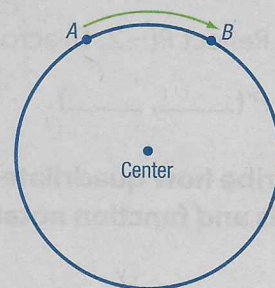


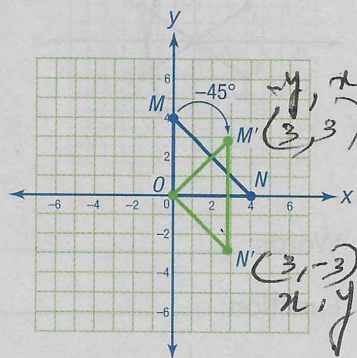
Rotations

UNDERSTAND A **circle** is the set of all points that are the same distance from a point called the center. Visualize turning the circle shown on the right so that point A moves onto point B . If you did that, the points would remain the same distance from the center, but they would each be in a different location.



A **rotation** is a transformation that turns a figure around a point, called the **center of rotation**. Just as with points on a circle, when you rotate a point around a center of rotation, it remains the same distance from the center of rotation. You can rotate a figure any number of degrees.

Counterclockwise is considered the positive direction, so the rotation shown on the right would be described as -45° rotation around the origin. The same image could be obtained, however, by rotating the figure 315° clockwise, since $360 - 45 = 315$. So, this rotation could also be called a 315° rotation around the origin.



You can represent a rotation as a function for which the input is a coordinate pair. The output of that function is the image produced by the rotation.

A 90° rotation is equivalent to a -270° rotation and has this function:

$$R_{90^\circ}(x, y) = (-y, x)$$

$$R_{90^\circ}(x, y) = (-y, x)$$

A 180° rotation is equivalent to a -180° rotation and has this function:

$$R_{180^\circ}(x, y) = (-x, -y)$$

A 270° rotation is equivalent to a -90° rotation and has this function:

$$R_{270^\circ}(x, y) = (y, -x)$$

Compare the preimage on the right and its image after a 90° rotation or a 270° rotation. Notice that the hypotenuse of each of these images is perpendicular to the hypotenuse of the preimage. Corresponding sides of a figure and its image after a 90° or 270° rotation lie on perpendicular lines.

Now compare the preimage and its image after a 180° rotation. Notice that the hypotenuse of the image is parallel to the hypotenuse of the preimage. Corresponding sides of a figure and its image after a 180° rotation always lie on parallel lines or on the same line.

