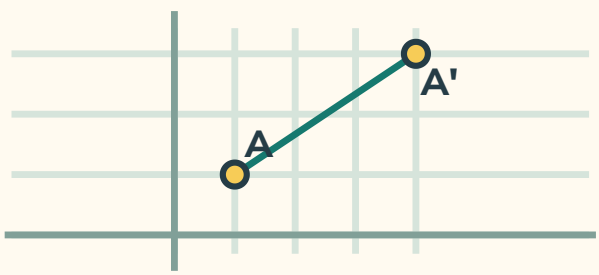
MATHS FIELD GUIDE · GRADE 6

Transformations change position by a rule

OPENING PROBLEM

What translation takes A to A′?



A (1, 1)
A' (4, 3)

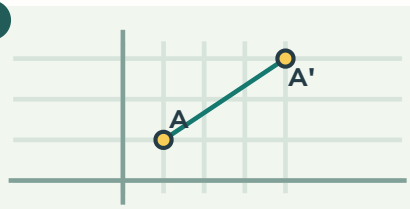
02 Track one point and one length
03 Rules and worked cases
04 Follow a badge on a grid
05 Locate a mirror by equal distances
06 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Track one point and one length

Translations, reflections and rotations preserve distances. Each moves points by a different rule.

1

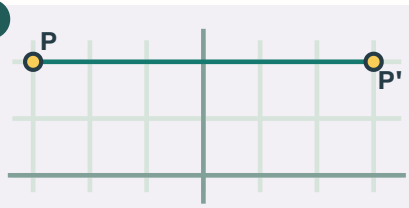


A (1, 1)
A' (4, 3)

What translation takes A to A'?

Three units right and two up. Apply that same displacement to every point.

2

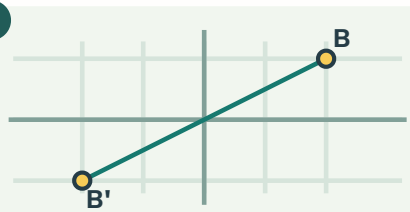


P (-3, 2)
P' (3, 2)

Where is the mirror line?

The y-axis. It bisects the horizontal segment between the two points at right angles.

3

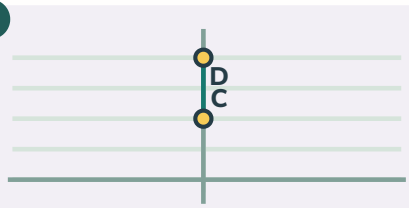


B (2, 1)
B' (-2, -1)

Which turn about the origin works?

A half-turn. Both coordinates change sign.

4



C (0, 2)
D (0, 4)

Reflect this segment in the y-axis. Where does it go?

Every point is already on the mirror. The segment stays in place.

Translate (3,2) by (−1,4)
(2,6).

Reflect (3,2) in the x-axis
(3,−2).

CHAPTER PROBLEM

Why does reflection in the y-axis keep a point's y-coordinate?

It changes the horizontal side of the mirror while keeping the same vertical position.

MATHS REFERENCE · GRADE 6

Transformations change position by a rule

A transformation maps points according to a rule. A translation moves every point by the same displacement. A reflection maps points to mirror positions across a line.

A rotation turns points about a centre through a specified angle and direction.

Four cases to recognise

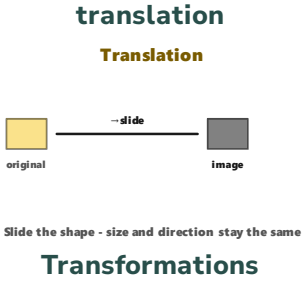
Situation	What to do and why
Translate (−1,4) by (3,−2)	Add component by component to reach (2,2).
Reflect (−1,4) in the y-axis	Reverse the horizontal displacement. The image is (1,4).
Rotate (2,0) a quarter turn anticlockwise about the origin	Its image is (0,2), still two units from the origin.
Reflect twice in the same line	The second reflection undoes the first because each perpendicular distance is traversed back.

Read the model

Build the idea

Translate a shape three units right and two units up. Apply the same movement to every vertex.

For reflection in the y-axis, a point and its image have opposite horizontal positions and equal vertical positions: (x, y) becomes (−x, y).

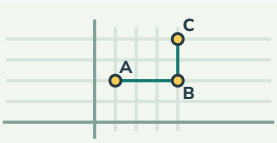


Why it works

Translations, reflections and rotations preserve lengths and angle sizes. Their images are congruent to the original.

A reflection places corresponding points the same perpendicular distance on opposite sides of its mirror line.

image The result of a transformation.
displacement A directed change in position.
congruent Same size and shape.
mirror line The line of a reflection.



