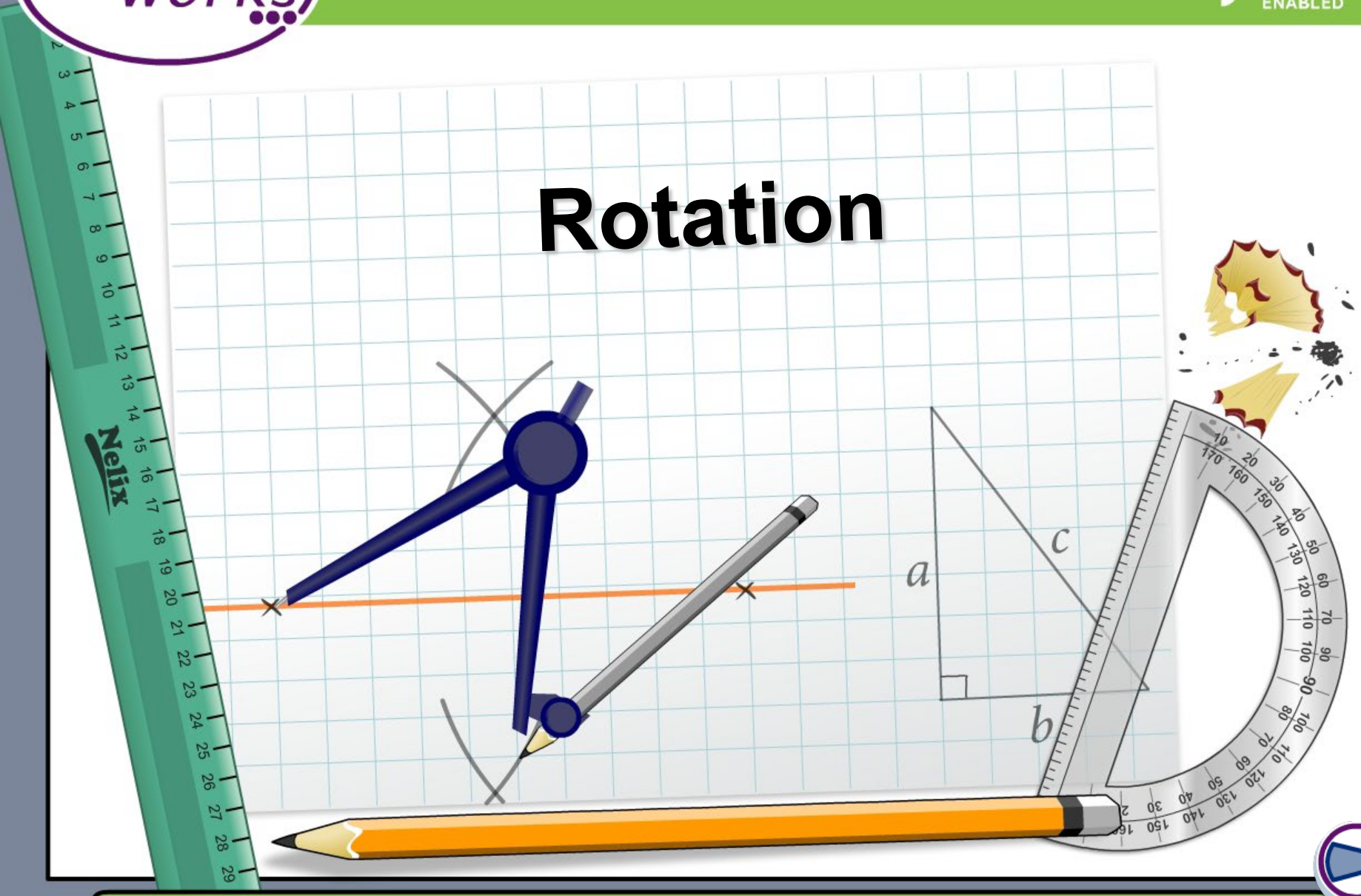
Rotation



Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

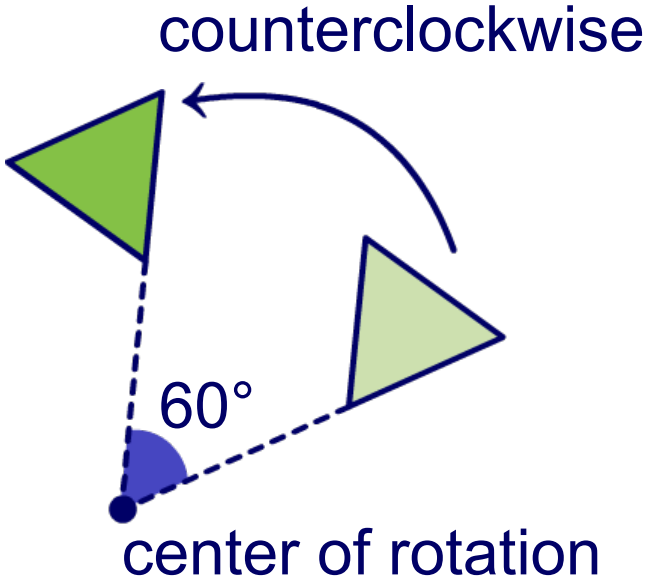
8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

Rotations

A **rotation** is a transformation that turns a figure around a point. Descriptions of rotations involve three different pieces of information:



- the **angle** of the rotation

  for example, ¼ turn = 90°
  ½ turn = 180°
  ¾ turn = 270°
  full turn = 360°

- the **direction** of the rotation

  for example, clockwise or counterclockwise

- the **center** of rotation

  the fixed point around which the object is rotated.

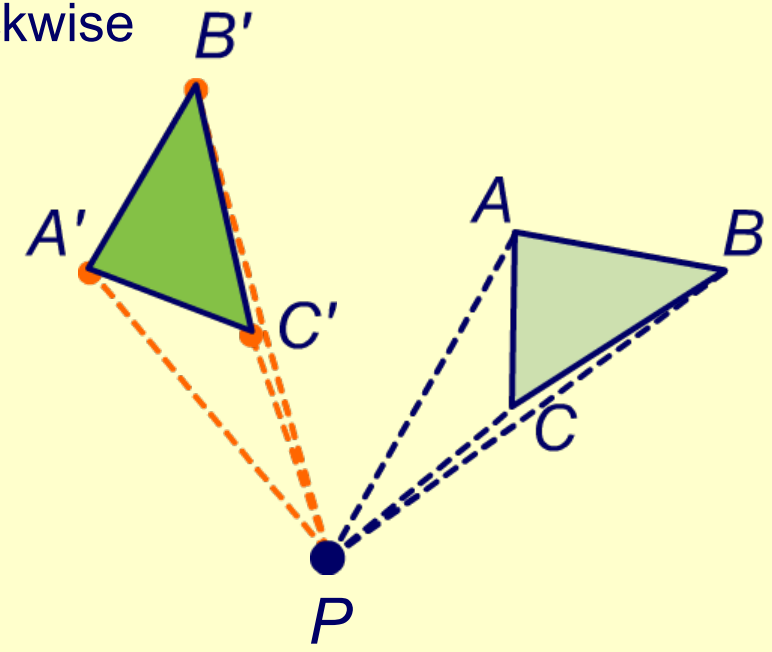
Rotating images

Rotate this image 270° clockwise.

Drawing rotations

What image is produced by the rotation of $\triangle ABC$ around point P by 70° counterclockwise?

1. Draw a line from each point of the triangle to point P.
2. Construct an angle 70° counterclockwise from each line segment.
3. Measure the length of the line segment from point P to each point of $\triangle ABC$, then duplicate that length on the new line segments.
4. Connect the new points and label the new $\triangle A'B'C'$.



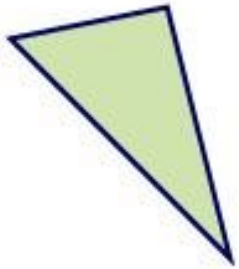
$\triangle A'B'C'$ is the rotation of $\triangle ABC$ 70° around point P.

Finding the center and angle of rotation

Rotating shapes

A rotation occurs when an object is turned around a fixed point.

Press **play** to see how it happens.

