

9.5 NOTES: SYMMETRY

Obj. for Part 1, 2, 3: Identify and describe symmetry in Geometric Figures.

Obj. for Part 4: Understand how solids can be produced by rotating a 2-dimensional figure through space.

Think and Discuss: What does it mean for a figure to have symmetry?

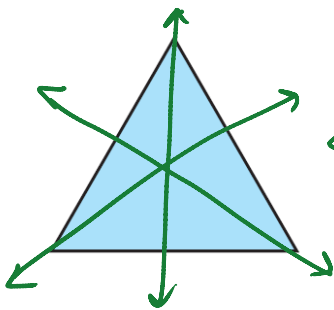
A figure has symmetry if there is a transformation of the figure such that the image coincides with the preimage.

- ① Line symmetry (think reflections)
- ② Rotational Symmetry (think rotations)

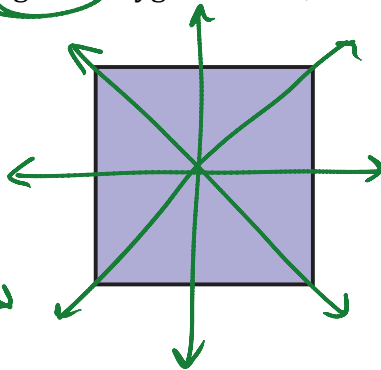
PART 1: LINE SYMMETRY

A figure has line symmetry (or reflection symmetry) if it can be reflected across a line so that the image coincides with the preimage. The line of symmetry, also called the axis of symmetry, divides the figure into two congruent halves.

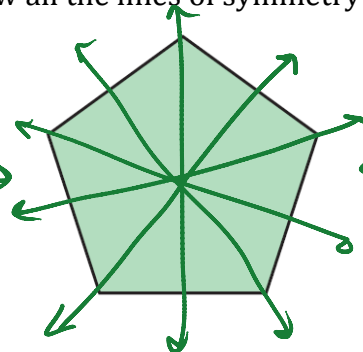
1. For each of the regular polygons below, draw all the lines of symmetry (L.O.S).



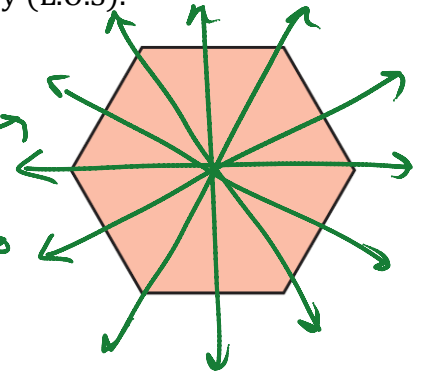
Total # of L.O.S: 3



Total # of L.O.S: 4



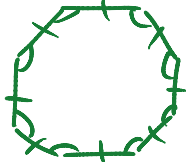
Total # of L.O.S: 5



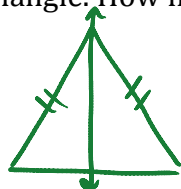
Total # of L.O.S: 6

2. Look for a pattern. How many lines of symmetry does a regular n-gon have? n

3. Sketch a regular polygon that has exactly eight lines of symmetry. Mark the diagram to prove that the figure has eight lines of symmetry. a regular octagon

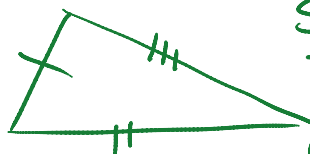


4. Sketch an isosceles triangle. How many lines of symmetry does it have? Explain.



An isosceles only has 1 line of symmetry. It must go through the vertex and midpt. of base

5. Sketch a scalene triangle. How many lines of symmetry does it have? Explain.



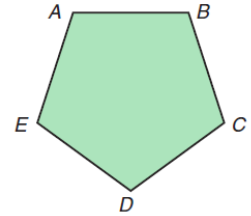
Since no sides are the same, there is no place to draw a line where the figure would coincide w/ itself. \therefore no L.O.S.

6. Discuss whether or not it is possible for a regular polygon to have exactly two lines of symmetry. Explain. Draw picture if necessary.

