

Point Reflections (Using Geometer's Sketchpad 4.0) (rotation of 180°)




Discover what happens when you reflect a triangle over a point.

Open software and set up: Open Geometer's Sketchpad 4.0. Expand the screen to full screen view. On the left vertical toolbar, be sure that the arrow is clicked. Under **DISPLAY**, choose **Show Text Palette**.



Set the graph grid: Under **GRAPH**, choose **Grid Form, Square Grid**.

Plot the points for the triangle: Under **GRAPH**, choose **Plot Points** and plot (2,1), (6,2), (3,4). In the drop down box for Plot Points, use your mouse (or TAB key) to enter the coordinates. Hit PLOT.

Complete the triangle: To draw the triangle, highlight (by clicking on) the three points. Choose **CONSTRUCT, Segments**. If you would like to label your triangle vertices, choose the A  from the left vertical toolbar, and click on each point.

Highlight the three vertices only of the triangle. Choose **CONSTRUCT, Interior**. Adjust your color by right clicking in the triangle interior and choosing a new color.

Measure the coordinates: Highlight one point. Be sure only the point is highlighted. Under **MEASURE**, choose **Coordinates**. This will place the coordinates on the screen. Repeat this process for each of the points.

Mark the point of reflection: Highlight the origin. Under **TRANSFORM**, choose **Mark center**. We are getting ready to reflect the triangle over the origin.

Reflect the figure: You will need to select the triangle by drawing a marquee around the figure. With your arrow clicked, use your mouse to click a starting corner to draw a box (marquee) around the triangle. The triangle will become highlighted. Under **TRANSFORM**, choose **Rotate** and enter 180 in the drop down box. Click **Rotate**.



Remember that a point reflection is the same as a rotation of 180° .
It is often referred to as a "half-turn".

Now investigate:

1. Measure the coordinates of the image triangle. What do you notice? _____

Generalize your hypothesis into a rule that will illustrate the changes in the coordinates:

$$\text{Point reflection: } R_{180^\circ} (x, y) \rightarrow (\quad , \quad)$$

2. Highlight one side of the original triangle. Choose MEASURE, Length. Record this length. _____
Highlight the corresponding side in the image triangle. MEASURE, Length. Record this length.

_____ Do the sides of a triangle maintain their lengths through a point reflection? _____

3. Choose an angle in the original triangle by highlighting three vertices in order. Choose MEASURE, Angle. Record this measurement. _____
Highlight the corresponding angle in the image triangle. MEASURE, Angle. Record this measurement. _____

Do the angles of a triangle maintain their measurements through a point reflection? _____

4. Delete everything except the original triangle. Plot a point anywhere on the grid. Mark this point as the point of reflection. Reflect the original triangle.
Highlight one side of the original triangle. Choose MEASURE, Length. Record this length. _____
Highlight the corresponding side in the image triangle. MEASURE, Length. Record this length.

_____ Do the sides of a triangle maintain their lengths through a point reflection not at the origin? _____

5. When reflected in the origin,
any point in the first quadrant will be in the _____ quadrant.
any point in the second quadrant will be in the _____ quadrant.
any point in the third quadrant will be in the _____ quadrant.
any point in the fourth quadrant will be in the _____ quadrant.

