlargement
4. Translation
5. Vectors
6. Magnitude



vector geometry

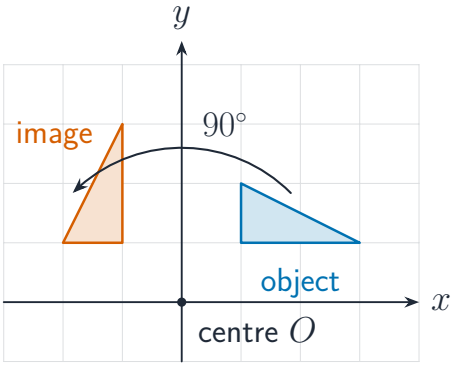
Reflection





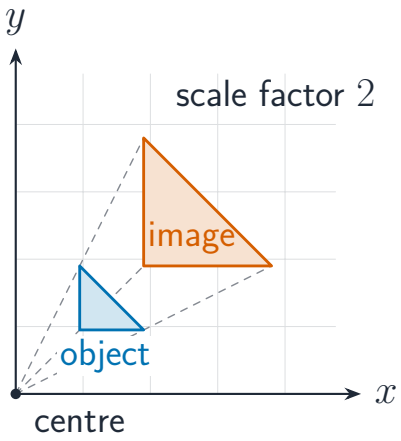
transformations tiles

Rotation



vectors sailing

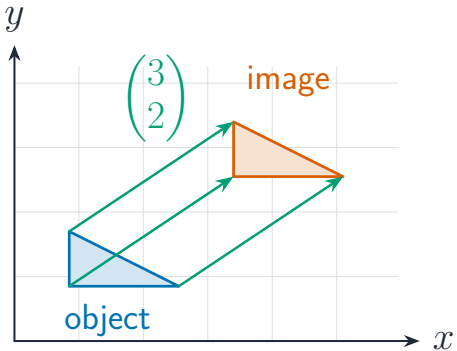
Enlargement



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

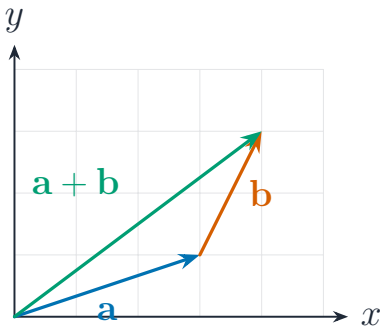
> Give the centre & the scale factor k (k may be fractional or negative).

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).

Vectors

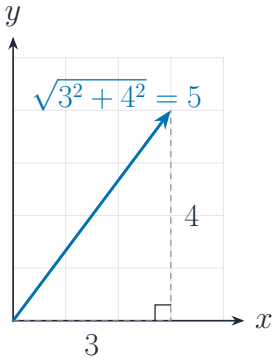


A **vector** 向量 has size & direction.

- 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:

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

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

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

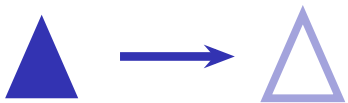
centre & scale factor k

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.** $\sqrt{9+16} = 5$