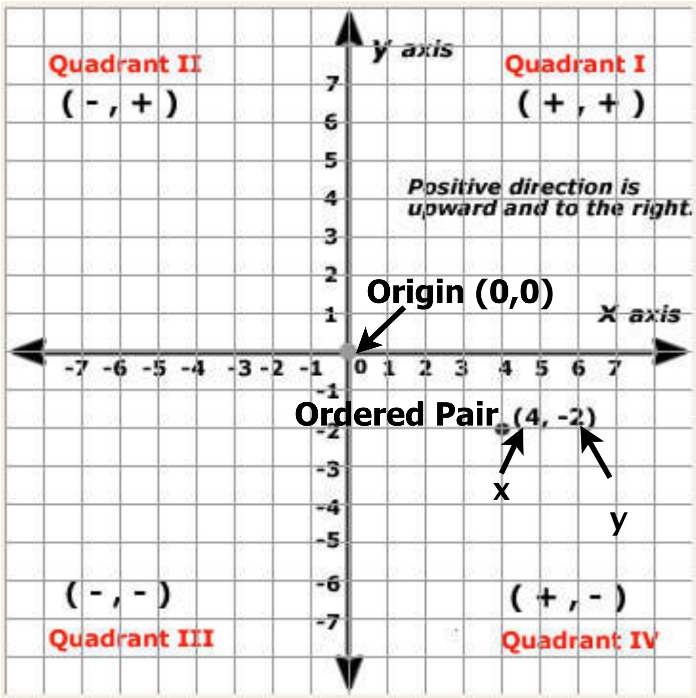
Name: ______________________ Date:______________________

The Fast Guide to Cartesian Coordinate Planes



Transformations:

The word transform means "to change." In geometry, a transformation changes the position of a shape on a coordinate plane. What that really means is that a shape is moving from one place to another. There are three basic transformations:

- Flip (Reflection)
- Slide (Translation)
- Turn (Rotation)

The **figure** is the original shape or set of points, the **image** is the new shape or set of points.

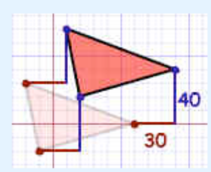
<table>
<tr><th>Transformation</th><th>Explanation</th></tr>
<tr><td>Translation
(Slide)</td><td>

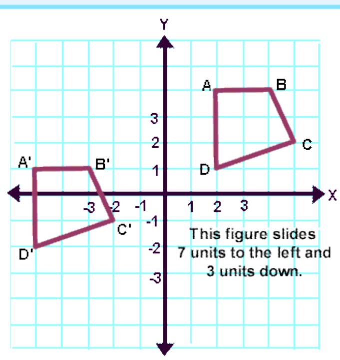
Translations take place when a shape moves in one direction from one place to another **in a straight line.** The figure and the image have the same size and shape. You can describe a translation as up or down or right and left.

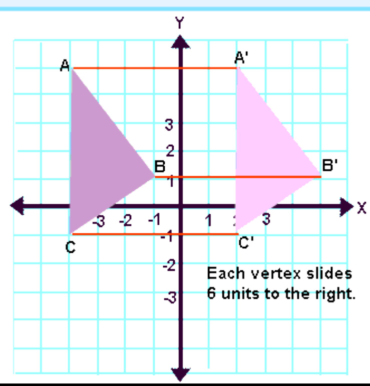
Example: when we want to say the shape gets moved **30 Units in the "X" direction**, and **40 Units in the "Y" direction**, we can write:

$$(x, y) \rightarrow (x + 30, y + 40)$$

Which says "all the x and y coordinates will become x+30 and y+40"







</td></tr>
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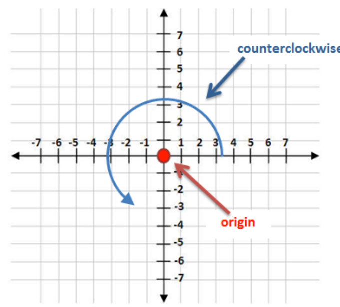
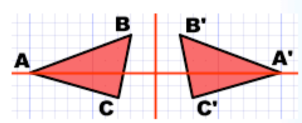
<tr><th>Transformation</th><th>Explanation</th></tr>
<tr><td>Rotation
(Turn)</td><td>Rotations are when a shape turns on a point away from its original position. It almost looks like a clock hand turning around the face of a clock.The distance from the center to any point on the shape stays the same. Every point makes a circle around the center.
Shapes can rotate by four different angles. When it rotates by 90º, it looks like it is laying on its side. When it rotates by 180º, it looks like it is upside down. When it rotates by 270º, it also looks like it is lying on its side. A 360º rotation means the shape will turn all the around.

