Unit 1: Transformations in the Coordinate Plane

Vocabulary Builder

Transformations

Choose the word from the list below that best matches each phrase.

composition of transformations	corresponding parts	image
rigid motion	preimage	translation
transformation(s)		

1. The figure that results from a transformation _____ *Image* _____

2. The original figure in a transformation _____ *Pre-Image* _____

3. Flipping, sliding, or turning a figure _____ *transformation* _____

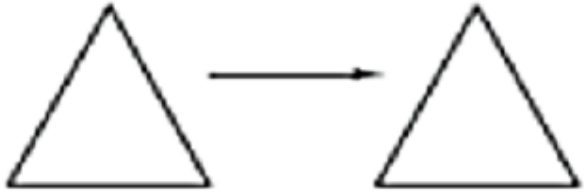
4. Two or more transformations in combination _____ *Composition of transformations* _____

Transformations

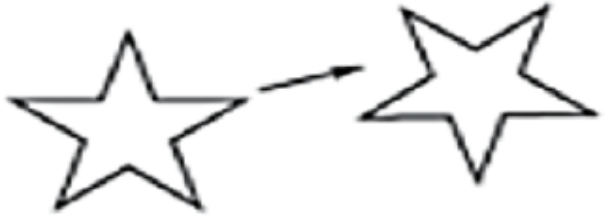
Choose the word from the list below that best matches each phrase.

composition of transformations	corresponding parts	image
rigid motion	preimage	translation
transformation(s)		

5. This transformation is an example of a ___translation___ because the figure slides in one direction, but does not flip, turn, or change size.



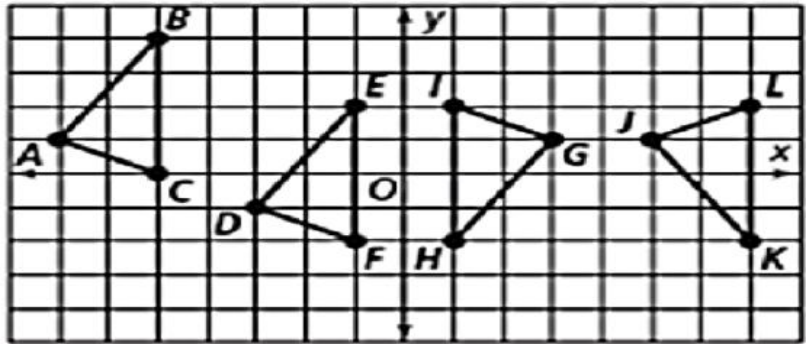
6. This translation is an example of a(n) ___Rigid motion___ because it preserves distance and angle measures.



7. In a translation, the sides or angles of the preimage and image that have the same lengths or angle measures are ___Corresponding parts___.

Transformations

angle of rotation	center of rotation	congruence transformation
congruent	glide reflection	line of reflection
reflection	rotation	translation



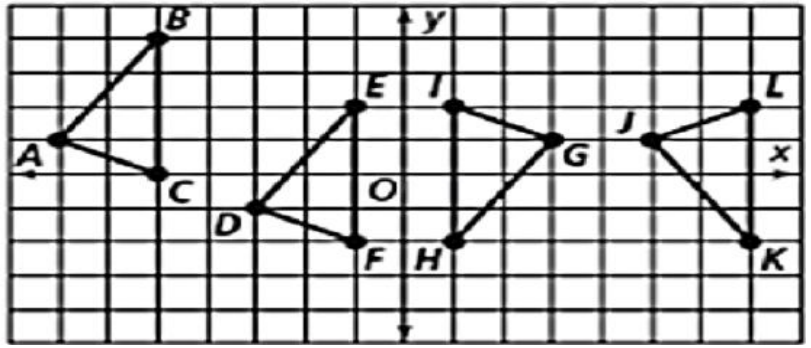
8. In the coordinate plane above, all the triangles are congruent figures.

9. To show that any two figures above are congruent, you can identify a Congruence transformation that maps one figure to another.

10. A transformation that maps ΔABC to ΔDEF is a translation that slides ΔABC four units to the right and two units down.

Transformations

angle of rotation	center of rotation	congruence transformation
congruent	glide reflection	line of reflection
reflection	rotation	translation



11. A transformation that maps ΔDEF to ΔGHI is a rotation with Angle of rotation of 180° and Center of rotation at the origin.

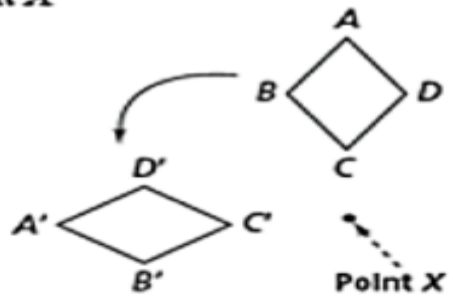
12. A transformation that maps ΔGHI to ΔJKL is a reflection with Line of reflection of $x = 4$.

13. A transformation that maps ΔABC to ΔJKL is a Glide reflection by sliding ΔABC twelve units to the right and two units down and then reflecting across the x-axis.

