Name ______________________________________

LEARNING TARGETS

I CAN identify lines of symmetry.
I CAN identify rotational symmetry.

Lesson 16: Line and Rotational Symmetry

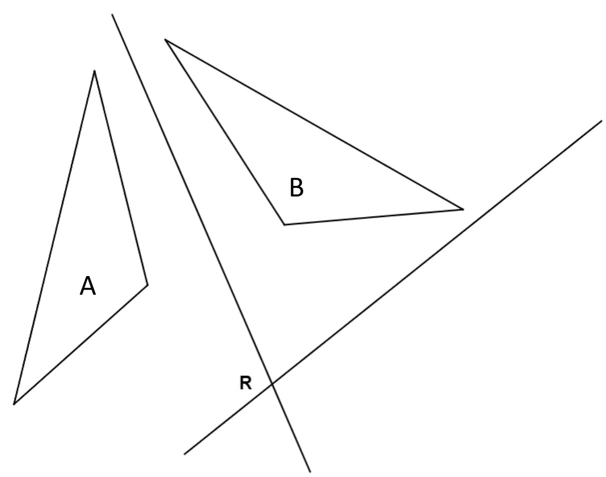
Warm Up

The original triangle, labeled with "A," has been reflected across the first line, resulting in the image labeled with "B."

1) Reflect the image across the second line. (A rough sketch is fine, but try to reasonably preserve the distance between vertices and the line of reflection)

Carlos looked at the image of the reflection across the second line and said, "That's not the image of triangle "A" after two reflections, that's the image of triangle "A" after a rotation!"

2) Do you agree? Why or why not?



Mini Lesson

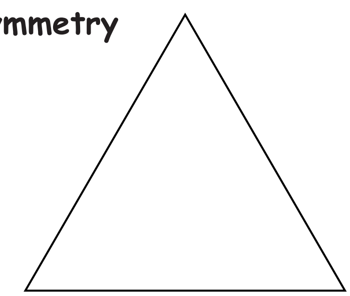
Discussion

When you reflect a figure across a line, the original figure and its image share a line of symmetry, which we have called the ***line of reflection***. *When you reflect a figure across a line, then reflect the image across a line that intersects the first line, your final image is a rotation of the original figure.* The ***center of rotation*** is the point at which the two lines of reflection intersect. **(Why does this make sense/sound familiar?)** The ***angle of rotation*** is determined by connecting the center of rotation to a pair of corresponding vertices on the original figure and the final image. The figure above is a $210°$ rotation (or $150°$ clockwise rotation. **Why are both ways of specifying the rotation equivalent?**).

Symmetry

A figure has symmetry if there is a way to map that figure onto itself.

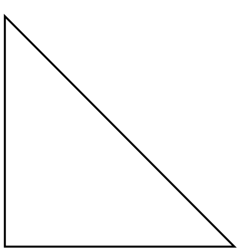
The triangle at the right has **line symmetry**, also called **reflectional symmetry** because if you fold the figure along a line of symmetry the halves will match exactly



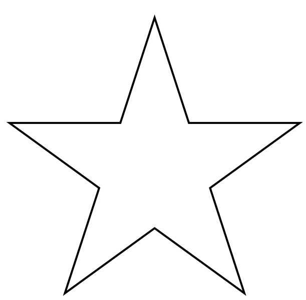
Construct each line of symmetry for the triangle.

EXAMPLE A: Use your compass and straightedge to construct one line of symmetry on each figure below that has at least one line of symmetry. Then, sketch any remaining lines of symmetry that exist. What did you do to justify that the lines you constructed were, in fact, lines of symmetry? How can you be certain that you have found all lines of symmetry?

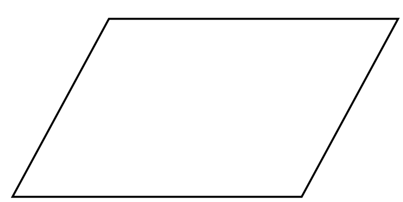
1.