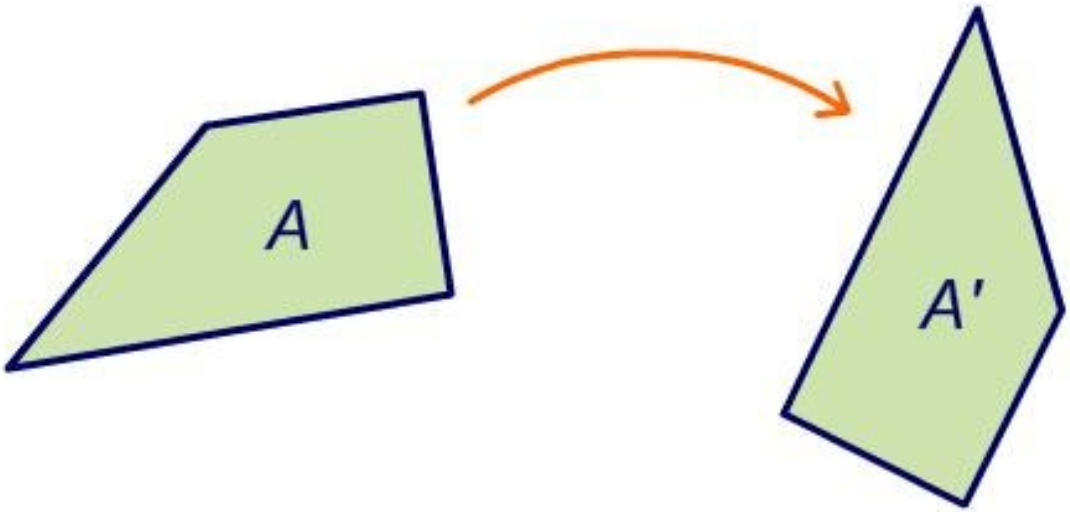


Finding the center and angle of rotation

Center of rotation and angle of rotation

Shape A is rotated about a center to give the image A'.

Press **play** to see how to find the center of rotation and the angle of rotation.



Prove congruence

A rotated figure is congruent to the original object.

Press "**start**" to begin.

start

Rotation of a sundial

At the equator the shadow of a sundial rotates 180° clockwise in 12 hours, from 6:00am to 6:00pm.

Describe the angle and direction of rotation of the sundial's shadow 144 minutes after 6:00am.

Place the sundial on a set of axes.

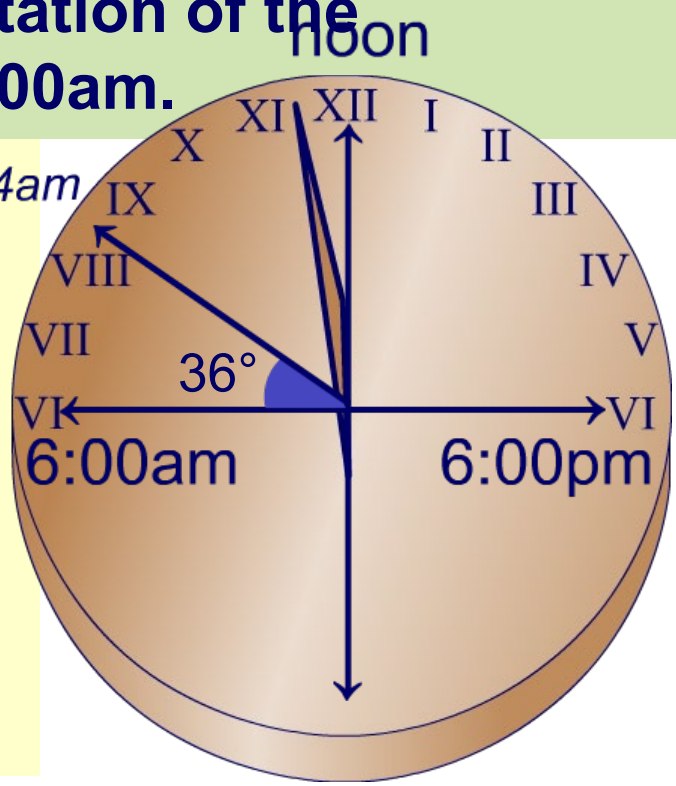
convert to minutes: 12 hours = 720 min

find percentage out of 720 minutes: $\frac{144 \text{ min}}{720 \text{ min}} \times 100 = 20\%$

In 720 minutes the shadow moves 180°.

find angle: 20% x 180° = 36°

The shadow has rotated **36°** clockwise.

