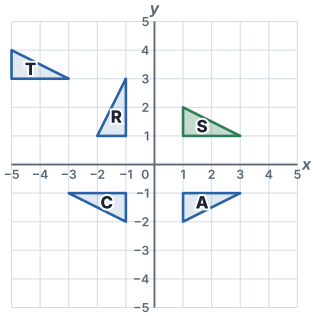
JUNIOR CYCLE MATHS · FREE REVISION SHEET

Transformations & symmetry

↗ Léim

Learning outcomes (2018 specification): GT.6a, GT.6b. Play the game: **leim.ie/mirror-move.html**

1. The four transformations



The new shape is the **image** (S′, "S dash"). All four keep the **same shape and size**. In the picture:

Translation (slide), S → T: every point moves 6 left and 2 up. Not turned, not flipped.

Axial symmetry (mirror), S → A: in the x-axis. Same distance from the line on the other side; the shape is **flipped**.

Central symmetry (half turn), S → C: in (0, 0). Go to the centre, then the same again. Same as a **rotation of 180°**.

Rotation (turn), S → R: 90° anticlockwise about (0, 0). Trace it and turn the page a quarter turn.

2. The quick rules

In the x-axis (x, y) → (x, −y)	**In the y-axis** (x, y) → (−x, y)
In the origin (x, y) → (−x, −y)	**Translation** add the move to x and y
90° anticlockwise about (0, 0) (x, y) → (−y, x)	**90° clockwise about (0, 0)** (x, y) → (y, −x)

3. Other lines and centres

A line m: count the squares straight across to the line (at right angles), then the same number on the other side. A point ON the line is its own image.

A centre C: P(1, 4), C(2, 1): 1 right and 3 down to C, then 1 right and 3 down again → (3, −2).

A translation from two points: (2, 1) → (5, −3) is 3 right and 4 down. Do the same to every point. Backwards (which point maps onto…?): do the opposite move.

4. Symmetry in shapes

An **axis of symmetry** folds a shape exactly onto itself. A **centre of symmetry** is a point where a half turn fits it back on itself.

Square	4 axes · centre
Rectangle, rhombus	2 axes · centre
Parallelogram	0 axes · centre
Kite, isosceles trapezium	1 axis · no centre
Isosceles / equilateral triangle	1 / 3 axes · no centre
Regular polygon, n sides	n axes · centre if n is even

A rectangle's diagonals are **not** axes of symmetry (fold one and see).

Classic mistakes: changing the wrong sign · clockwise v anticlockwise · thinking a half turn flips the shape · translating backwards · counting to m along the grid instead of straight across · "4 axes" for a rectangle.

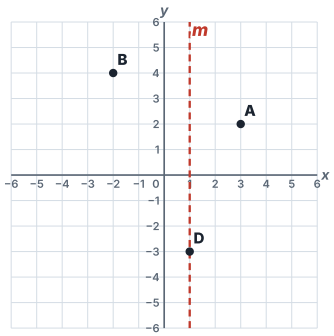
Exam tip: name a transformation fully ("axial symmetry in the y-axis", "a rotation of 90° clockwise about (0, 0)"), move the corners one at a time, label the image, and use a ruler.

PRACTICE · 34 QUESTIONS

Have a go

↗ Léim

A. Axial symmetry



1. Find the image of (4, 1) under axial symmetry in the x-axis. _____
2. Find the image of (−3, 5) under axial symmetry in the y-axis. _____
3. Find the image of (0, −4) under axial symmetry in the x-axis. _____
4. Find the image of (−2, −6) under axial symmetry in the y-axis. _____
5. Use the diagram. Find the image of A under axial symmetry in the line m.
   _____
6. Find the image of B under axial symmetry in the line m. _____
7. Find the image of D under axial symmetry in the line m. _____
8. The image of P under axial symmetry in the y-axis is (−5, 2). Find P.
   _____

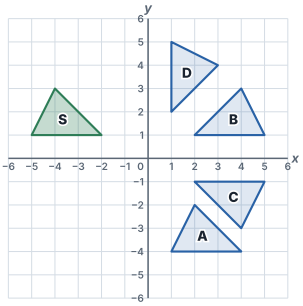
B. Translations and central symmetry

9. Translate (1, 4) by 3 units right and 2 units down. _____
10. A translation maps (2, 1) onto (5, −3). Find the image of (−4, 0). _____
11. Which point does the translation in question 10 map onto (0, 0)? _____
12. Find the image of (3, −5) under central symmetry in the origin. _____
13. Find the image of (−6, −2) under central symmetry in the origin. _____
14. Find the image of (3, 5) under central symmetry in the point C(1, 2). _____
15. Find the image of (2, 3) under central symmetry in the point C(−1, 0). _____
16. Under central symmetry in the origin, which point is its own image? _____