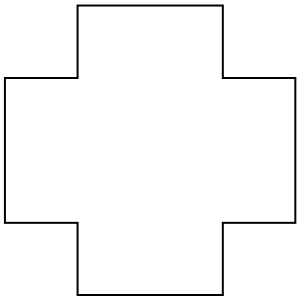


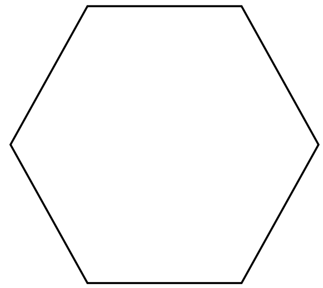
2.



3.



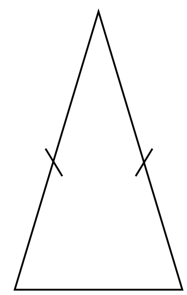
4.


5.


Does every figure have a line of symmetry?

Work Time:

Line of Symmetry of a Figure:



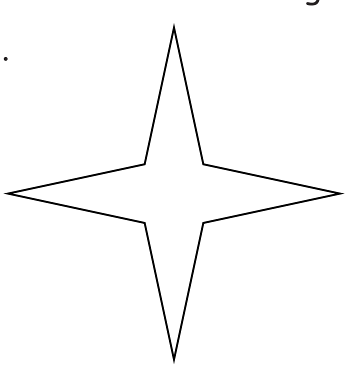
This is an isosceles triangle. By definition, an isosceles triangle has at least two congruent sides. A line of symmetry of the triangle can be drawn from the top vertex to the midpoint of the base, decomposing the original triangle into two congruent right triangles. Every point of the triangle on one side of the line of symmetry has a corresponding point on the triangle on the other side of the line of symmetry, given by reflecting the point across the line. The line of symmetry is equidistant from all corresponding pairs of points.

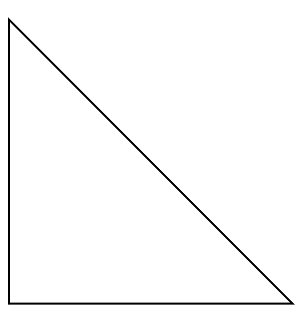
A figure has **line symmetry** if there exists a line (or lines) such that the image of the figure when reflected over the line is itself.

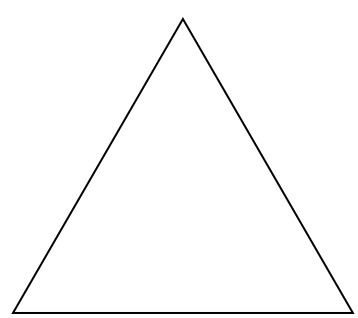
Rotational Symmetry:

A figure has **rotational symmetry** if a rotation of 180° or less maps the figure onto itself.

Which of the following figures have rotational symmetry.

6.


7.


8.


Name ____ Classwork/Homework

Lesson 16: Line and Rotational Symmetry

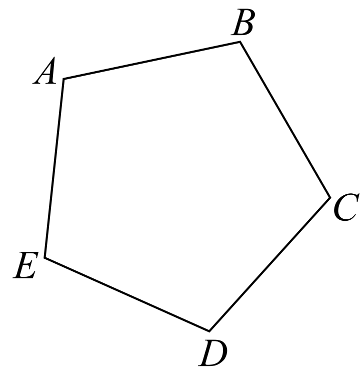


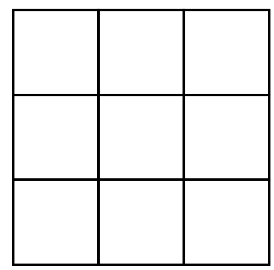
Figure 1

Use Figure 1 to answer Problems 1–3.

1. Draw all lines of symmetry. Locate the center of rotational symmetry.
2. Describe all symmetries explicitly.
   a. What kinds are there?
   b. How many are rotations (including the identity symmetry)?
   c. How many are reflections?

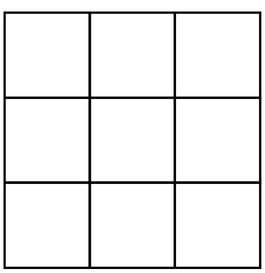
Use Figure 2 to answer Problem 3.

