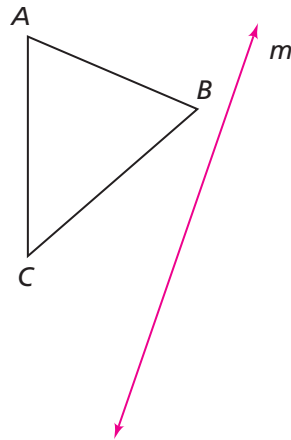
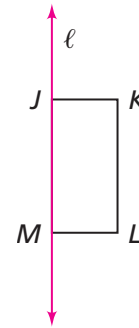


Applications

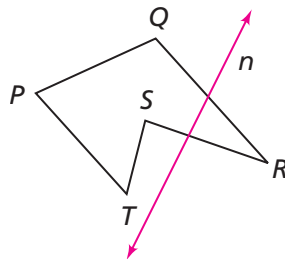
1. Copy the diagram below. Draw the image of triangle ABC after a reflection in line m . Describe how the vertices of the image triangle relate to the vertices of the original triangle.



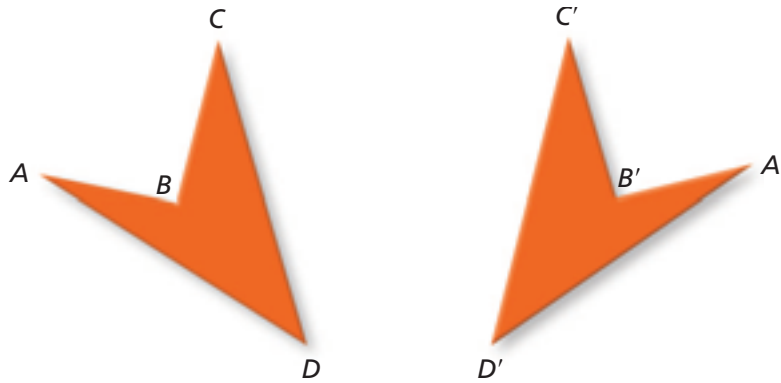
2. a. Copy the diagram at the right. Draw the reflection image of rectangle $JKLM$ in line ℓ .
 b. Does the final drawing have reflection symmetry? Explain.



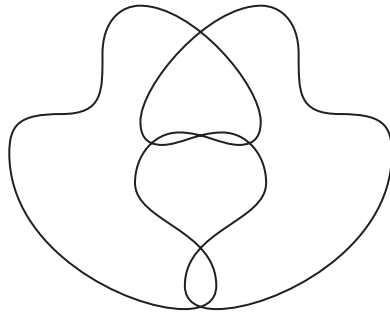
3. a. Copy the diagram below. Draw the reflection image of $PQRST$ in the line n .
 b. Does the final drawing have reflection symmetry? Explain.



4. Quadrilateral $A'B'C'D'$ is a reflection image of quadrilateral $ABCD$.

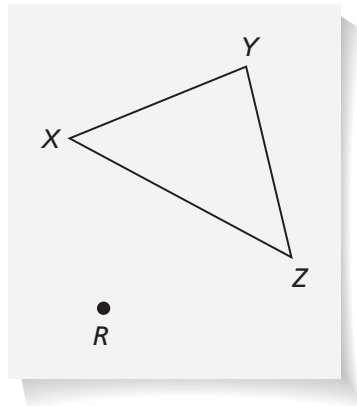
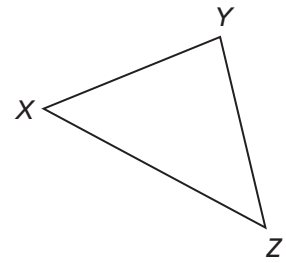


- a. Copy the diagram and draw the line of reflection. Explain how you found it.
- b. Describe the relationship between a point on the original figure and its image point on $A'B'C'D'$.
5. Shown below is a shape with reflection symmetry.

