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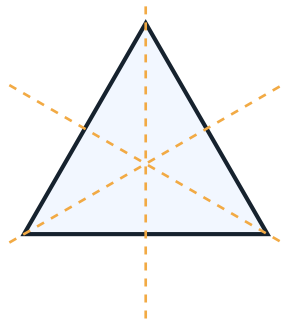
Date _____

8.3 Symmetry — worked answers

Identify line symmetry and rotational symmetry in 2D shapes, and state the order of rotational symmetry. · 52 questions

A · Fluency — Count the lines and the order.

- 1 How many lines of symmetry does a **equilateral triangle** have?

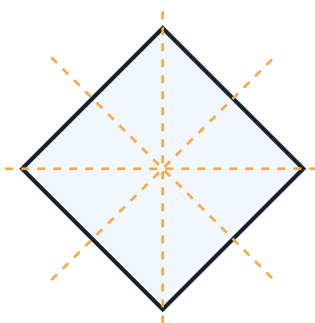


equilateral triangle

Answer: 3

A regular polygon with 3 sides has exactly 3 lines of symmetry.

- 2 How many lines of symmetry does a **square** have?

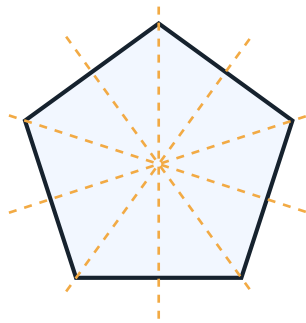


square

Answer: 4

A regular polygon with 4 sides has exactly 4 lines of symmetry.

- 3 How many lines of symmetry does a **regular pentagon** have?

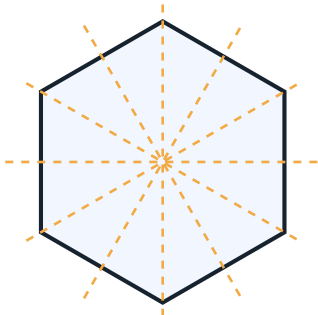


regular pentagon

Answer: 5

A regular polygon with 5 sides has exactly 5 lines of symmetry.

- 4 How many lines of symmetry does a **regular hexagon** have?

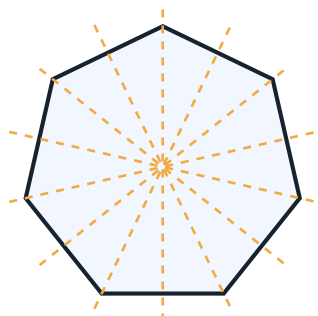


regular hexagon

Answer: 6

A regular polygon with 6 sides has exactly 6 lines of symmetry.

- 5 How many lines of symmetry does a **regular heptagon** have?

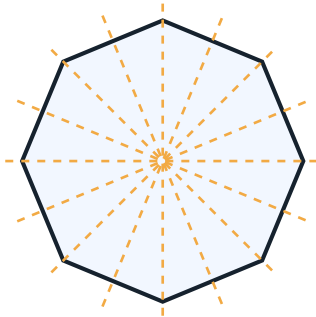


regular heptagon

Answer: 7

A regular polygon with 7 sides has exactly 7 lines of symmetry.

- 6 How many lines of symmetry does a **regular octagon** have?

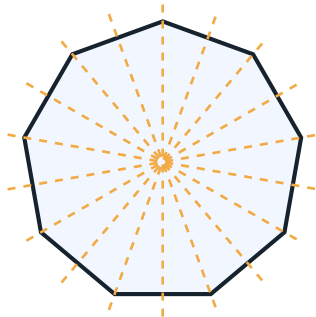


regular octagon

Answer: 8

A regular polygon with 8 sides has exactly 8 lines of symmetry.

- 7 How many lines of symmetry does a **regular nonagon** have?

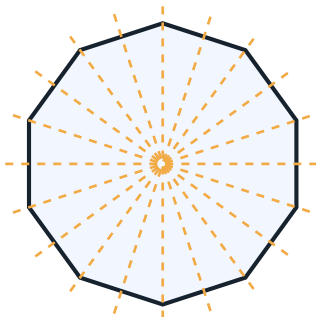


regular nonagon

Answer: 9

A regular polygon with 9 sides has exactly 9 lines of symmetry.

- 8 How many lines of symmetry does a **regular decagon** have?

