

Math by Design
Lesson Plan: Transformations – Reflections

National Standard: Geometry : Apply transformations.../describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling
MD Standard 2: Knowledge of Geometry
MD Topic E: Transformations
MD Indicator 1: Analyze a transformation on a coordinate plane
MD Objective a: Identify, describe, and plot the results of multiple transformations on a coordinate plane
Materials and/or Set Up: Several cutout geometric figures and a large mirror to demonstrate reflections, <i>Interactive Resources 1, 2, and 3</i>
Relevant Vocabulary: Coordinate plane, coordinates, transformation, reflection, image, perpendicular, line of reflection
Note to Teacher: This lesson is designed to be used in conjunction with the online interactive activity at http://mathbydesign.thinkport.org .
Suggested Activities: <ul style="list-style-type: none">▪ Lead a discussion about reflections in a mirror. Cut out several geometric figures and position them (one at a time) so that the students can see the images in a mirror. Ask questions regarding the similarities and differences in the sizes and orientations of the figures and their reflection images. Also ask about the distance of the figure from the mirror and the perceived distance of the image from the mirror. Move the figure closer to or farther from the mirror so that students understand that the figure and its image appear to be the same distance from the mirror. You may want to introduce the words “image” and “equidistant” at this time.▪ Using <i>Interactive Resource 1</i>, explain that the line represents the mirror and is called the line of reflection. Ask them to draw the image of the triangle. Give the students an opportunity to share their drawings with a partner and to discuss the method they used to complete them. Lead a discussion with the class regarding methods used by students. If no one has suggested folding the paper on the line of reflection, you should demonstrate that method to the class and have them use it to check their drawings. This may also be an appropriate time to compare locating a reflection image to “flipping” the figure over the line of reflection.▪ Using <i>Interactive Resource 2</i>, ask the students to draw the image of the triangle again. Lead a discussion about how the coordinate plane simplified the process they used. Be sure that the students understand how to use the units and gridlines on the coordinate plane when locating the images.▪ Use the completed picture of the triangle and its image to draw the perpendicular segment from the one vertex of the triangle to the y-axis and extend the segment to locate the image the same distance away on the other side of the y-axis. Have the students demonstrate how to locate the images of the other two vertices. Use the

Math by Design

Lesson Plan: Transformations – Reflections

images to draw the reflected triangle.

- Use *Interactive Resource 3* to provide practice in locating the reflection images of the figures using the y -axis as the line of reflection.
- Use the original triangle again and ask the students to draw the reflection using the x -axis as the mirror or line of reflection. Lead a discussion about the similarities and differences between this activity and the first one.
- Have the students use *Interactive Resource 3* again, this time drawing the reflections over the x -axis. They may check with a partner or by folding along the axis.
- Ask the students to reflect a figure over the x -axis and then reflect the resulting figure over the y -axis. Ask if they think that the resulting answer would be the same if they changed the order and reflected over the y -axis first. Use figures from *Interactive Resource 3* again to explore the results of reflecting a figure over both axes and changing the order. Be sure to discuss the results. (*You may want to have partners do this exploration, so that each student does just one set of reflections.*)

Differentiation Suggestions:

- Cut out a copy of the triangle from *Interactive Resource 1* and “flip it over the axis” to show it landing on its reflection image.
- Compare the idea of “flipping the figure” to turning a page of a book.
- Allow the students to fold along the line of reflection and trace the figure they see “through the paper” in order to draw the image.

Assessment:

- On a coordinate plane, a point P located at coordinates (a, b) is reflected over the x -axis. What are the coordinates of the reflected point?
Answer: $(a, -b)$

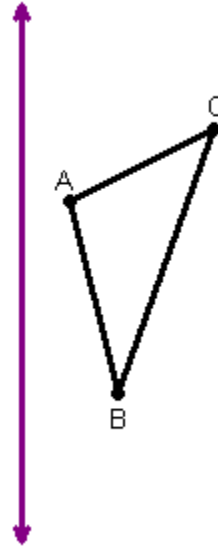
Follow Up:

- Use the interactive graphs available at the following websites to provide additional insights about reflections.
<http://www.shodor.org/interactivate/activities/Transmographer/>
<http://www.shodor.org/interactivate/activities/TransmographerTwo/>
- Use the clip art to ask students to identify reflection images within the figures.
http://etc.usf.edu/clipart/37300/37300/pattern_22_37300.htm
- If the students have already learned other types of transformations, use the figures from *Interactive Resources 2* and *3* to provide practice in applying several transformations.