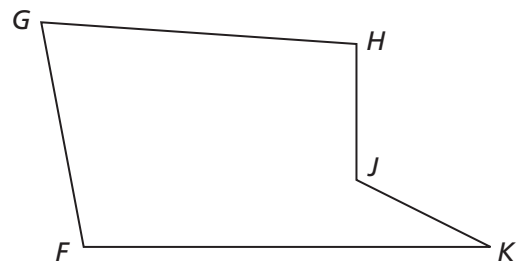


- a. Copy the figure. Draw the line of reflection.
- b. Label three points on the figure. Label the images of these points. Describe the relationship between each point and its image.

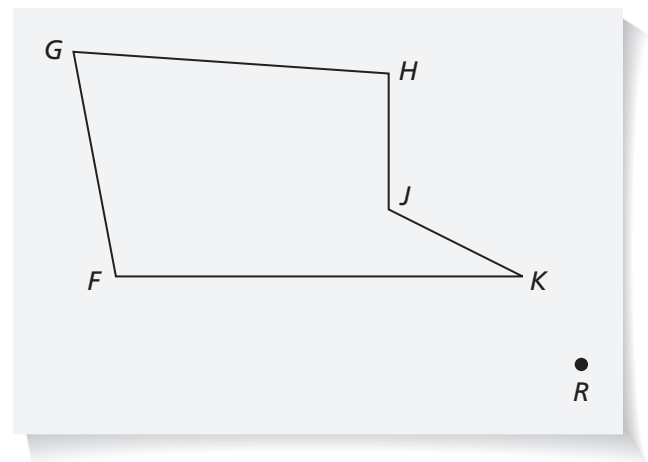
6. a. Copy triangle XYZ . Draw the image of the triangle after a 90° counterclockwise rotation about point Z . Describe how each vertex of the image triangle relates to the corresponding vertex on the original triangle.
- b. Copy triangle XYZ and point R . Draw the image of the triangle after a 90° counterclockwise rotation about point R . Describe how each vertex of the image triangle relates to the corresponding vertex on the original triangle.



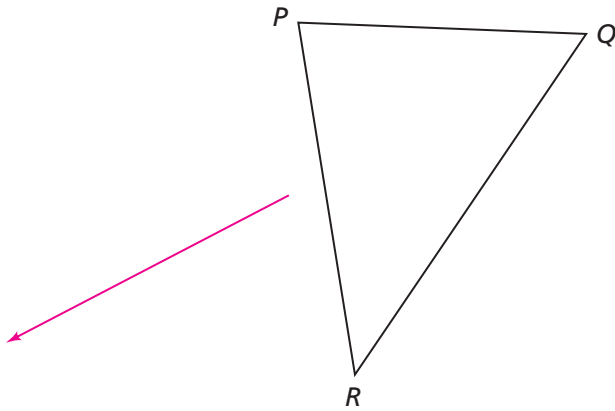
7. a. Copy polygon $FGHJK$. Draw the image of the polygon after a 180° counterclockwise rotation about point K . Describe how each vertex of the image polygon relates to the corresponding vertex on the original polygon.



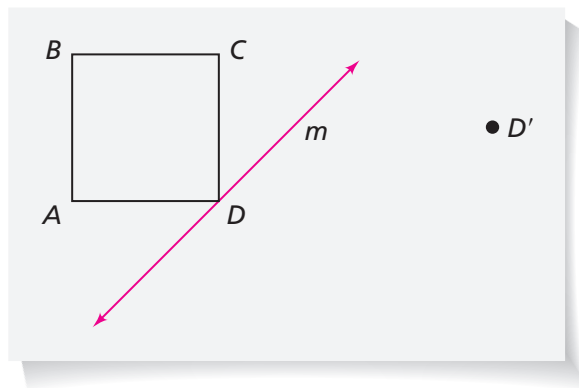
- b. Copy polygon $FGHJK$ and point R . Draw the image of the polygon after a 180° counterclockwise rotation about point R . Describe how each vertex of the image polygon relates to the corresponding vertex on the original polygon.