A positive angle of rotation turns the figure counterclockwise, and a negative angle of rotation turns the figure in a clockwise direction.


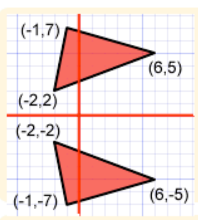
Rotation of 90°: $R_{90°}(x,y) = (-y,x)$
Rotation of 180°: $R_{180°}(x,y) = (-x,-y)$ (same as point reflection in origin)
Rotation of 270°: $R_{270°}(x,y) = (y,-x)$</td></tr>
<tr><td>Reflection
(Flip)</td><td>A reflection takes place when a shape is flipped across a line and faces the opposite direction. Because the shape ends up facing the opposite direction, it appears to be reflected, as in a mirror. A shape can reflect across the y-axis, the x-axis, or across a bisector (diagonal line).

Labels

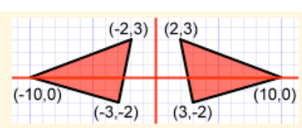
It is common to label each corner with letters, and to use a little dash (called a Prime) to mark each corner of the reflected image.


Here the original is ABC and the reflected image is A'B'C'

Some Tricks



X-Axis
When the mirror line is the x-axis we change each (x,y) into (x,−y)

Y-Axis
When the mirror line is the y-axis we change each (x,y) into (−x,y)

</td></tr>
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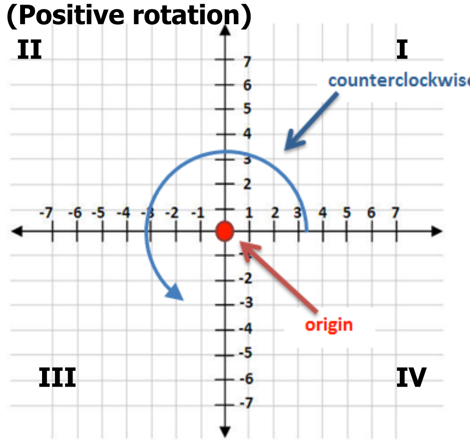
Rotations

Rotation notation is usually denoted **R(**center , degrees**)**

- "**Center**" is the 'center of rotation.' This is the point around which you are performing your mathematical rotation (this can be on the figure or off the figure)
- "**Degrees**" stands for how many degrees you should rotate. Positive rotations are **counterclockwise** and negative rotations are **clockwise.**

Rotation	If I started in quadrant I I'll end up in...
90°	Quadrant II (negative *x*-axis)
180°	Quadrant III (negative *y*-axis)
270°	Quadrant IV (positive *x*-axis)
306°	Quadrant I (positive *y*-axis)

(Positive rotation)

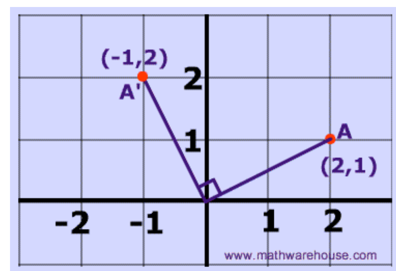


Rotation by 90° about the origin

R(origin, 90°): A rotation by 90° about the origin can be seen in the picture below in which A is rotated to its image A'.

The general rule for a rotation by 90° about the origin is:
(A,B) (-B, A)

Example:
(-1, 2) --> (2, 1)

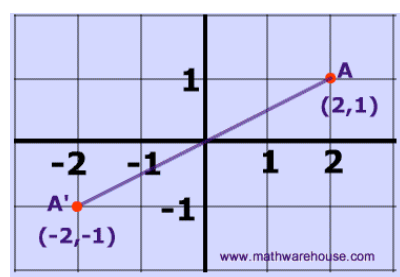


Rotation by 180° about the origin

R(origin, 180°): A rotation by 180° about the origin can be seen in the picture below in which A is rotated to its image A'.

The general rule for a rotation by 180° about the origin is:
(A,B) (-A, -B)

Example:
(-2, -1) --> (2, 1)

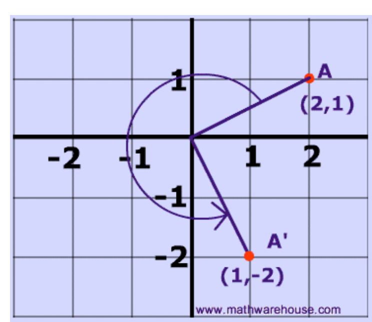


Rotation by 270° about the origin

R(origin, 270°): A rotation by 270° about the origin can be seen in the picture below in which A is rotated to its image A'.

The general rule for a rotation by 270° about the origin is:
(A,B) (B, -A)

Example:
(2, 1) --> (1, -2)



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