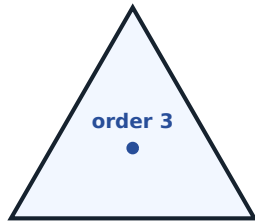


regular decagon

Answer: 10

A regular polygon with 10 sides has exactly 10 lines of symmetry.

- 9 What is the order of rotational symmetry of a **equilateral triangle**?

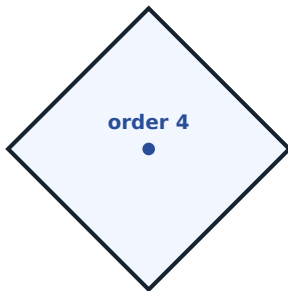


equilateral triangle

Answer: 3

Turning it through $360 \div 3 = 120^\circ$ maps it onto itself, and that happens 3 times in a full turn.

- 10 What is the order of rotational symmetry of a **square**?

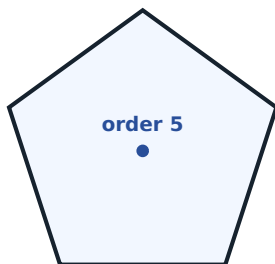


square

Answer: 4

Turning it through $360 \div 4 = 90^\circ$ maps it onto itself, and that happens 4 times in a full turn.

- 11 What is the order of rotational symmetry of a **regular pentagon**?

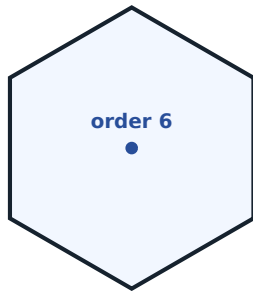


regular pentagon

Answer: 5

Turning it through $360 \div 5 = 72^\circ$ maps it onto itself, and that happens 5 times in a full turn.

- 12 What is the order of rotational symmetry of a **regular hexagon**?



regular hexagon

Answer: 6

Turning it through $360 \div 6 = 60^\circ$ maps it onto itself, and that happens 6 times in a full turn.

- 13 What is the order of rotational symmetry of a **regular octagon**?

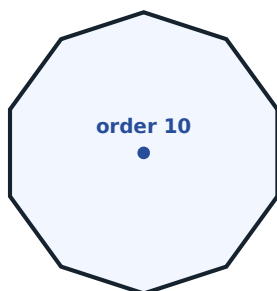


regular octagon

Answer: 8

Turning it through $360 \div 8 = 45^\circ$ maps it onto itself, and that happens 8 times in a full turn.

- 14 What is the order of rotational symmetry of a **regular decagon**?



regular decagon

Answer: 10

Turning it through $360 \div 10 = 36^\circ$ maps it onto itself, and that happens 10 times in a full turn.

- 15 How many lines of symmetry does a **rectangle** have?

Answer: 2

A rectangle has 2 lines of symmetry.

16 What is the order of rotational symmetry of a **rectangle**?

Answer: 2

It maps onto itself 2 times in a full turn.

17 How many lines of symmetry does a **rhombus** have?

Answer: 2

A rhombus has 2 lines of symmetry.

18 What is the order of rotational symmetry of a **rhombus**?

Answer: 2

It maps onto itself 2 times in a full turn.

19 How many lines of symmetry does a **parallelogram** have?

Answer: 0

A parallelogram has 0 lines of symmetry.

20 What is the order of rotational symmetry of a **parallelogram**?

Answer: 2

It maps onto itself 2 times in a full turn.

21 How many lines of symmetry does a **kite** have?

Answer: 1

A kite has 1 line of symmetry.

22 What is the order of rotational symmetry of a **kite**?

Answer: 1

It maps onto itself 1 time in a full turn.

23 How many lines of symmetry does a **isosceles triangle** have?

Answer: 1

A isosceles triangle has 1 line of symmetry.

24 What is the order of rotational symmetry of a **isosceles triangle**?

Answer: 1

It maps onto itself 1 time in a full turn.

25 How many lines of symmetry does a **scalene triangle** have?

Answer: 0

A scalene triangle has 0 lines of symmetry.

26 What is the order of rotational symmetry of a **scalene triangle**?

Answer: 1

It maps onto itself 1 time in a full turn.

27 How many lines of symmetry does a **trapezium** have?

Answer: 0

A trapezium has 0 lines of symmetry.