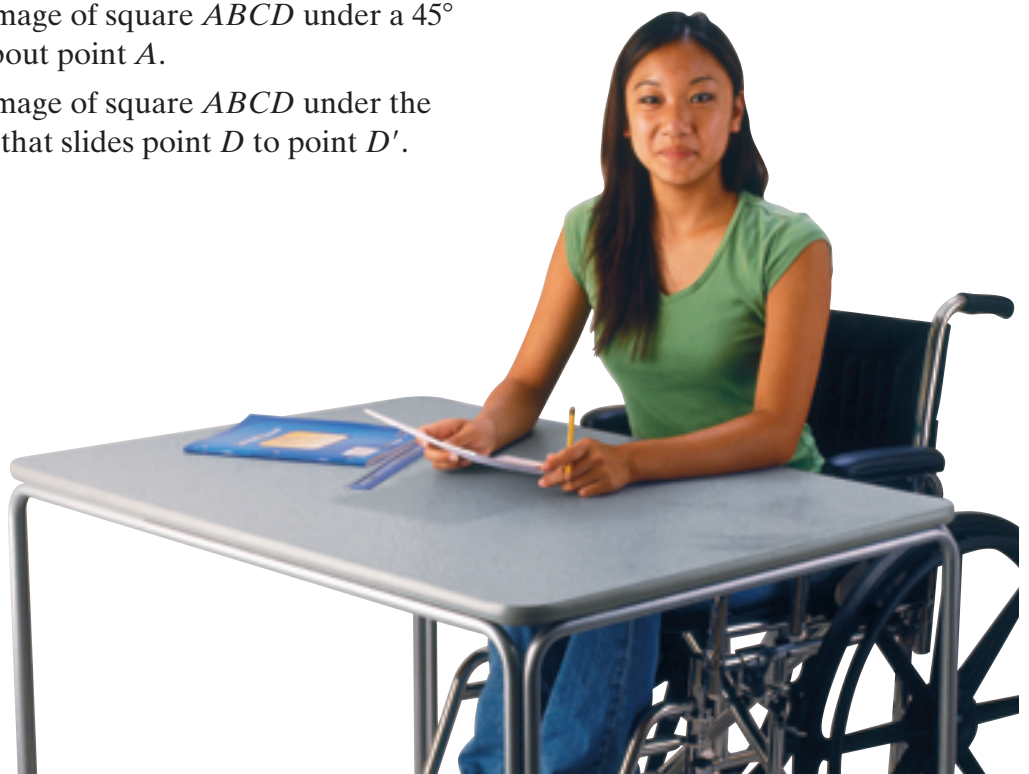
8. Copy triangle PQR and the arrow. Translate the triangle as indicated by the arrow. Describe how each vertex of the image triangle relates to the corresponding vertex on the original triangle.



9. Use copies of the figure below for the drawings in parts (a)–(c).

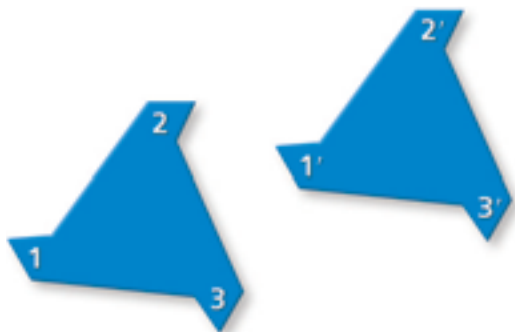


- Draw the image of square $ABCD$ under a reflection in line m .
- Draw the image of square $ABCD$ under a 45° rotation about point A .
- Draw the image of square $ABCD$ under the translation that slides point D to point D' .



Exercises 10–13 each give a figure and its image under a transformation. Tell whether the transformation was a reflection, rotation, or translation. Then, indicate the line of reflection, the center and angle of rotation, or the direction and distance of translation.

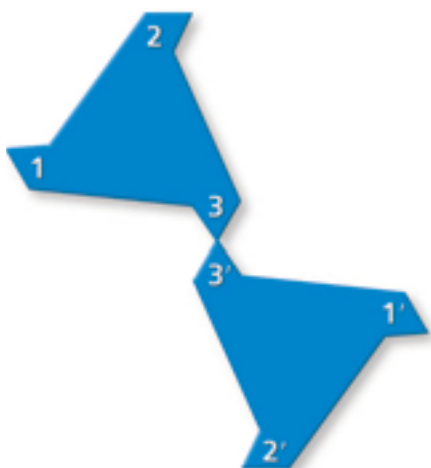
10.