Transformations

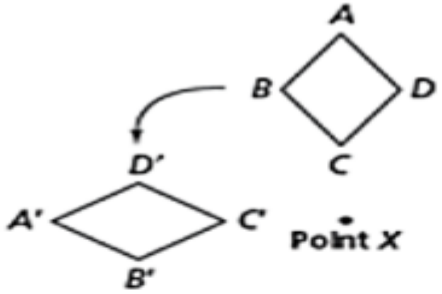
angle of rotation counterclockwise $r_{(90°, O)}$	center of rotation rigid motion $r_{(180°, O)}$	clockwise rotation $r_{(270°, O)}$

14. Point X



15. These transformations are all examples of this.

16. This type of transformation



17. 90° for this transformation

18. This transformation maps each point (x, y) to $(y, -x)$.

19.

20.

21. This transformation maps each point (x, y) to $(-y, x)$.

22. This transformation maps each point (x, y) to $(-x, -y)$.

14. **Center of rotation**
15. **Rigid motion**
16. **rotation**
17. **Angle of rotation**
18. $r_{(270,0)}$
19. **clockwise**
20. **counter-clockwise**
21. $r_{(90,0)}$
22. $r_{(180,0)}$

Unit 1: Transformations in the Coordinate Plane

1.1 Transformations

1.1 Transformations

A transformation is a change in the position, shape, or size of a figure.

The original figure is called the pre-image. The resulting figure is called the image. A transformation maps the preimage to the image.

Arrow notation (→) is sometimes used to describe a transformation, and primes (′) are used to label the image.

A dilation is a transformation that changed the size of a figure.

If we increase the size of a figure it is called an enlargement.

If we decrease the size of a figure it is called a reduction.

Daily Agenda

Today's Date

January 9, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

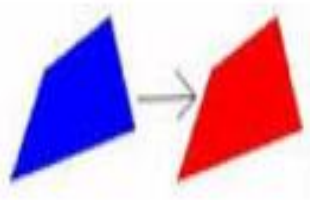
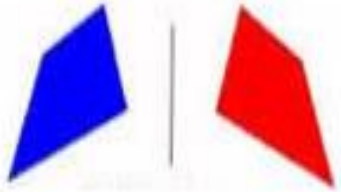
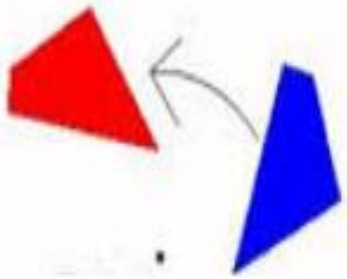
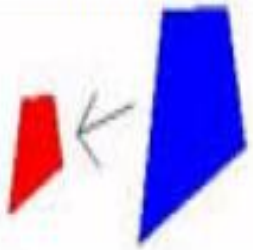
How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.1 Transformations

Transformations			
Isometry			
Translation	Reflection	Rotation	Dilation
			
Slide	**Flip**	**Turn**	**Size Change**

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What's for homework?

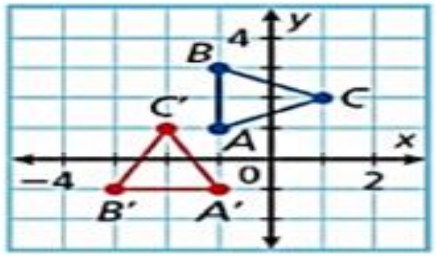
Booklet pg.

1.1 Transformations

Example 1

Identify the transformation, then use arrow notation to describe the transformation.

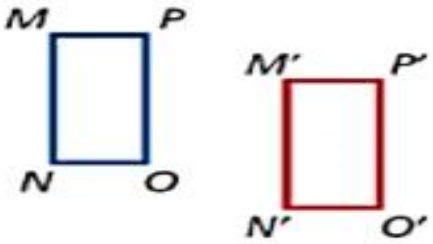
a)



$\Delta ABC \rightarrow \Delta A'B'C'$

rotation

b)



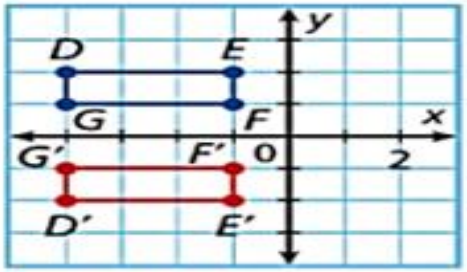
$MNOP \rightarrow M'N'O'P'$

translation

☑ Check for Understanding

Identify the transformation, then use arrow notation to describe the transformation.