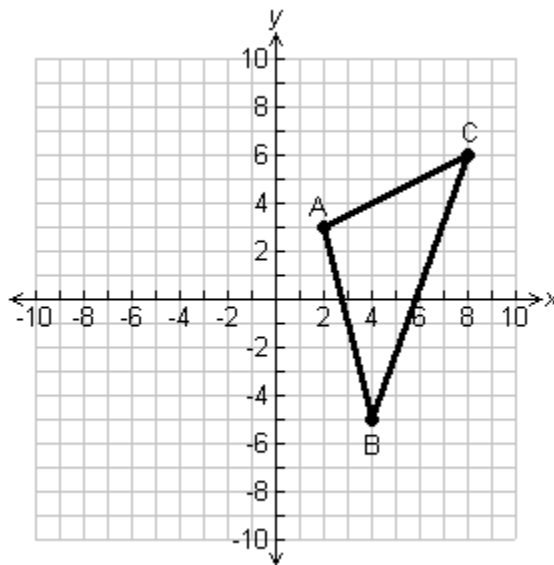
Math by Design
Lesson Plan: Transformations – Reflections

Interactive Resource 1

Using the purple line as the mirror, draw the reflection of triangle ABC.



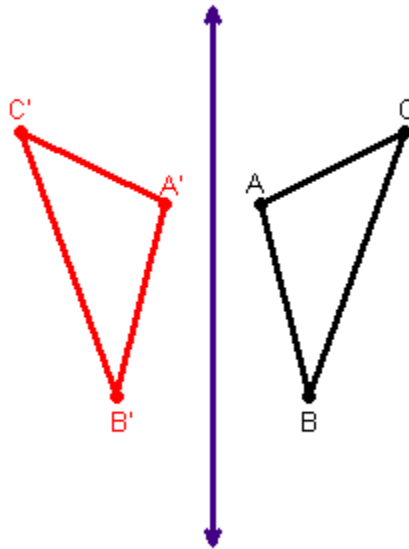
Interactive Resource 2



Math by Design
Lesson Plan: Transformations – Reflections

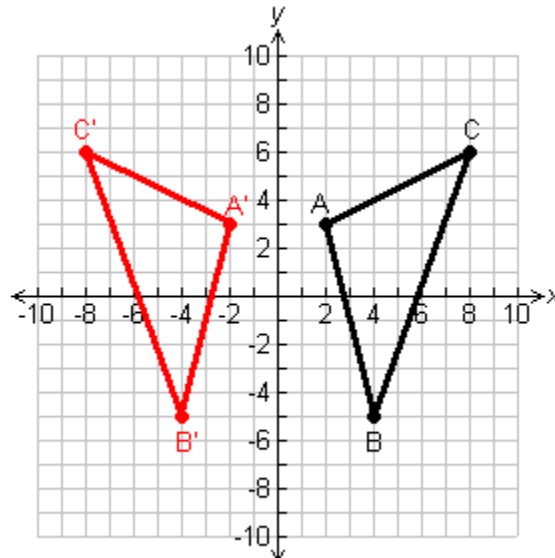
Interactive Resource 1 Answer Key

Using the purple line as the mirror, draw the reflection of triangle ABC.