11.



12.



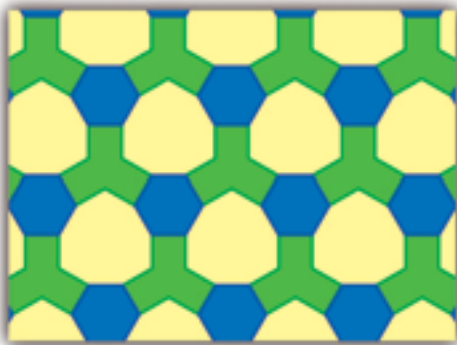
13.



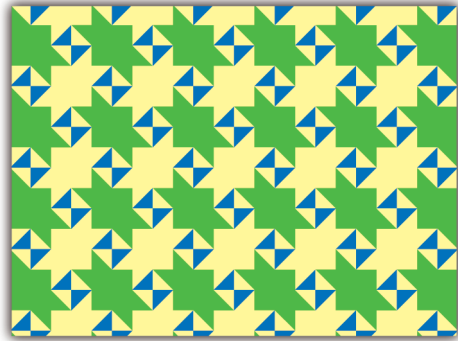
For Exercises 14 and 15, complete parts (a)–(c).

- Sketch a basic design element that can be used to produce the tessellation.
- Describe the types of symmetry in the tessellation. Assume the design continues without end in all directions.
- Describe the lines of symmetry, centers and angles of rotation, and directions and lengths of translations for the entire design.

14.

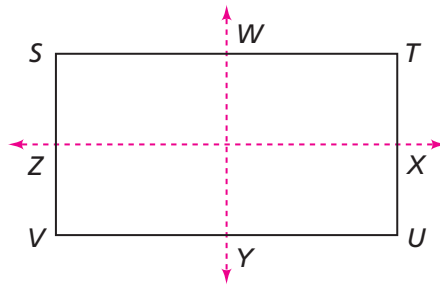


15.



Connections

16. In the rectangle below, the lines of symmetry are shown. Explain how to use these lines of symmetry to find equal lengths in the figure.



- Draw a design that has both reflection symmetry and rotation symmetry. Explain how your design shows both types of symmetry.
- What is the measure of each angle of a regular 10-sided polygon? Explain.

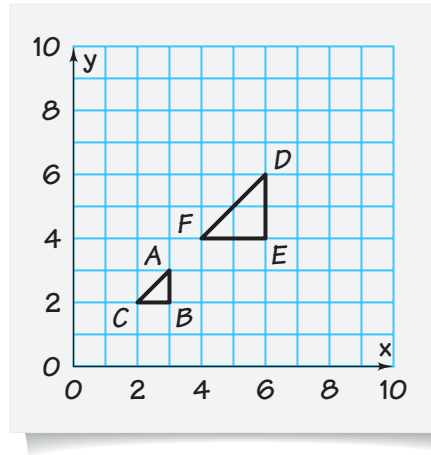
19. Draw a design that has reflection symmetry but no rotation symmetry. Show the line of symmetry.
20. Draw a design that has rotation symmetry but no reflection symmetry. What is the angle of reflection?
21. Can a regular pentagon and two regular hexagons meet at a vertex of a tessellation? Make a sketch to illustrate your answer.
22. Draw a design that has both reflection symmetry and translation symmetry. Indicate the distance and direction of the translation.
23. Draw a design that has translation symmetry but no reflection symmetry. Indicate the distance and direction of the translation.

24.
 - a. Plot the points listed in the table on a coordinate grid, connecting them in order.
 - b. What is the area of figure $ABCDE$?
 - c. Apply the rule $(2x, 2y)$ to figure $ABCDE$ to obtain figure $A'B'C'D'E'$. Are the two figures similar? Explain.
 - d. What is the area of figure $A'B'C'D'E'$?
 - e. What rule can you apply to figure $ABCDE$ to obtain a smaller similar figure?