Figure 2

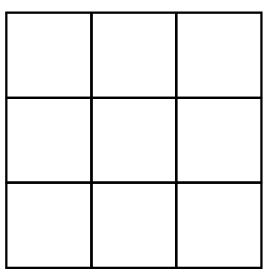


3. Shade exactly two of the nine smaller squares so that the resulting figure has
   a. Only one vertical and one horizontal line of symmetry.
   b. Only two lines of symmetry about the diagonals.
   c. Only one horizontal line of symmetry.
   d. Only one line of symmetry about a diagonal.
   e. No line of symmetry.

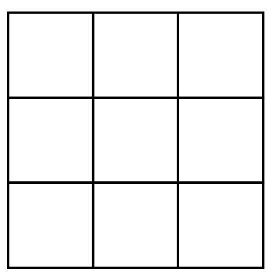
a.



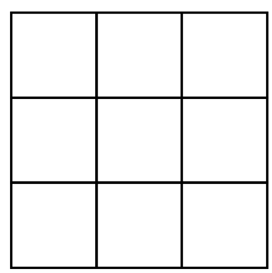
b.



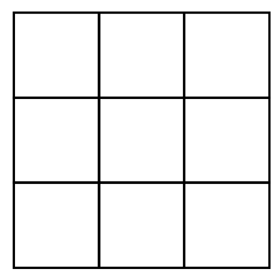
c.



d.



e.



Use Figure 3 to answer Problem 4.

4. Describe all the symmetries explicitly.
   f. How many are rotations (including the identity symmetry)?
   g. How many are reflections?
   h. How could you shade the figure so that the resulting figure only has three possible rotational symmetries

      (including the identity symmetry)?

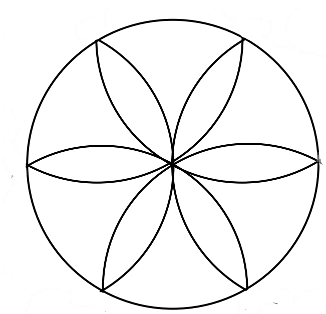


Figure 3

1 Which letter has rotational symmetry?

(1) **A** (3) **H**

(2) **B** (4) **W**

2 Which shape does *not* have rotational symmetry?

(1) trapezoid (3) circle

(2) regular pentagon (4) square

3 Which letter has rotational and line symmetry?

(1) **Z** (3) **C**

(2) **T** (4) **H**

4 Which letter has rotational symmetry but *not* line symmetry?

(1) **H** (3) **T**

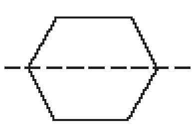
(2) **S** (4) **X**

5 Which letter demonstrates line symmetry but *not* rotational symmetry?

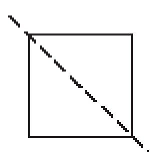
(1) **T** (3) **H**

(2) **N** (4) **S**

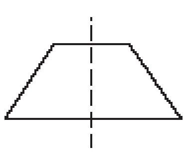
6 Which diagram shows a dotted line that is *not* a line of symmetry?



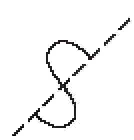
(1)



(3)

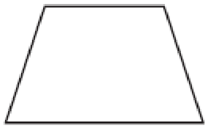


(2)



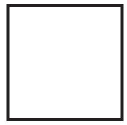
(4)

7 Which geometric figure has one and only one line of symmetry?



Isosceles trapezoid

(1)

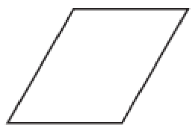


Square

(3)

Rectangle

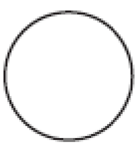
(2)



Rhombus

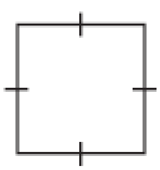
(4)

8 Which geometric shape does *not* have any lines of symmetry?

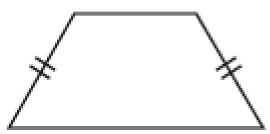


(1)

(3)



(2)



(4)

9 How many lines of symmetry does the accompanying figure have?

(1) an infinite number

(2) 2

(3) 8

(4) 4