

Geometry - Symmetry of Polygons and Rigid Motions - Answer Key

Common Core G-CO.A.3, G-CO.B.6 · maths-pdf.fr/en/

Use this answer key to check the 20 problems on symmetry. Every solution shows the formula or theorem used, each step of the work, and the final answer in bold. If an answer differs from yours, compare the steps line by line to find where the work changed.

Geometry · Common Core State Standards: **G-CO.A.3, G-CO.B.6**

Exercise 1 - Square lines

Two lines join midpoints of opposite sides and two lines are the diagonals.

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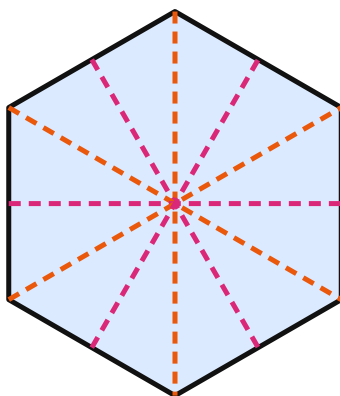
Exercise 2 - Table top

Only the two lines through the midpoints of opposite sides are lines of symmetry.

The diagonals are not, because the sides have different lengths.

2 lines, each through the midpoints of opposite sides

Exercise 3 - Regular hexagon



Six lines of symmetry: three through vertices and three through midpoints.

A regular hexagon has 6 lines of symmetry.

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

6 lines; 60°

Exercise 4 - Pentagon rotation

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

72°

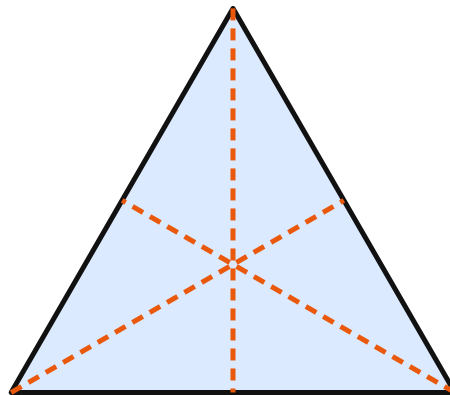
Exercise 5 - Octagon rotation

An octagon has 8 sides, so 8 lines of symmetry.

$$360^\circ \div 8 = 45^\circ$$

8 lines; 45°

Exercise 6 - Equilateral triangle



Three lines of symmetry.

Each line goes through a vertex and the midpoint of the opposite side: 3 lines.

$360^\circ \div 3 = 120^\circ$, so the rotations are 120° and 240° .

3 lines; rotations of 120° and 240°

Exercise 7 - Parallelogram

Reflecting across either diagonal or either midline sends a vertex to a point that is not a vertex, so there is no line of symmetry.

A rotation of 180° about the point O where the diagonals meet sends A to C and B to D.

No line symmetry; yes, a 180° rotation

Exercise 8 - Isosceles trapezoid

The perpendicular bisector of the two bases is the only line of symmetry.

No rotation less than 360° maps it onto itself, because the bases have different lengths.

1 line; no rotational symmetry

Exercise 9 - Rhombus

The two diagonals are lines of symmetry.

A rotation of 180° about the center maps it onto itself.

2 lines; 180°

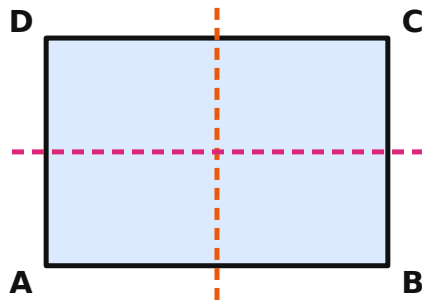
Exercise 10 - Twelve-sided polygon

$360^\circ \div 12 = 30^\circ$, so the rotations are all multiples of 30° : 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330.

There are 11 smaller rotations, so 12 counting 360° .

Multiples of 30° ; 12 rotations

Exercise 11 - Reflect a rectangle



The vertical line swaps A with B and C with D.

The reflection is (x,y) maps to $(6-x,y)$.

A maps to $(6,0)=B$, B maps to A , C maps to $(0,4)=D$, D maps to C .

Each vertex goes to a vertex, so it is a symmetry.

$A \rightarrow B$, $B \rightarrow A$, $C \rightarrow D$, $D \rightarrow C$; yes

Exercise 12 - Rotate a rectangle

$A(0,0)$ maps to $(6,4)=C$, $B(6,0)$ maps to $(0,4)=D$, C maps to A , D maps to B .

The rectangle maps onto itself.

$A \rightarrow C$, $B \rightarrow D$, $C \rightarrow A$, $D \rightarrow B$

Exercise 13 - Find n from the angle

$$360^\circ \div 40^\circ = 9$$

9 sides

Exercise 14 - Distances are preserved

Rigid motions preserve distance, so the sides stay 7, 5 and 5: perimeter $7+5+5=17$.

They also preserve angle measure, so the corresponding angle is 53° .

Perimeter 17; 53°

Exercise 15 - Square symmetries

Rotations: 90° , 180° , 270° .

Reflections: across the x-axis, the y-axis, the line $y = x$ and the line $y = -x$.

With the identity: $1+3+4=8$.

3 rotations, 4 reflections, 8 symmetries in all

Exercise 16 - Capital letters

A, H, M and T are mirror images across a vertical line. B has a horizontal line only, and F and R have none.

A, H, M, T

Exercise 17 - Pinwheel

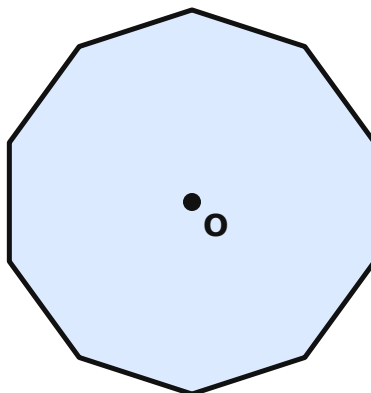
The blades are $360^\circ \div 6 = 60^\circ$ apart.

150 is not a multiple of 60, so it looks different.

Angles below 180° : 60° and 120° .

No; 60° and 120°

Exercise 18 - Wheel spokes



Ten spokes, 36 degrees apart.

$$360^\circ \div 10 = 36^\circ.$$

Multiples below 180° : 36° , 72° , 108° , 144° .

36° ; 36° , 72° , 108° , 144°

Exercise 19 - Road signs

Triangle: 3 lines, 120° . Octagon: 8 lines, 45° .

Octagon has $8 - 3 = 5$ more lines. The triangle's rotation is larger by $120^\circ - 45^\circ = 75^\circ$.

Stop sign has 5 more lines; yield sign's rotation is 75° larger

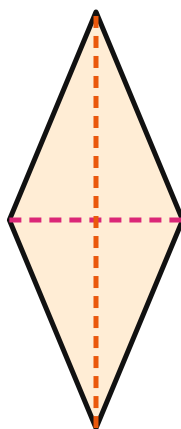
Exercise 20 - Rhombus tile

The diagonals bisect each other at right angles, giving right triangles with legs 5 and 12.

$$\sqrt{5^2 + 12^2} = \sqrt{169} = 13$$

$$4 \cdot 13 = 52$$

Side 13 in; perimeter 52 in



Rhombus with diagonals 10 and 24.

Find the side length and the perimeter of the tile.