

Exercise walk-through

C4.5

Symmetry

IGCSE Mathematics

You must be able to

- Identify lines of symmetry of plane figures
- Find rotational order and the smallest matching turn
- Distinguish reflection symmetry from rotation symmetry

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The method

Method — Key knowledge: Symmetry

A line of symmetry reflects a shape onto itself. Rotational symmetry order is the number of matches in one full turn, including the starting position at 360° . The smallest positive matching turn is $360^\circ/n$ for order n . A regular polygon with n sides has n symmetry lines and rotation order n . Order 1 means no smaller matching turn.

Exercises 2.1·2.3

2.1 Give the line-symmetry count and rotation order of a square. [2]

2.2 Give the line-symmetry count and rotation order of a non-equilateral isosceles triangle. [2]

2.3 A shape has rotation order 6. Find its smallest matching turn. [2]

Exercises 2.1·2.3

2.1 Give the line-symmetry count and rotation order of a square. [2]

2.1

- Both diagonals and both midlines give **4 lines**; quarter-turn matches give **order 4**.
-

2.2 Give the line-symmetry count and rotation order of a non-equilateral isosceles triangle. [2]

2.2

- Only the apex-to-base-midpoint line works: **1 line; order 1**.
-

2.3 A shape has rotation order 6. Find its smallest matching turn. [2]

2.3

- $\theta = 360/6 = \mathbf{60^\circ}$.

Exercise 2.4

2.4 Give both symmetry counts for a regular pentagon.

[2]

3 Exam-style questions

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3 Exam-style questions

2.4

- Five vertices give **5 lines; order 5**.

Exercise 3.1 (a)

3.1 Apply the symmetry methods below. Show working and include units where appropriate.

- (a) A logo is a regular octagon. State its number of lines of symmetry. [2]

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(a)

- **8 lines**, through opposite vertices or opposite side midpoints.

Exercise 3.1 (b)

3.1 Apply the symmetry methods below. Show working and include units where appropriate.

(b) Find its rotational symmetry order and smallest matching turn. [2]

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3.1 Apply the symmetry methods below. Show working and include units where appropriate.

(b) Find its rotational symmetry order and smallest matching turn. [2]

(b)

- **Order 8**; $\theta = 360/8 = 45^\circ$.

Exercise 3.1 (c)

3.1 Apply the symmetry methods below. Show working and include units where appropriate.

(c) A second logo is a nonsquare rectangle. Compare its two symmetry counts with the octagon. [2]

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3.1 Apply the symmetry methods below. Show working and include units where appropriate.

(c) A second logo is a nonsquare rectangle. Compare its two symmetry counts with the octagon. [2]

(c)

- The rectangle has **2 lines and order 2**, fewer than the octagon in both cases.

Exercise 3.2 (a)

3.2 Logo A is a regular pentagon. Logo B is a parallelogram that is neither a rectangle nor a rhombus.

(a) State A's number of symmetry lines, rotation order and smallest positive matching turn. [3]

Exercise 3.2 (a)

3.2 Logo A is a regular pentagon. Logo B is a parallelogram that is neither a rectangle nor a rhombus.

(a) State A's number of symmetry lines, rotation order and smallest positive matching turn. [3]

(a)

- A has **5 lines**, rotation order **5**, and smallest turn $\theta = 360/5 = \mathbf{72^\circ}$.

Exercise 3.2 (b)

3.2 Logo A is a regular pentagon. Logo B is a parallelogram that is neither a rectangle nor a rhombus.

(b) State B's number of symmetry lines and rotation order. Explain why the absence of a mirror line does not make its rotation order 1. [3]

Exercise 3.2 (b)

3.2 Logo A is a regular pentagon. Logo B is a parallelogram that is neither a rectangle nor a rhombus.

(b) State B's number of symmetry lines and rotation order. Explain why the absence of a mirror line does not make its rotation order 1. [3]

(b)

- B has **0 symmetry lines** and rotation order **2**.
- A 180° turn swaps opposite vertices and maps the figure onto itself even though no reflection does.