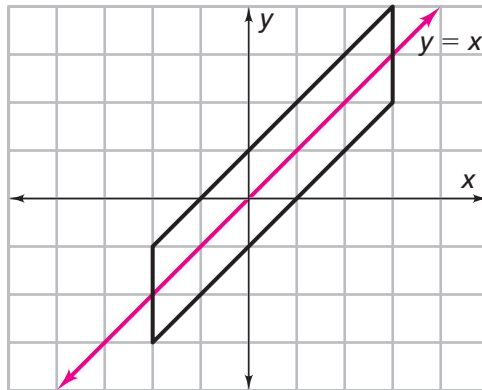
Point	Coordinates
A	$(-2, -2)$
B	$(2, -2)$
C	$(2, 2)$
D	$(0, 5)$
E	$(-2, 2)$
A	$(-2, -2)$

25.
 - a. On a coordinate grid, draw a simple figure that has the x -axis as a line of symmetry.
 - b. Apply the rule $(1.5x, 1.5y)$ to your figure. Is the new figure similar to the original?
 - c. Apply the rule $(0.75x, 0.75y)$ to your original figure. Is the new figure similar to the original?
 - d. Is the image in part (c) similar to the image in part (b)? Explain.

26. In *Stretching and Shrinking*, you used rubber bands to enlarge shapes. In the figure below, a rubber band was used to enlarge triangle ABC . The anchor point for the rubber band was at the origin. The knot traced around triangle ABC as the pencil drew triangle DEF .

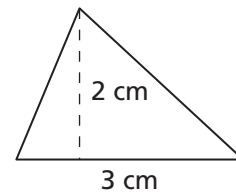


- a. What is the scale factor from triangle ABC to triangle DEF ?
 - b. On grid paper, sketch an enlargement of triangle ABC by a scale factor of 1.5 with the anchor point at the origin. Call this enlargement triangle XYZ .
 - c. How is triangle XYZ like or unlike a translation image of triangle ABC ?
27. **Multiple Choice** This parallelogram has sides parallel to the line $y = x$. Which statement is true about the parallelogram?



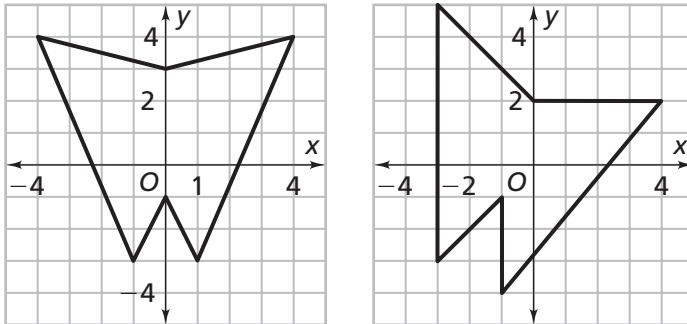
- A. It has reflection symmetry in the line $y = x$.
- B. It has rotation symmetry about the origin.
- C. It has reflection symmetry in a vertical line that is not the y -axis.
- D. It has rotation symmetry about a point that is not the origin.

28. a. Find the volume of a prism with the triangle at the right given as its base and with a height of 10 centimeters.
 b. Find the volume of a pyramid with the same base and height.

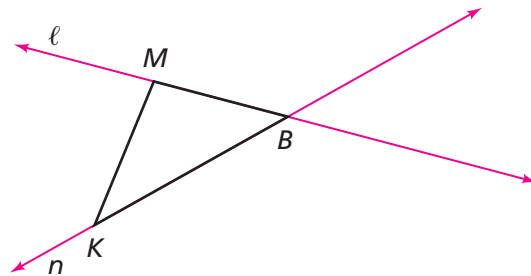


Extensions

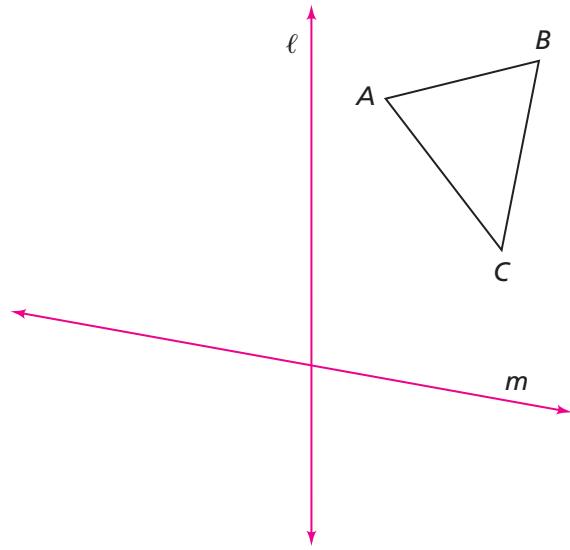
29. Copy the figures below onto grid paper.



