# 5.3 Transformations: rotation, reflection, translation

Name: _____ Class: _____ Date: _____ **Total: 15 marks**

**KEY WORDS** rotation • reflection

## Transformations: rotation, reflection, translation

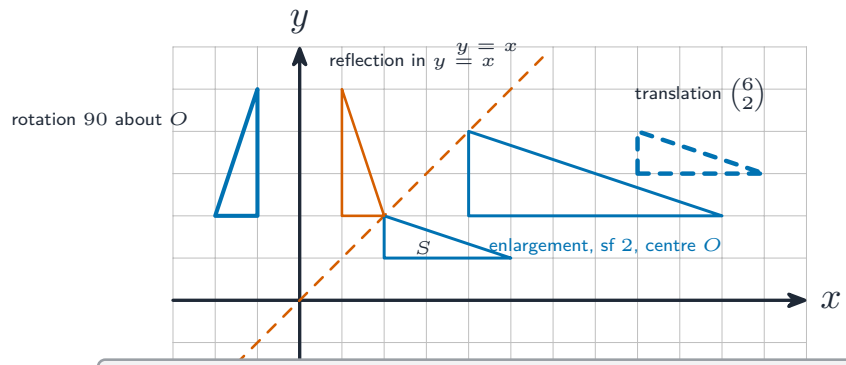
### Objective

Rotate about a centre, reflect in a mirror line, translate by a column vector, and describe transformations completely; know that these three preserve length and angle so images are congruent (objectives Foundation 5.2 A–I).

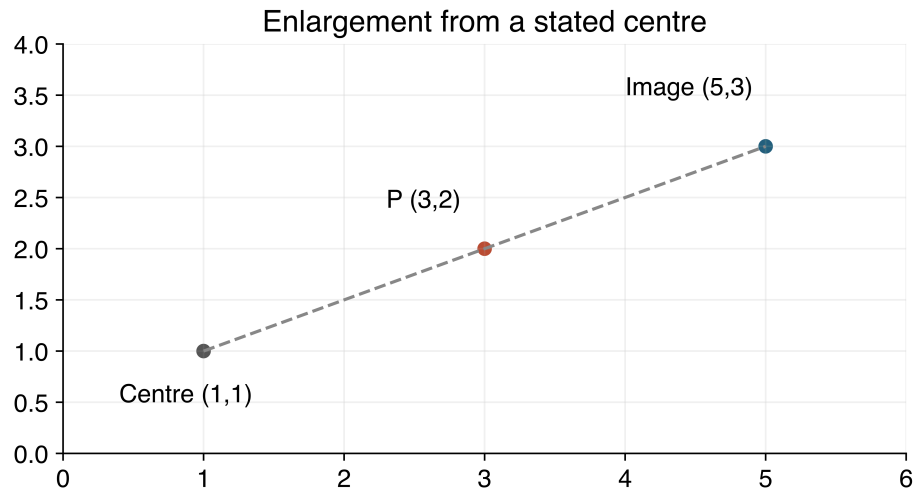
## 1 Key knowledge and worked examples

**The three isometries.** Rotation: centre + angle + direction (anticlockwise positive). Reflection: a mirror line such as $x = 1$, $y = 2$, $y = x$. Translation: distance and direction as the column vector $\binom{a}{b}$. All three preserve lengths and angles, so every image is congruent to the original.

**Coordinate shortcuts.** Reflect: $x$-axis $(x, y) \to (x, -y)$; $y$-axis $(x, y) \to (-x, y)$; $y = x$: $(x, y) \to (y, x)$. Rotate about $O$: $90°$ anticlockwise $(x, y) \to (-y, x)$; $180°$: $(x, y) \to (-x, -y)$. Translate: $(x, y) \to (x + a, y + b)$.




a complete description names the transformation AND every parameter




*Original native-lesson illustration; labels belong to its worked example.*

## 2 Practice

**2.1** Reflect $(3, 5)$ in the $x$-axis. [1]

**2.2** Reflect $(3, 5)$ in the line $y = x$. [1]

**2.3** Rotate $(-2, 4)$ through $90°$ anticlockwise about $O$. [2]

**2.4** Translate $(1, -3)$ by the vector $\binom{4}{6}$ [1]

**2.5** A shape and its image have equal side lengths and equal angles, and every point has moved the same distance in the same direction. Name the transformation. [1]

## 3 Exam-style questions

**3.1** *(Edexcel 4MA1 2HR June 2024 Q23 family, adapted.)* The point $P(2, 7)$ lies on the graph of $y = f(x)$. Write down the coordinates of the image of $P$ on the graph of (a) $y = f(x - 4)$ (b) $y = 2f(x)$. [2]

**3.2** *(Original.)* Triangle $A$ has vertices $(1, 1)$, $(4, 1)$, $(1, 3)$. It is rotated $90°$ clockwise about $(0, 0)$. (a) Draw or describe the image's vertices. (b) Describe fully the single transformation that maps the image back onto $A$. [4]

**3.3** *(Original.)* Shape $B$ is the image of shape $A$ under a reflection in the line $x = 2$. State the coordinates of the image of the point $(5, -1)$, and explain why the image is congruent to $A$. [3]