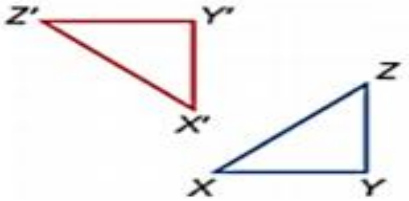
c)



$DEFG \rightarrow D'E'F'G'$

reflection

d)



$\Delta XYZ \rightarrow \Delta X'Y'Z'$

rotation

Daily Agenda

Today's Date

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What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

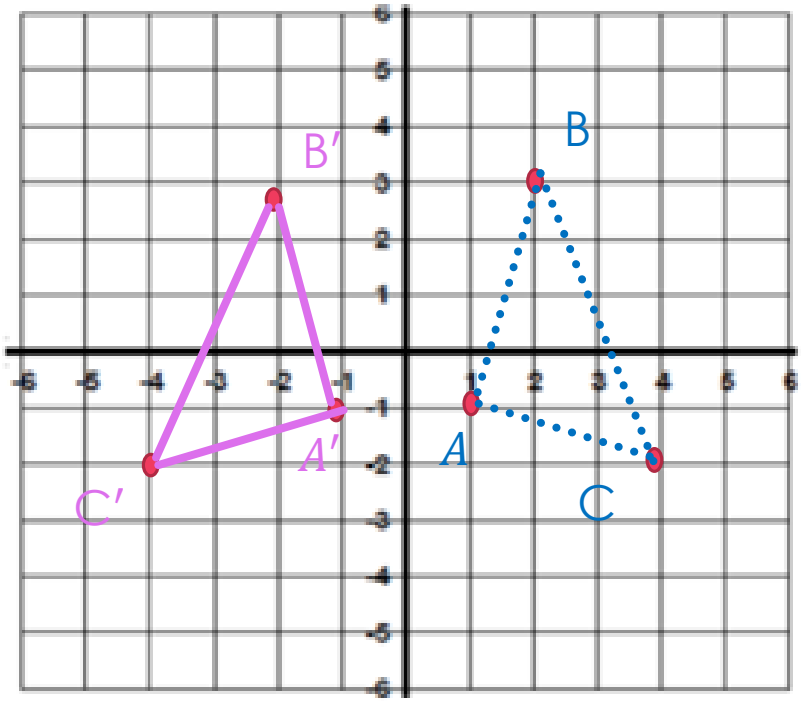
What's for homework?

Booklet pg.

1.1 Transformations

Example 2

A figure has vertices at $A(1,-1)$, $B(2,3)$ and $C(4,-2)$. After a transformation, the image of the figure has vertices at $A'(-1,-1)$, $B'(-2,3)$ and $C'(-4,-2)$. Draw the preimage and the image, then identify the transformation.



Reflection across the y-axis

Daily Agenda

Today's Date

January 9, 2017

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What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

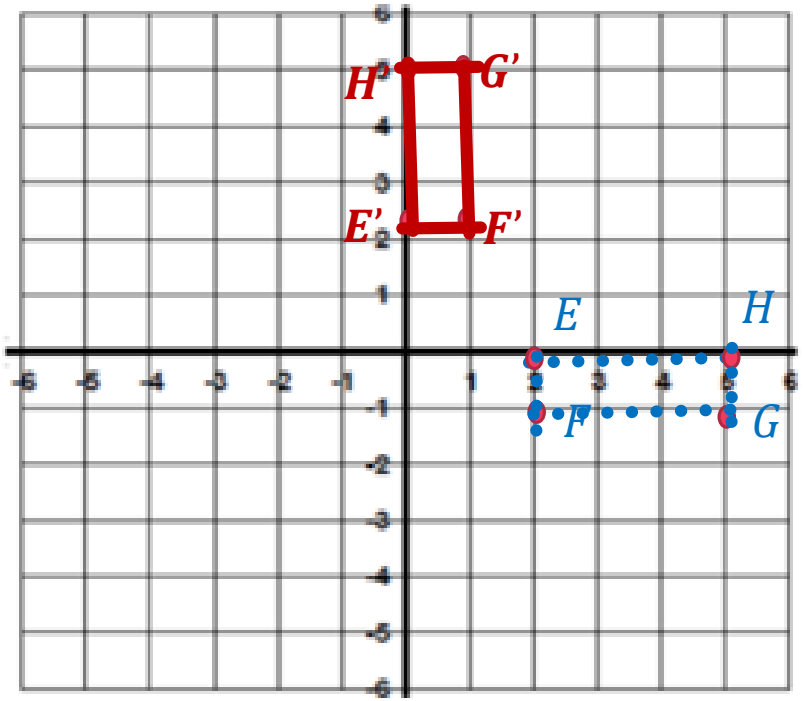
What's for homework?

Booklet pg.

1.1 Transformations

☑ Check for Understanding

A figure has vertices at $E(2,0)$, $F(2,-1)$, $G(5,-1)$ and $H(5,0)$. After a transformation, the image of the figure has vertices at $E'(0,2)$, $F'(1,2)$, $G'(1,5)$ and $H'(0,5)$. Draw the preimage and the image, then identify the transformation.



90˚ rotation counter-clockwise

Daily Agenda

Today's Date

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What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

Unit 1: Transformations in the Coordinate Plane

1.1 Transformations

- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure

Direct Explanation

1

- INDEPENDENT PRACTICE
  - Booklet Pages
- HOMEWORK
  - Booklet Pages

Worktime

2

- How can I apply all that I have learned about **Transformations** to demonstrate mastery of the standards?