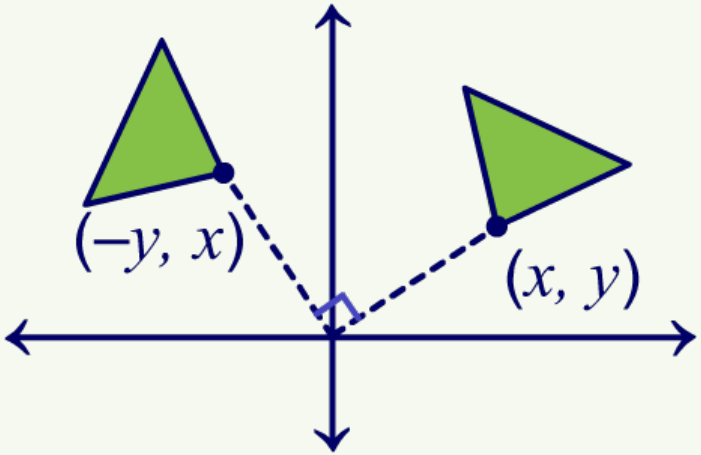


What time would it be if the sundial's shadow had rotated 85° clockwise past 10:00am?

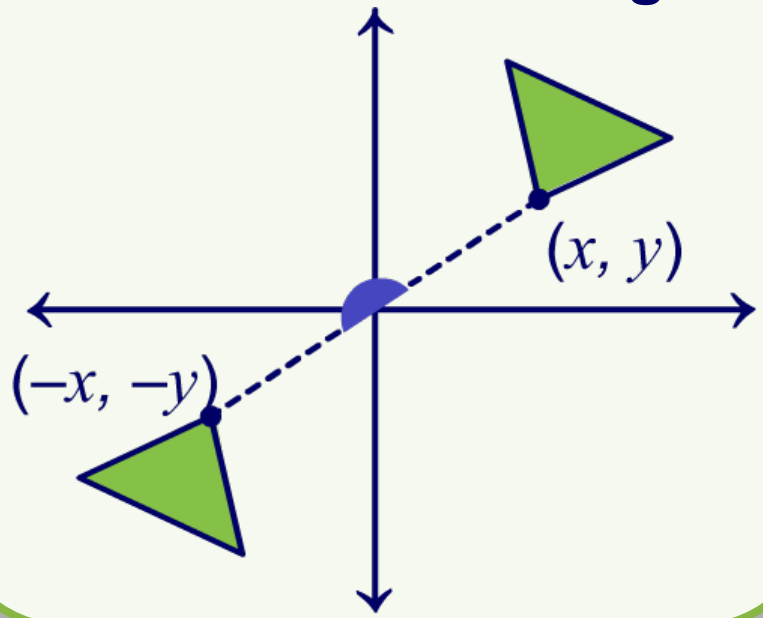
Rotation in the coordinate plane

Rotations can be represented in the coordinate plane. For rotations that are a multiple of 90°:

