

E4.5 Symmetry

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

KEY WORDS line of symmetry 对称轴 • rotational symmetry 旋转对称
• order of rotational symmetry 旋转对称阶数 • chord 弦 • bisect 平分

Objective

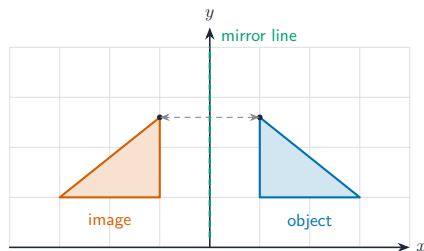
Build the skills to answer Extended exam questions on **symmetry** 对称 — counting **lines of symmetry** 对称轴 and the **order of rotational symmetry** 旋转对称阶数 of a 2D shape, and using the **symmetry properties of a circle** 圆的对称性质.

You must be able to:

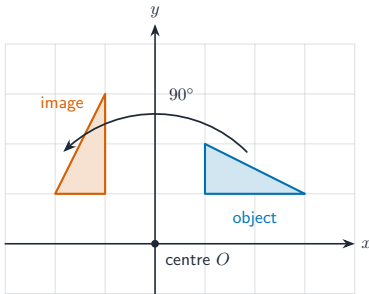
- state the number of lines of symmetry and the order of rotational symmetry of a shape
- name the symmetry properties of a circle: the perpendicular from the centre bisects a chord, and tangents from an external point are equal
- use those properties in a calculation with Pythagoras

1 Worked examples

■ Fold it, then turn it



A line of symmetry is a fold line: the two halves match exactly



The order of rotational symmetry counts how many times it looks the same in one full turn

- **Regular polygons:** a regular n -sided polygon has n lines of symmetry and rotational symmetry of order n .
- **Watch the parallelogram:** it has NO lines of symmetry but rotational symmetry of order 2. A rectangle has 2 and 2; a rhombus has 2 and 2; a square has 4 and 4.
- **Every shape** has rotational symmetry of at least order 1 — order 1 means no rotational symmetry.
- **Circle properties:** the perpendicular from the centre to a chord **BISECTS** it, and the two tangents from an external point are equal in length.

Answer shapes (marked by **method marks** — M1 for a correct method, A1 for the correct answer): in a circle calculation, naming the property used is a mark on its own — write it down before the arithmetic.

2 Practice

2.1 Write down the number of lines of symmetry and the order of rotational symmetry of a regular hexagon. [2]

2.2 Write down the order of rotational symmetry of a parallelogram. [1]

2.3 Write down the number of lines of symmetry of an isosceles trapezium. [1]

3 Exam-style questions

3.1 For each shape, write down the number of lines of symmetry and the order of rotational symmetry.

- (a) A rectangle that is not a square. [2]

- (b) A regular pentagon. [2]

3.2 A chord AB of length 16 cm is drawn in a circle of centre O and radius 10 cm.

- (a) State the symmetry property of a circle that lets you find the distance from O to AB . [1]

- (b) Find the distance from O to AB . [3]

Solutions

Marking: **M1** a correct method, **A1** the correct answer.

Each answer shows the steps, then the **result**.

2.1

- a regular n -gon has n of each

6 lines, **order 6**

2.2

- turning it through 180° gives the same shape, and a full turn gives it twice

order 2

2.3

- the fold line runs through the midpoints of the two parallel sides

1

3.1

(a)

- the fold lines join the midpoints of opposite sides; the diagonals are NOT lines of symmetry

2 lines, **order 2**

(b)

- regular, so both equal the number of sides

5 lines, **order 5**

3.2

(a)

- the perpendicular from the centre of a circle to a chord **bisects the chord**

(b)

- half the chord is $16 \div 2 = 8$ cm
- the radius, the half-chord and the distance form a right-angled triangle, so $d = \sqrt{10^2 - 8^2}$
 $= \sqrt{36} = 6$ cm
- the radius is the HYPOTENUSE, so it is subtracted from, not added to