Closing

3

Unit 1: Transformations in the Coordinate Plane

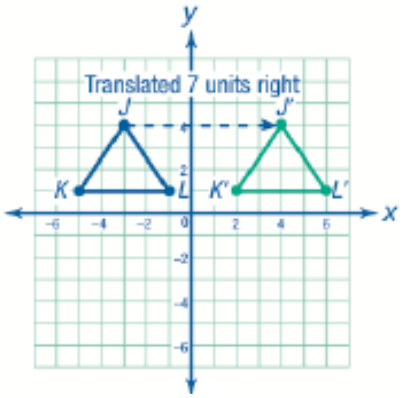
1.2 Translations

1.2 Translations

A ___translation___ is an operation that ___slides___ a geometric figure in the plane.

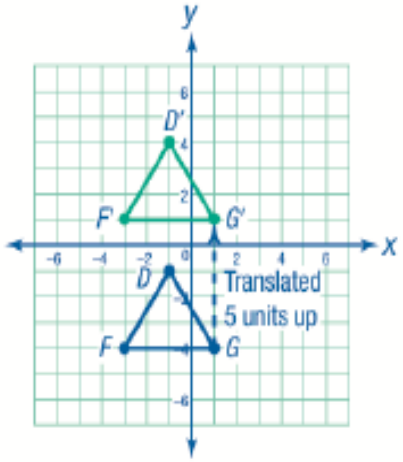
In a ___horizontal___ translation, the x-coordinate changes but the y-coordinate stays the same.

This translation can by represented by the function $T(x, y) =$ $(x + a, y)$



In a ___vertical___ translation, the y-coordinate changes but the x-coordinate stays the same.

This translation can by represented by the function $T(x, y) =$ $(x, y + b)$



Daily Agenda

Today's Date

January 10, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

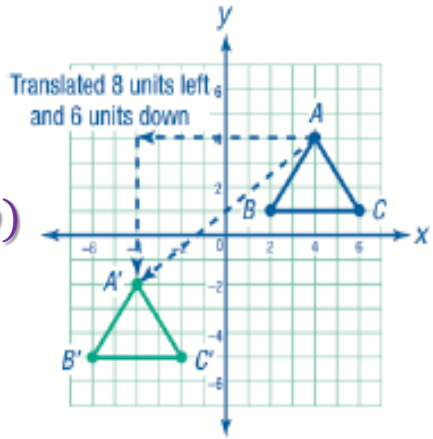
What's for homework?

Booklet pg.

1.2 Translations

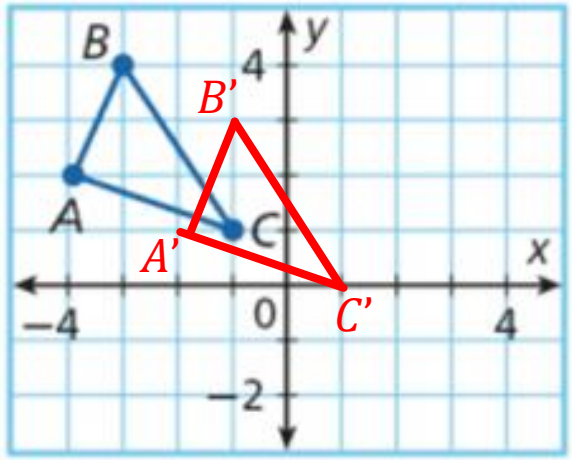
In a _____slant_____ translation, both the x- and y-coordinate change.

This translation can by represented by the function $T(x, y) =$ $(x + a, y + b)$



Example 1

Find the coordinates for the image of ΔABC after the translation $(x, y) \rightarrow (x + 2, y - 1)$. Draw the image.



$A'(-2, 1)$ $B'(-1, 3)$ $C'(1, 0)$

Daily Agenda

Today's Date

January 10, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

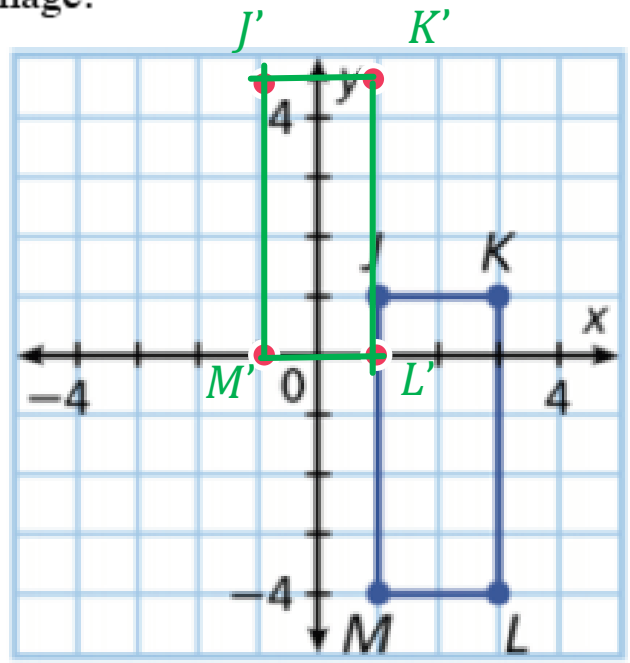
What's for homework?