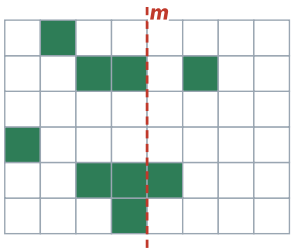
C. Rotations

17. Rotate (4, 1) by 90° anticlockwise about (0, 0). _____
18. Rotate (4, 1) by 90° clockwise about (0, 0). _____
19. Rotate (2, −3) by 180° about (0, 0). _____
20. Rotate (−2, −5) by 90° anticlockwise about (0, 0). _____
21. Rotate (0, 3) by 90° clockwise about (0, 0). _____
22. Two rotations of 90° clockwise about (0, 0), one after the other, are the same as which single transformation?
    _____

D. Naming and symmetry



23. Use the diagram. Name the transformation that maps S onto A. _____
24. Use the diagram. Name the transformation that maps S onto B. _____
25. Use the diagram. Name the transformation that maps S onto C. _____
26. Use the diagram. Name the transformation that maps S onto D. _____
27. How many axes of symmetry does a rectangle have? _____
28. How many axes of symmetry does a regular pentagon have? _____
29. Which of these has a centre of symmetry: a kite, a parallelogram or an isosceles triangle? _____
30. Use the squared paper. How many more squares must be shaded so that m is an axis of symmetry? _____



Questions 31–34 are on the next page.

EXAM-STYLE · THEN CHECK

Exam corner + answers

↗ Léim

E. Exam-style questions (show your work)

31. **Triangle T** has corners (1, 1), (4, 1) and (2, 3). (a) Write the corners of its image under axial symmetry in the x-axis. (b) Write the corners of its image under the translation 5 units left and 1 unit up. (c) Find the image of (4, 1) under a rotation of 90° anticlockwise about (0, 0). (d) Which single transformation maps the image in (a) onto the image of T in the y-axis?

32. **The logo.** A logo is a regular hexagon. (a) How many axes of symmetry does it have? (b) Does it have a centre of symmetry? (c) Name a quadrilateral with exactly 2 axes of symmetry and a centre of symmetry.

33. **Centre and slide.** A is (−2, 3) and C is (1, 1). (a) Find A′, the image of A under central symmetry in C. (b) Describe the translation that maps A onto A′. (c) Find the image of (0, 0) under that translation.

34. **Spot the slip.** Ciara says the image of (3, 1) under a rotation of 90° clockwise about (0, 0) is (−1, 3). Explain her mistake and give the right answer.

Answers

A	1. (4, −1) · 2. (3, 5) · 3. (0, 4) · 4. (2, −6) · 5. (−1, 2) · 6. (4, 4) · 7. (1, −3) · 8. (5, 2)
B	9. (4, 2) · 10. (−1, −4) · 11. (−3, 4) · 12. (−3, 5) · 13. (6, 2) · 14. (−1, −1) · 15. (−4, −3) · 16. (0, 0)
C	17. (−1, 4) · 18. (1, −4) · 19. (−2, 3) · 20. (5, −2) · 21. (3, 0) · 22. central symmetry in (0, 0)
D	23. translation, 6 units right and 5 units down · 24. axial symmetry in the y-axis · 25. central symmetry in the origin · 26. rotation of 90° clockwise about (0, 0) · 27. 2 · 28. 5 · 29. a parallelogram · 30. 5
E	31. (a) **(1, −1), (4, −1), (2, −3)** (b) **(−4, 2), (−1, 2), (−3, 4)** (c) **(−1, 4)** (d) **central symmetry in the origin** · 32. (a) **6** (b) **yes** (c) a **rectangle** (or a rhombus) · 33. (a) **(4, −1)** (b) **6 units right and 4 units down** (c) **(6, −4)** · 34. (−1, 3) is the **anticlockwise** turn. Clockwise: **(1, −3)**

Got one wrong? Check: did you change the right sign? Clockwise or anticlockwise? Did you count to the line m straight across? Then play **Mirror Move** at leim.ie/mirror-move.html: the "Go back over these" list at the end shows the rule for each mistake.

All questions written by Léim. Léim is independent and not connected with the State Examinations Commission or the NCCA.