28 What is the order of rotational symmetry of a **trapezium**?

Answer: 1

It maps onto itself 1 time in a full turn.

29 How many lines of symmetry does a **isosceles trapezium** have?

Answer: 1

A isosceles trapezium has 1 line of symmetry.

30 What is the order of rotational symmetry of a **isosceles trapezium**?

Answer: 1

It maps onto itself 1 time in a full turn.

B · Reasoning — What the two kinds mean.

31 What is a line of symmetry?

- ☐ A line through the middle
- ☐ A line where the shape folds exactly onto itself
- ☐ A diagonal
- ☐ A line of any length

Answer: A line where the shape folds exactly onto itself

Fold along it and the two halves match exactly. A parallelogram has a line through the middle, but the halves do not match.

32 What does “order of rotational symmetry 4” mean?

- ☐ It has 4 sides
- ☐ It looks the same 4 times in a full turn
- ☐ It has 4 lines of symmetry
- ☐ It can be turned 4°

Answer: It looks the same 4 times in a full turn

Turning through $360 \div 4 = 90^\circ$ maps it onto itself.

33 What is the smallest possible order of rotational symmetry?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 4

Answer: 1

Every shape maps onto itself after a full turn, so the order is at least 1. Order 1 means no rotational symmetry beyond that.

34 A parallelogram has no lines of symmetry but order 2. What does that show?

- ☐ It has no symmetry
- ☐ Line symmetry and rotational symmetry are separate properties
- ☐ It is not a polygon
- ☐ The order must be wrong

Answer: Line symmetry and rotational symmetry are separate properties

A shape can have one without the other. Turning a parallelogram 180° maps it onto itself, but no fold does.

35 Does a regular polygon always have as many lines of symmetry as sides?

- ☐ Yes
- ☐ No

Answer: Yes

n sides gives exactly n lines of symmetry, and order n.

36 Does every shape with rotational symmetry also have line symmetry?

- ☐ Yes
☐ No

Answer: No

A parallelogram is the standard counter-example: order 2, no lines.

37 Through what angle must a shape of order 5 be turned to map onto itself?

- ☐ 36°
☐ 60°
☐ 72°
☐ 90°

Answer: 72°

$360 \div 5 = 72^\circ$.

38 A shape has order of rotational symmetry 6. Through what angle is the smallest turn?

- ☐ 30°
☐ 60°
☐ 72°
☐ 90°

Answer: 60°

$360 \div 6 = 60^\circ$.

C · Challenge — Working back from the turn.

39 A regular polygon has 9 lines of symmetry. How many sides has it?

Answer: 9

For a regular polygon, lines of symmetry = number of sides.

40 A shape maps onto itself every 45° . What is its order of rotational symmetry?

Answer: 8

$360 \div 45 = 8$.

41 A shape maps onto itself every 120° . What is its order?

Answer: 3

$360 \div 120 = 3$.

42 A regular polygon has order of rotational symmetry 12. What is its smallest turn, in degrees?

Answer: 30°

$360 \div 12 = 30^\circ$.

43 How many lines of symmetry does a regular 20-sided polygon have?

Answer: 20

A regular n-gon has n lines of symmetry.

44 Can a shape have 3 lines of symmetry but order 2?

- ☐ Yes
☐ No

Answer: No

For any shape, the number of lines of symmetry is either 0 or equal to the order of rotational symmetry.

D · Word problems — Symmetry in real objects.

- 45** A snowflake pattern maps onto itself every 60° . What is its order of rotational symmetry?

Answer: 6

$$360 \div 60 = 6.$$

- 46** A car wheel has 5 identical spokes. What is its order of rotational symmetry?

Answer: 5

It repeats 5 times in a full turn.

- 47** A square tile is turned until it looks the same. What is the smallest turn, in degrees?

Answer: 90

$$360 \div 4 = 90^\circ.$$

- 48** A rectangular flag has how many lines of symmetry?

Answer: 2

One horizontal and one vertical, through the middle.

- 49** A capital letter H has how many lines of symmetry?

Answer: 2

One vertical and one horizontal.

- 50** A capital letter S has what order of rotational symmetry?

Answer: 2

Turning it 180° leaves it looking the same.

- 51** A three-blade fan has what order of rotational symmetry?

Answer: 3

$$360 \div 120 = 3.$$

- 52** An equilateral triangular road sign has how many lines of symmetry?

Answer: 3

One from each vertex to the opposite side.