Booklet pg.

1.2 Translations

☑ Check for Understanding

Find the coordinates for the image of ΔABC after the translation $(x, y) \rightarrow (x - 2, y + 4)$. Draw the image.



$J'(-1, 5)$ $K'(1, 5)$
$M'(-1, 0)$ $L'(1, 0)$

Daily Agenda

Today's Date

January 10, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.2 Translations

Example 2

A four-sided figure has the following coordinates $A(1,-5), B(2,-6), C(3,-7), D(4,-8)$. After a translation, its coordinates are $A'(6,-7), B'(7,-8), C'(8,-9), D'(9,-10)$. Write the rule for the translation.

$$T(x,y) = (x+5, y-2)$$

Daily Agenda

Today's Date

January 10, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

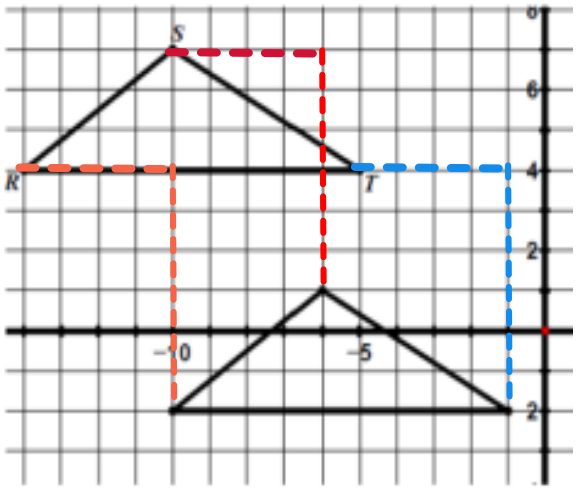
What's for homework?

Booklet pg.

1.2 Translations

☑ Check for Understanding

Use the graph below to answer questions 1-3. ΔRST has been translated to $\Delta R'S'T'$.



1. Write the coordinates for the vertices of the pre-image and image.

Pre-image	Image
R: $(-14, 4)$	R': $(-10, -2)$
S: $(-10, 7)$	S': $(-6, 1)$
T: $(-5, 4)$	T': $(-1, -2)$

2. Show by using jumps in the graph above how you would move on the coordinate plane to get from the vertices in the pre-image to the corresponding vertices in the image.

4 units to the right and 6 units down

3. Write the coordinate rule that describes this translation.

$$T(x, y) = (x + 4, y - 6)$$

Daily Agenda

Today's Date

January 10, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

Unit 1: Transformations in the Coordinate Plane

1.2 Translations

- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure

Direct Explanation

1

- INDEPENDENT PRACTICE
  - Booklet Pages
- HOMEWORK
  - Booklet Pages

Worktime

2

- How can I apply all that I have learned about **Translations** to demonstrate mastery of the standards?

Closing

3

Unit 1: Transformations in the Coordinate Plane

1.3 Reflections

1.3 Reflections

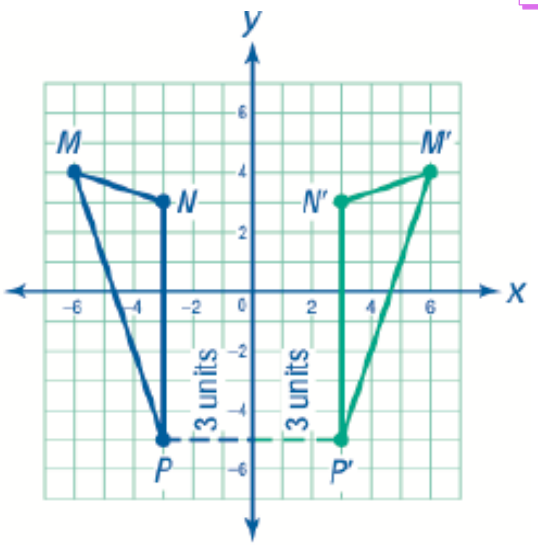
A **reflection** is a transformation that flips a figure across a line called a

Line of reflection.

When a point is reflected across the y-axis,

the sign of its x-coordinate changes.