90° around the origin



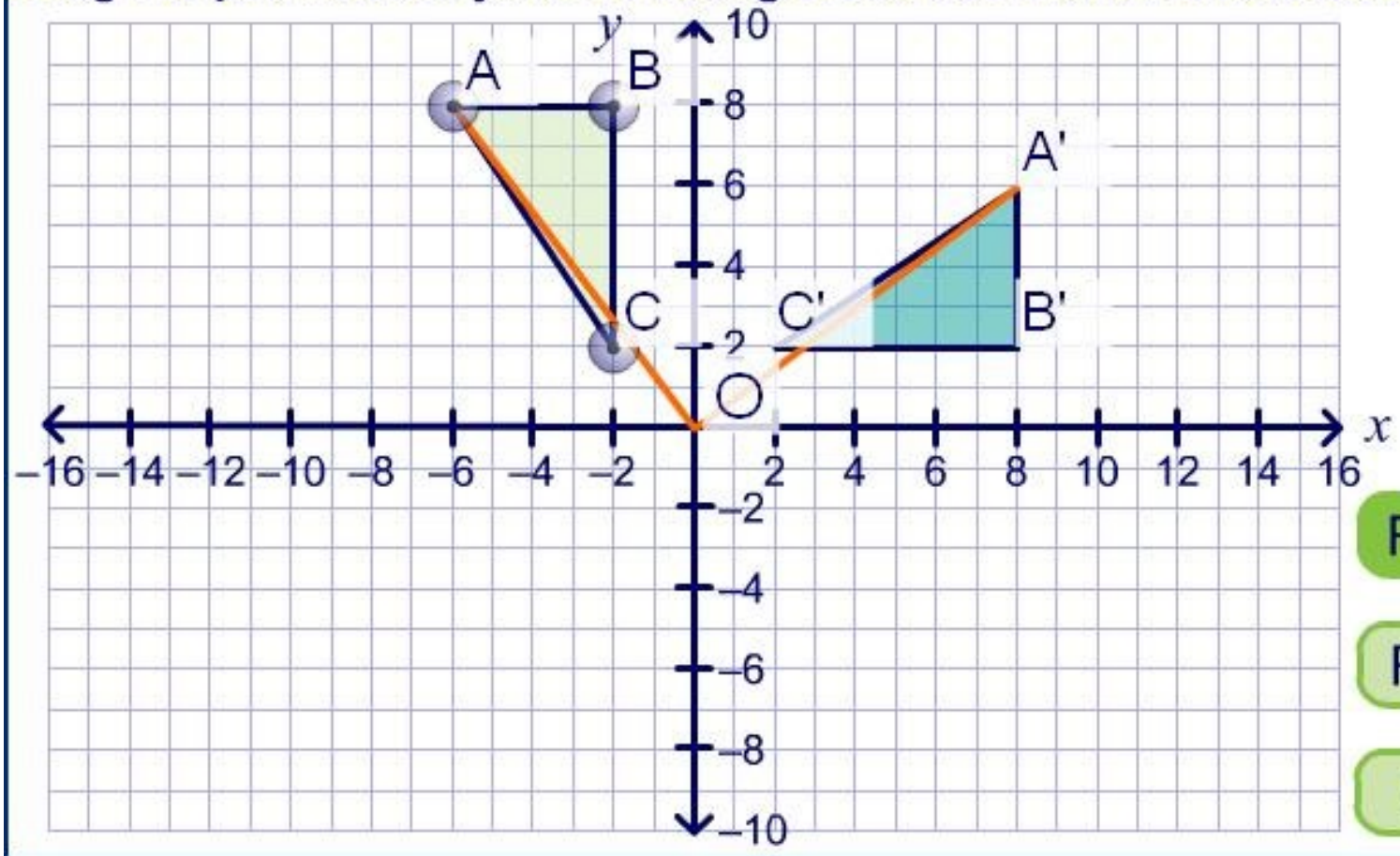
180° around the origin



Can you write a statement about the coordinates of a rotation 270° around the origin?

Rotations on a coordinate grid

Drag the points to adjust the triangle and see how it is rotated by each angle.



Rotate 270°

Rotate 180°

Rotate 90°

Coordinates of a rotated function

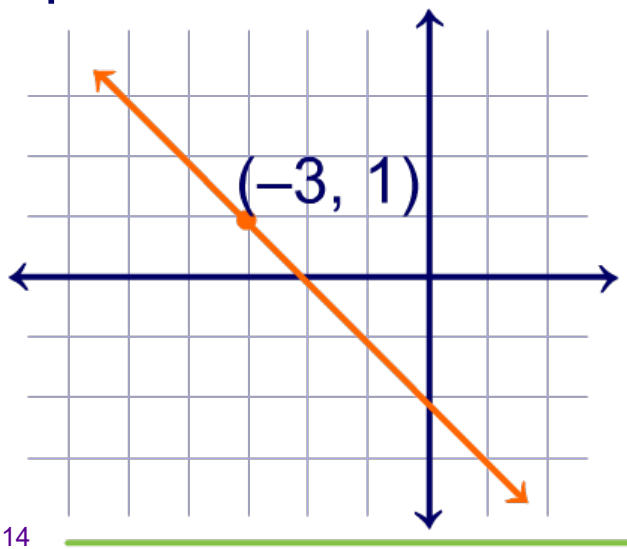
A function can also be rotated around the origin.