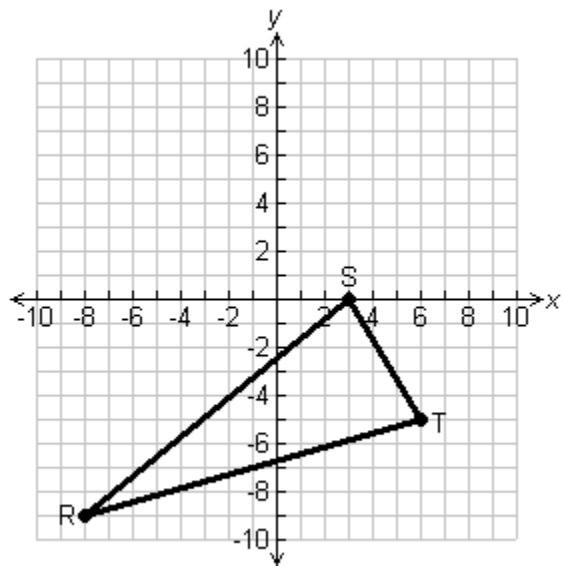
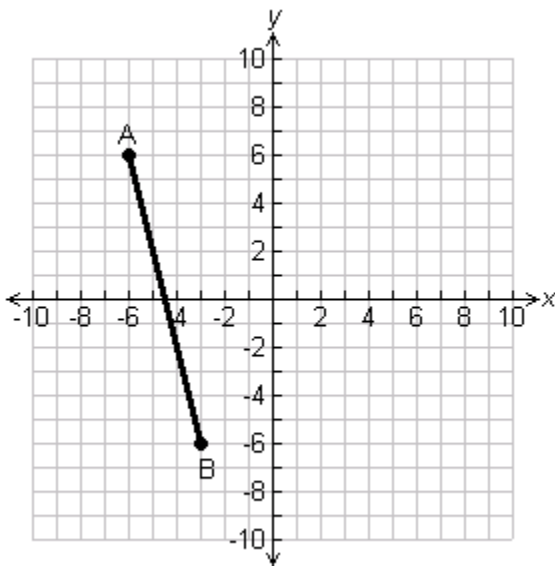
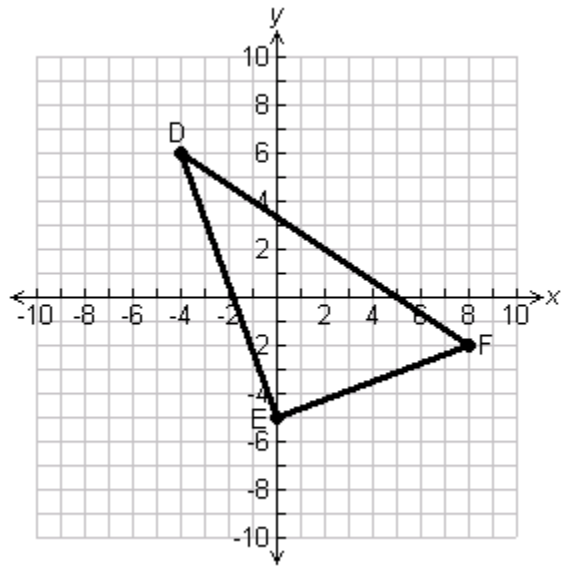
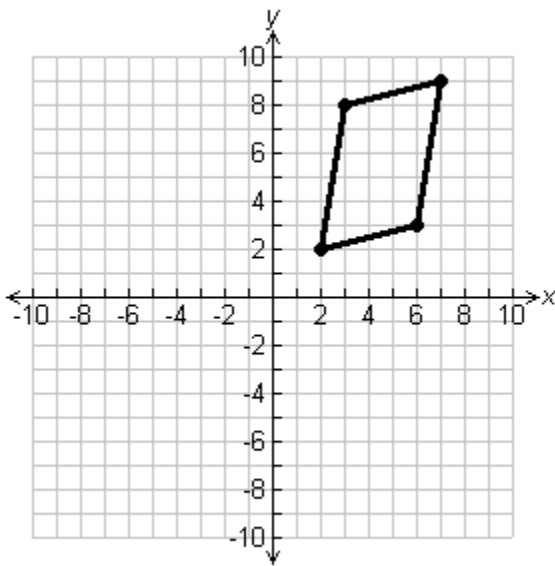