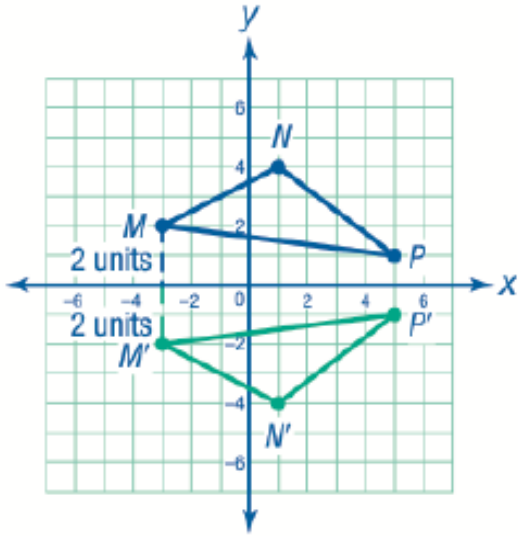
The function for a reflection across the y-axis is $R_{y-axis}(x, y) = (-x, y)$



When a point is reflected across the x-axis,

the sign of its y-coordinate changes.

The function for a reflection across the y-axis is $R_{x-axis}(x, y) = (x, -y)$



Daily Agenda

Today's Date

January 11, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

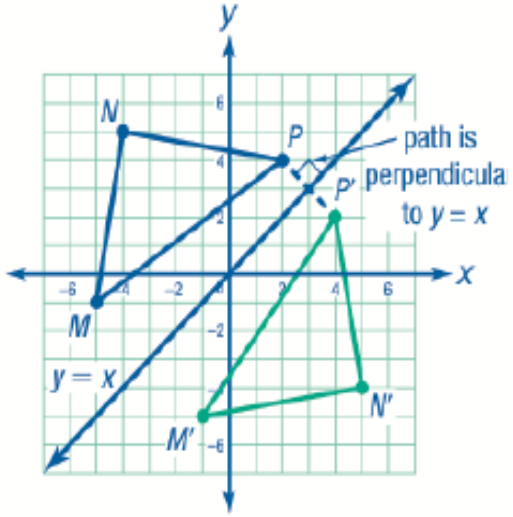
1.3 Reflections

Another common line of reflection is the diagonal line $y = x$.

To reflect over this line, ___swap___ the x- and y-coordinates.

The function for a reflection across line $y = x$ is

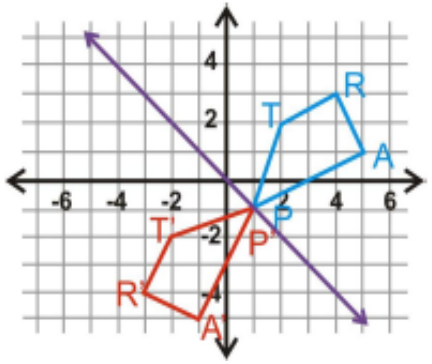
$R_{y=x}(x, y) =$ ___(y, x)___



To reflect over the line $y = -x$, ___swap___ and ___opposite sign___ the x- and y-coordinates.

The function for a reflection across line $y = -x$ is

$R_{y=-x}(x, y) =$ ___$(-y, -x)$___



Daily Agenda

Today's Date

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What am I going to do?

Transformations in the Coordinate Plane

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Daily Exit Tickets

What's for homework?

Booklet pg.

1.3 Reflections

Example 1

Reflect the figure with the given vertices across the given line.