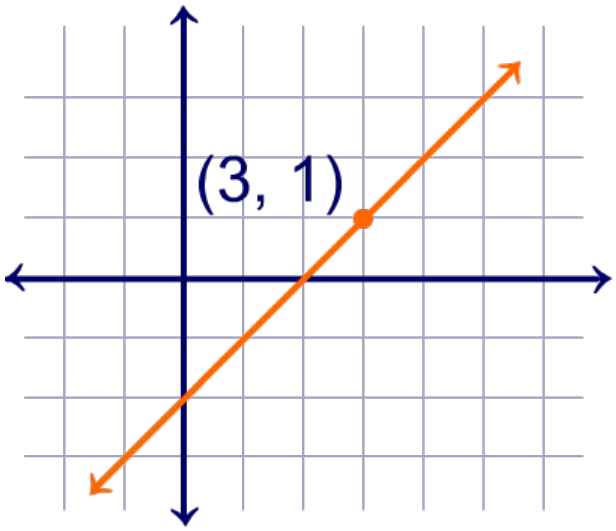
Using what you know about 90° rotations, describe the change in the function:

$$y = -x - 2$$

when it is rotated 90° counterclockwise about the origin.

The equation becomes $y = x - 2$ because the x-coordinate changes its sign in a 90° rotation which changes the slope of the graph.





Rotations in the coordinate plane

For rotations that are not a multiple of 90°, sine and cosine are used to find the coordinates of the image.

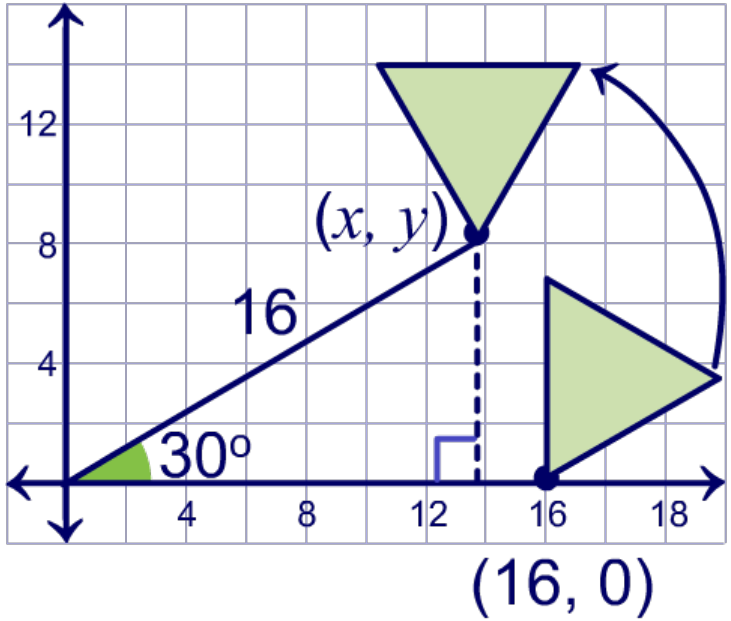
How can the coordinates of the rotated point be found?

1. To find the x-coordinate use cosine (adjacent/hypotenuse):

$$\cos 30° = x \div 16$$
$$x = 16\cos 30°$$
$$x \approx 13.86$$

2. To find the y-coordinate use sine (opposite/hypotenuse):

$$\sin 30° = y \div 16$$
$$y = 16\sin 30°$$
$$y = 8$$
$$(x, y) = \mathbf{(13.86, 8)}$$



Rotation summary quiz

Question: 1/6

What are the new coordinates of the point (6, –3) after it has been rotated 90° counterclockwise?

(☐ , ☐)

type the answer in the boxes above