Interactive Resource 2 Answer Key for Reflection over the y-axis

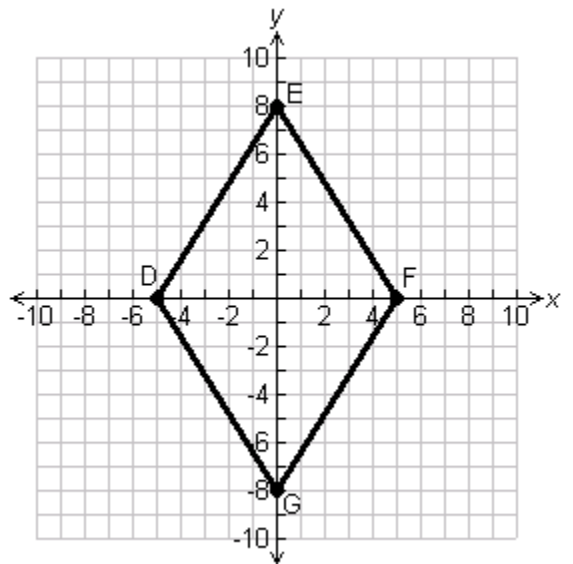
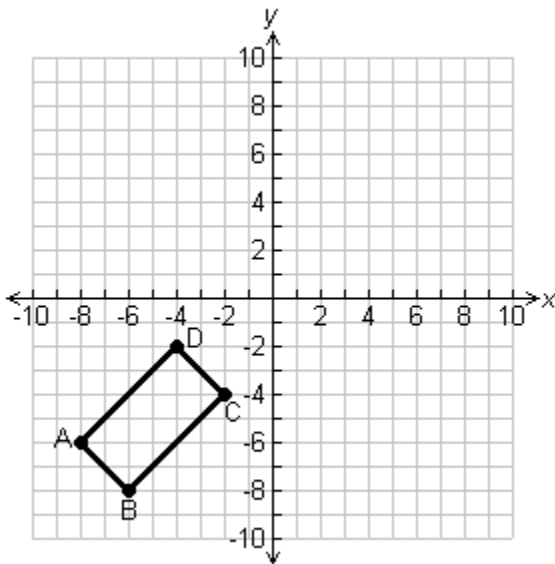
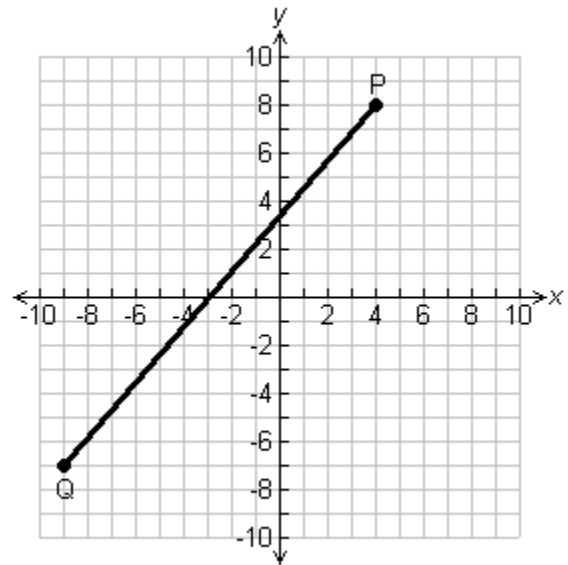
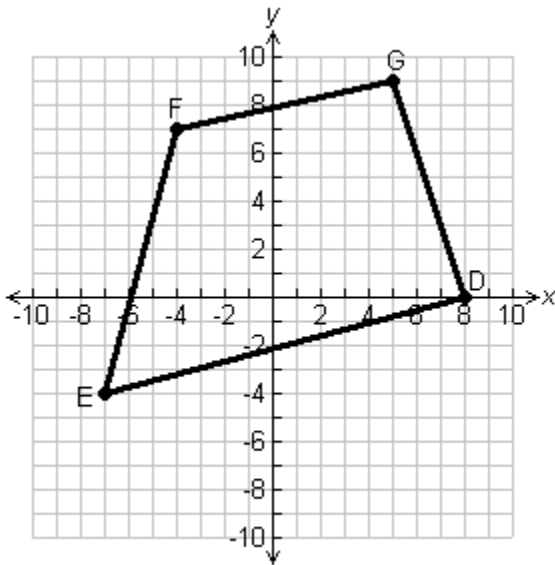
Using the y-axis as the line of reflection, draw the reflection of triangle ABC.