Reflect over the x-axis

$X(2,-1)$ $X'(2,1)$

$Y(-4,-3)$ $Y'(-4,3)$

$Z(3,2)$ $Z'(3,-2)$

Reflect over the y-axis

$S(3,4)$ $S'(-3,4)$

$T(3,1)$ $T'(-3,1)$

$U(-2,1)$ $U'(2,1)$

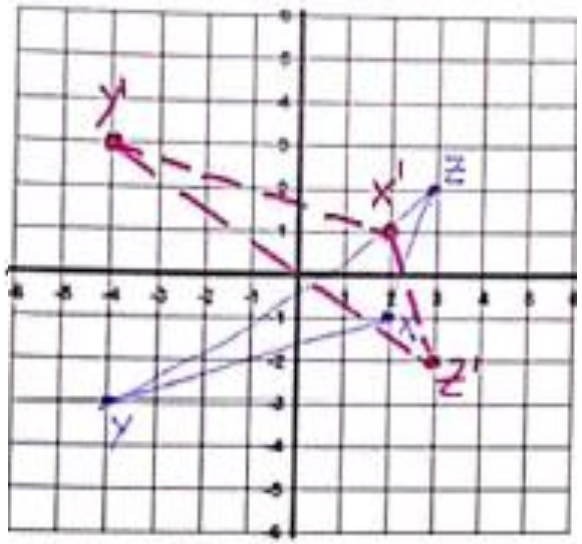
$V(-2,4)$ $V'(2,4)$

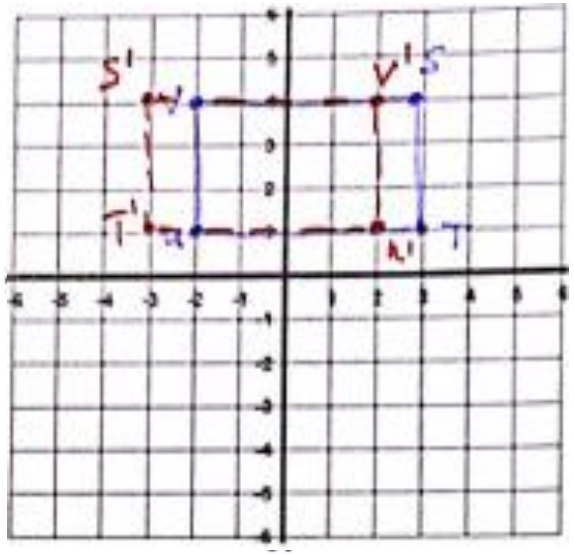
Reflect over the $y = x$

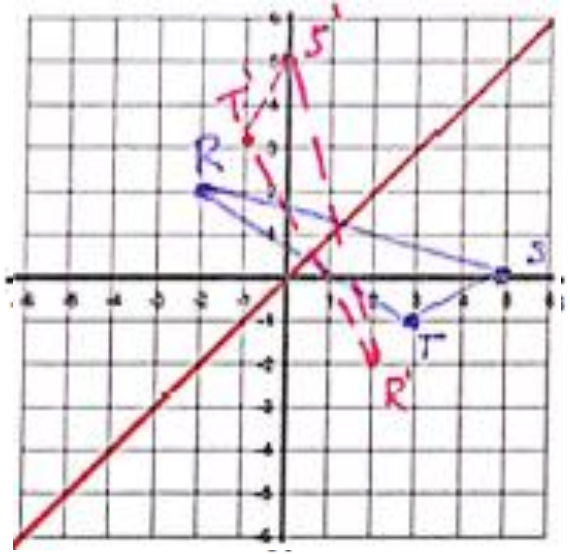
$R(-2,2)$ $R'(2,-2)$

$S(5,0)$ $S'(0,5)$

$T(3,-1)$ $T'(-1,3)$







Daily Agenda

Today's Date

January 11, 2017

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What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.3 Reflections

☑ Check for Understanding

Reflect the figure with the given vertices across the given line.

Reflect over the x-axis

$A(1,2)$ $A'(1,-2)$

$B(3,6)$ $B'(3,-6)$

$C(5,4)$ $C'(5,-4)$

Reflect over the y-axis

$A(-6,-1)$ $A'(6,-1)$

$B(-2,-1)$ $B'(2,-1)$

$C(-2,-4)$ $C'(2,-4)$

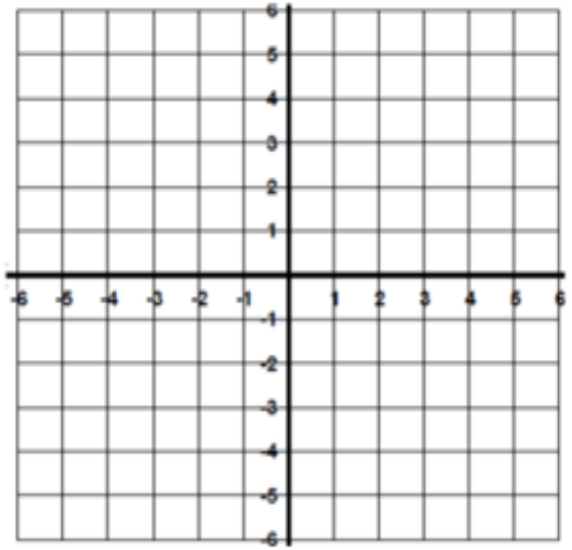
Reflect over the $y = x$

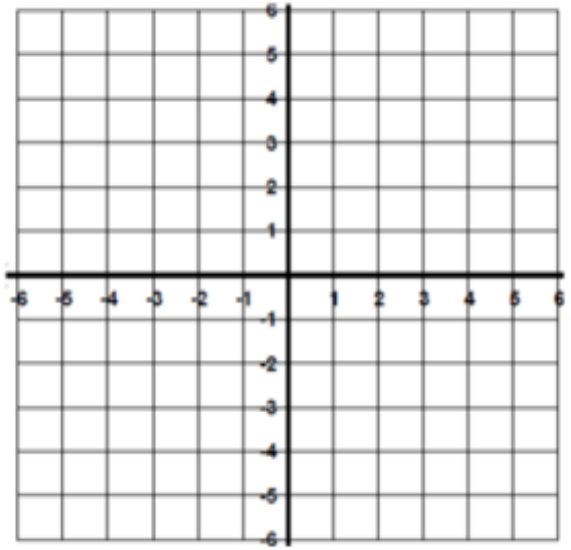
$J(-4,3)$ $J'(3,-4)$

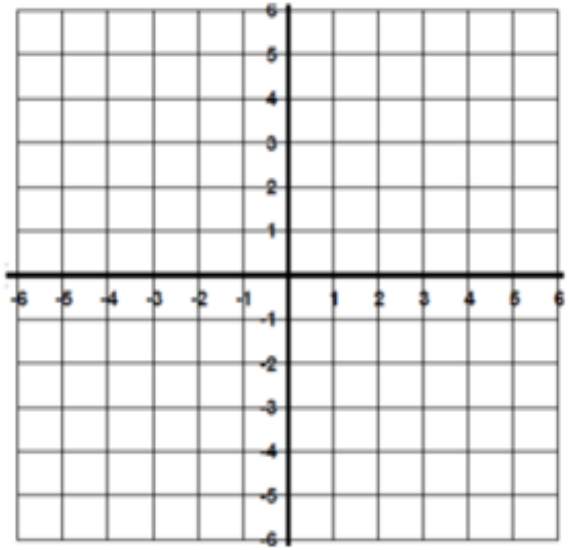
$K(0,4)$ $K'(4,0)$

$L(2,2)$ $L'(2,2)$

$M(-1,1)$ $M'(1,-1)$







Daily Agenda

Today's Date

January 11, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.3 Reflections

Example 2

Reflect the figure with the given vertices across the given line.