A (1, 2)
B (4, 2)
C (4, 4)

Describe A to C via B.

Go three right, then two up. The total route length is five grid units.

WORKED INVESTIGATION

Follow a badge on a grid

A badge has a marked corner at (2, 1). Reflect the badge in the y-axis and then translate it three units right. Track the corner at each step.

Look at this part	What it tells you
Before	(2, 1)
After reflection	(−2, 1)
After translation	(1, 1)

Work it through

Reverse the order from the original position. Translation sends the corner to (5, 1) and reflection sends it to (−5, 1). The order matters.

Catch the mistake

A reflection flips the badge's orientation, even if a corner on the mirror line stays fixed. Track a second corner to see the flip.

Compare the cases

Follow an example

Reflect (−3, 2) in the y-axis to obtain (3, 2). Reflect it in the x-axis instead to obtain (−3, −2).

The mirror line determines which position changes. The rules are consequences of geometry, not arbitrary sign tricks.

What changes? What stays true?

A rotation needs a centre, angle and direction. "Turn the shape" is not a complete mathematical instruction.

Enlargements belong to a different family: they usually change lengths, even though they preserve angles and shape.

Change one condition

To undo the original pair of moves, translate three left first, then reflect in the y-axis. Undo the latest operation first.



P (2, 5)
Q (5, 2)

Are the points the same if the coordinates swap?

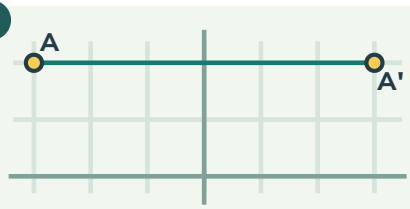
No. Each has its horizontal and vertical distances exchanged.

ILLUSTRATED PROBLEM SHEET

Locate a mirror by equal distances

A point on the mirror stays fixed. For any other point, the mirror crosses the segment to its image halfway, at a right angle.

1

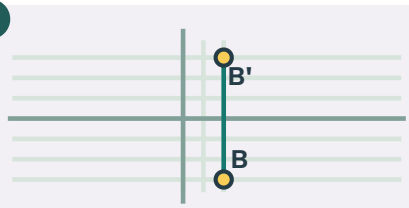


A (-3, 2)
A' (3, 2)

Reflect A(–3,2) in the y-axis.

The height stays two. Three units left becomes three units right, so A' = (3,2).

2

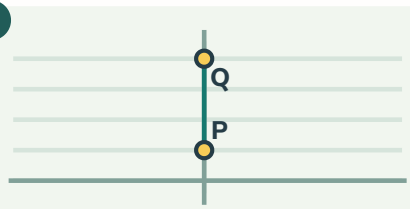


B (2, -3)
B' (2, 3)

Reflect B(2,–3) in the x-axis.

The horizontal position stays two. The sign of the vertical coordinate changes.

3

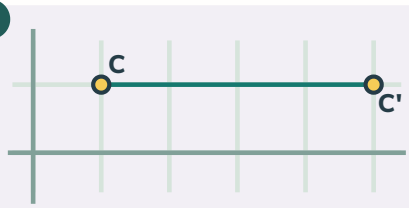


P (0, 1)
Q (0, 4)

What happens to P and Q in the y-axis mirror?

Both are on the mirror line. Each maps to itself.

4



C (1, 1)
C' (5, 1)

Find the vertical mirror taking (1,1) to (5,1).

Halfway from x = 1 to x = 5 is x = 3. Each point is two units from that line.

Mirror in y-axis
(x,y) goes to (–x,y).

Mirror in x-axis
(x,y) goes to (x,–y).

CHAPTER PROBLEM

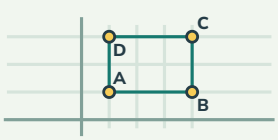
Reflect (–3, 2) in the vertical y-axis. What changes?

The image is (3, 2). It stays at the same height and the same distance from the axis, on the other side.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
01 Can a translation turn a right-pointing arrow upside down?	No. Every point moves through the same displacement, so the direction stays fixed.
02 Does a mirror image preserve the distances between a shape's vertices?	Yes. Its size and angles stay the same even though orientation reverses.
03 Apply the original two moves to (−1, 4). Where does it finish?	Reflection gives (1, 4). Translating three right gives (4, 4).
04 Reflect (3,−2) in the x-axis, then move left five.	Reflection gives (3,2). Translation gives (−2,2).
05 A half-turn about the origin sends (2,3) where?	Both directed distances reverse. The point becomes (−2,−3).



A (1, 1)
B (4, 1)
C (4, 3)
D (1, 3)

How can you recognise this rectangle?

Opposite sides have the same lengths. Horizontal and vertical neighbours meet at right angles.

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