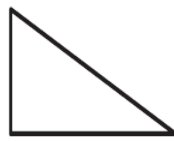
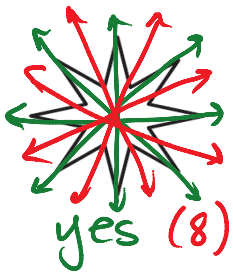
It is not possible for a regular polygon to have 2 lines of symmetry, because the polygon w/ the least # of sides is a Δ and it has 3 L.O.S when it is regular

7. Explain how you could use paper folding to find all the lines of symmetry of regular pentagon ABCDE.

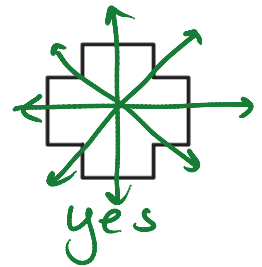
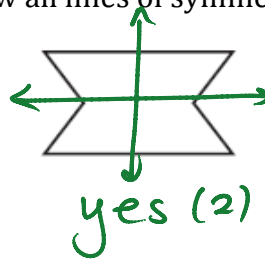
I would fold the regular polygon through each vertex in order to find all 5 lines of symmetry.



8. Tell whether the figure has line symmetry. If so, draw all lines of symmetry.



none



9. Anna, Bob, and Otto write their names in capital letters. Draw all lines of symmetry for each whole name if possible.

ANNA
none

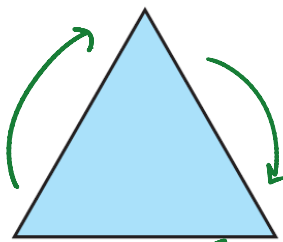
BOB
yes (1)

OTTO
yes (1)

PART 2: ROTATIONAL SYMMETRY

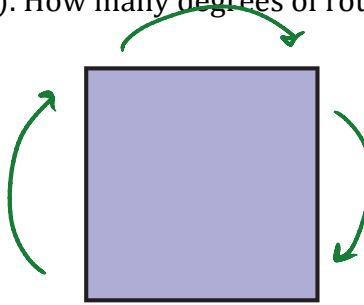
A figure has rotational symmetry (or radial symmetry) if it can be rotated about a point by an angle greater than 0° and less than 360° so that the image coincides with the preimage.

10. For each regular polygon, determine the order (the number of turns it takes for a figure to look exactly like itself). How many degrees of rotational symmetry does each figure have?



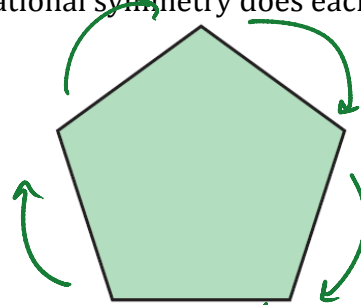
Order: 3

Degrees of Rotational Symmetry: 120°



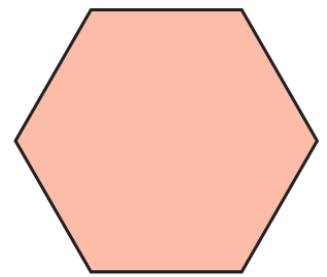
Order: 4

Degrees of Rotational Symmetry: 90°



Order: 5

Degrees of Rotational Symmetry: 72°



Order: 6

Degrees of Rotational Symmetry: 60°

11. Look for a pattern. How many degrees of rotational symmetry does a regular n-gon have? $\frac{360^\circ}{n}$

12. Discuss whether it is possible for a regular polygon to have 180° of rotational symmetry. Explain your reasoning here. Draw picture if necessary.

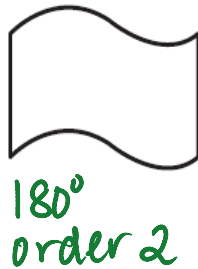
In order for a regular polygon to have 180° of rotational symmetry, the polygon would need to have an order of 2. In a regular polygon, the order tells you the # of sides. This would mean we would need a 2 sided polygon, which is impossible. Therefore a regular polygon cannot have 180° of rotational symmetry.

13. Draw an irregular figure that has 180° of rotational symmetry.

answers will vary

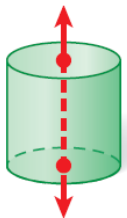
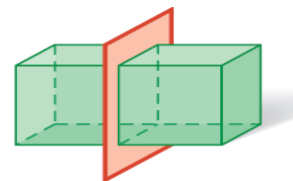


14. Tell whether each figure has rotational symmetry. If so, give the angle of rotational symmetry and the order of the symmetry.