Math by Design
Lesson Plan: Transformations – Reflections
Interactive Resource 3

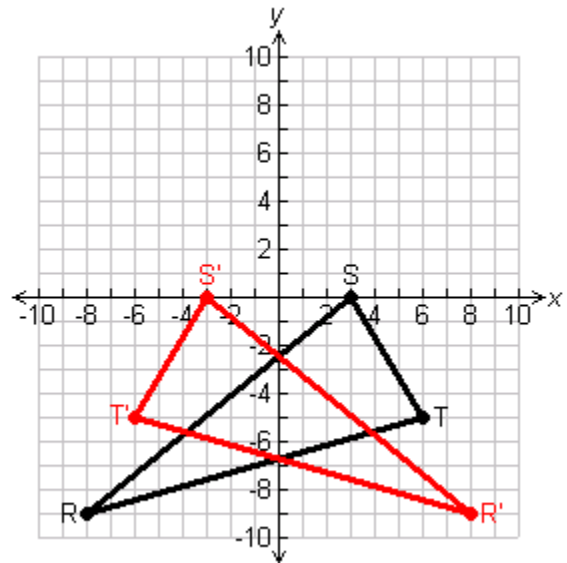
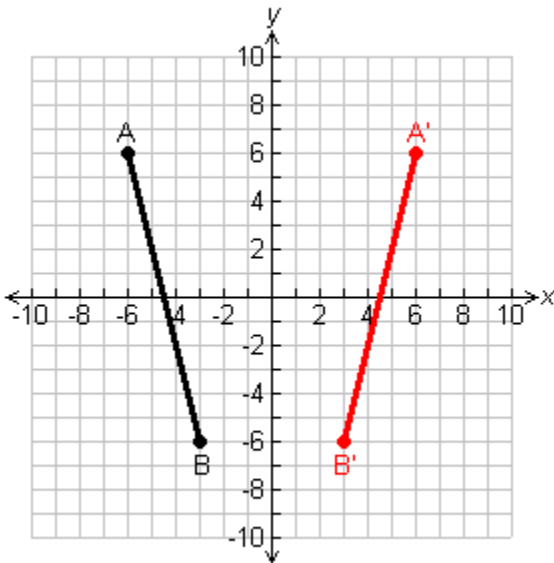
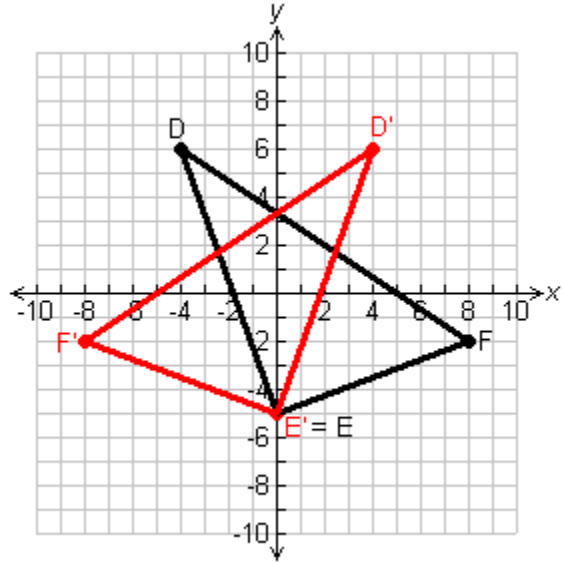
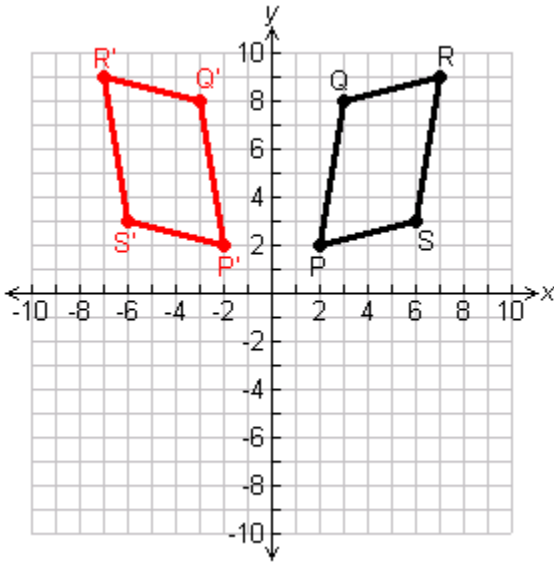


Math by Design
Lesson Plan: Transformations – Reflections



Math by Design
Lesson Plan: Transformations – Reflections

Interactive Resource 3 Answer Key for Reflection over the y -axis



Math by Design
Lesson Plan: Transformations – Reflections