- a. Which polygon has reflection symmetry about the y -axis?
 b. Sketch images of each polygon under a line reflection in the y -axis.
 c. How does the reflection image of the symmetric figure differ from the reflection image of the non-symmetric figure?
 d. Will the difference you observed in part (c) occur for any pair of polygons in which one polygon has reflection symmetry and the other does not? Test your conjecture on several examples to see if you can find reasons for the patterns you observe.
30. Triangle MBK has its vertices on lines ℓ and n . Vertex B is the point of intersection of the lines.
- a. Copy the figure at the right. Sketch the image of triangle MBK under a rotation of 180° about point B . Describe the locations of points M' , B' , and K' .
 b. What angle in triangle $M'B'K'$ corresponds to angle MBK in the original triangle?
 c. Make a conjecture about the angles formed when two lines intersect. Test your conjecture with several examples to see if you can find reasons for the patterns you observed.



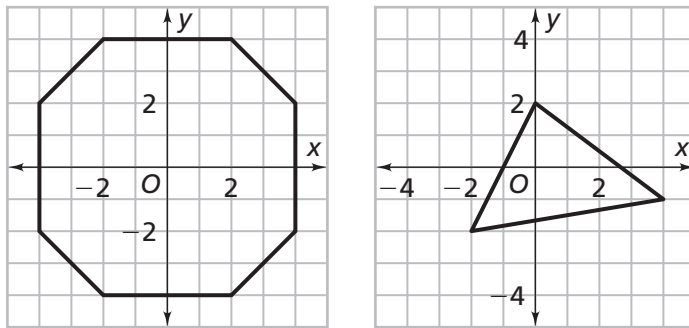
31. a. Copy the figure. Reflect triangle ABC in line ℓ . Label the image $A'B'C'$. Reflect triangle $A'B'C'$ in line m . Label the image $A''B''C''$.



- b. Can you relate triangle ABC to triangle $A''B''C''$ with a single transformation? If so, describe the transformation.
- c. Practice reflecting figures in two intersecting lines. Make a conjecture based on your findings.

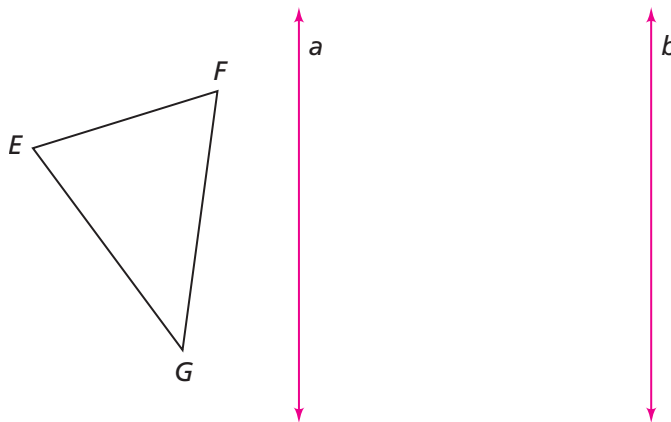


32. Copy the figures below onto grid paper.



- Which polygon has rotation symmetry about the origin?
- Sketch the image of each polygon under a 90° counterclockwise rotation about the origin.
- How does the rotation image of the symmetric figure differ from the rotation image of the non-symmetric figure?

33. a. In the diagram below, lines a and b are parallel. Copy the diagram. Reflect triangle EFG in line a . Label the image $E'F'G'$. Reflect triangle $E'F'G'$ in line b . Label the image $E''F''G''$.



- Can you move triangle EFG to triangle $E''F''G''$ with a single transformation? If so, describe the transformation.
- Practice reflecting figures in two parallel lines. Make a conjecture based on your findings.