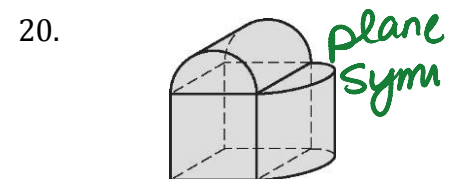
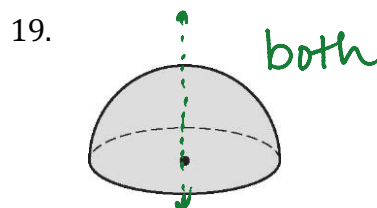
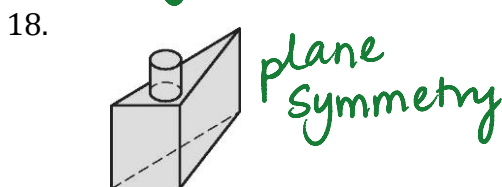
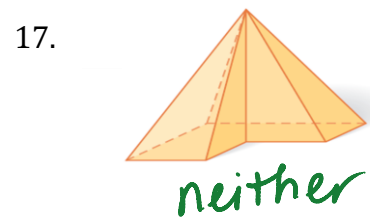
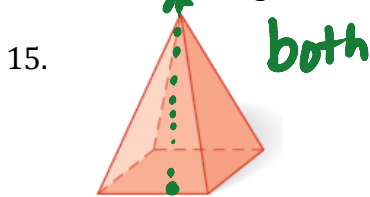
PART 3: PLANE SYMMETRY AND SYMMETRY ABOUT AN AXIS

A three-dimensional figure has plane symmetry if a plane can divide the figure into two congruent reflected halves.



A three-dimensional figure has symmetry about an axis if there is a line about which the figure can be rotated (by an angle greater than 0° and less than 360°) so that the image coincides with the preimage.

Tell whether the figure has plane symmetry, symmetry about an axis, both or neither. Explain your answer.

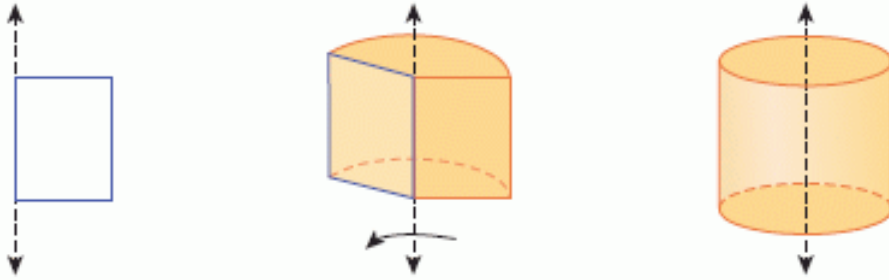


PART 4: SOLIDS OF REVOLUTION

A solid of revolution is a 3-D figure that is formed by rotating a 2-D shape around an axis.

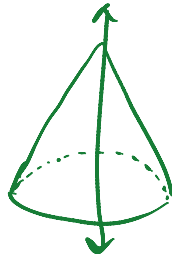
Example:

Draw the solid of revolution formed by the shape around the axis given. Describe the resulting shape.



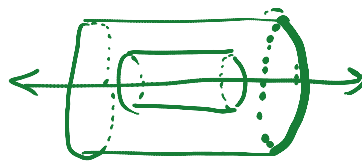
Description: If you rotate a rectangle around one of its sides, the path it makes through space is a cylinder.

21. Draw the solid of revolution formed by the shape around the axis given. Describe the resulting shape.



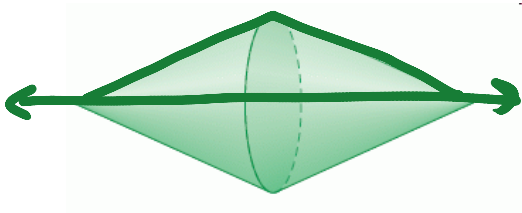
If you rotate a Δ around one of its sides, the path it makes through space is a cone.

22. Draw the solid of revolution formed by the shape around the axis given. Describe the resulting shape.



A cylinder with the center removed

22. Draw a 2-dimensional shape and axis of rotation that could form the figure below.



The 2-D shape should match the outline of the 3-D shape