Reflect over the $y = -1$

$A(-1,1)$ $A'(-1,-3)$

$B(-5,1)$ $B'(-5,-3)$

$C(-4,2)$ $C'(-4,-4)$

$D(-2,2)$ $D'(-2,-4)$

Reflect over $x = 2$

$P(4,2)$ $P'(0,2)$

$Q(3,0)$ $Q'(1,0)$

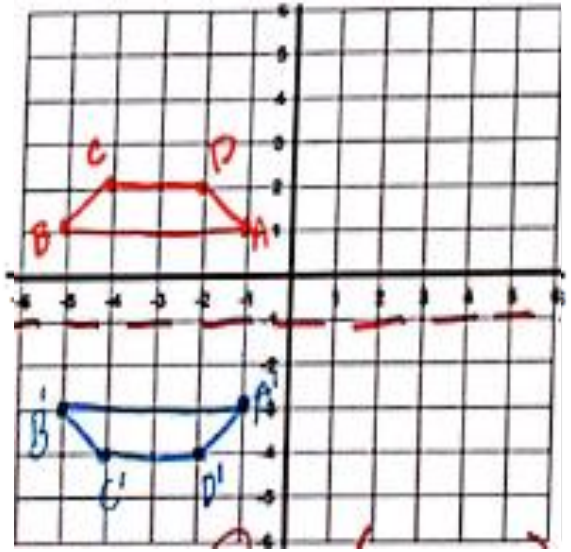
$R(5,-5)$ $R'(-1,-5)$

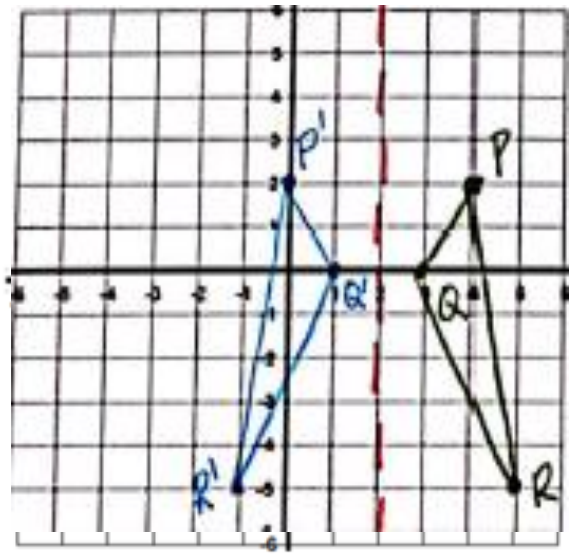
Reflect over the $y = -x$

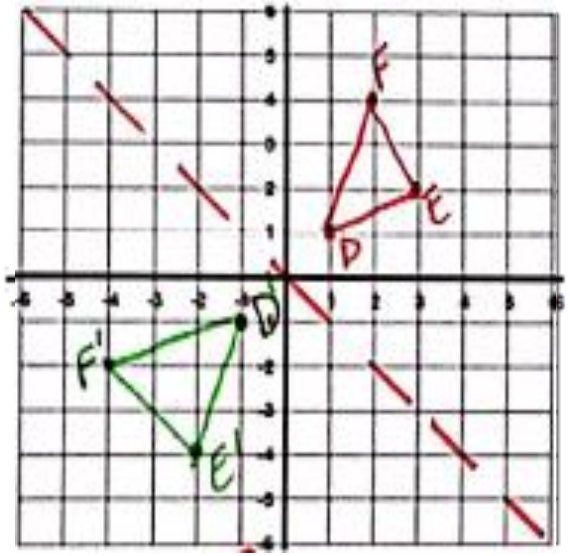
$D(1,1)$ $D'(-1,-1)$

$E(3,2)$ $E'(-2,-3)$

$F(2,4)$ $F'(-4,-2)$







Daily Agenda

Today's Date

January 11, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.3 Reflections

☑ Check for Understanding

Reflect the figure with the given vertices across the given line.

Reflect over the $y = 3$

$G(-6,-1)$ $K(-2,-1)$

$H(-6,1)$ $L(-3,-3)$

$J(-2,1)$ $G'(-6,7)$ $H'(-6,5)$

$J'(-2,7)$ $K'(-2,5)$ $L'(-3,9)$

Reflect over $x = 4$

$S(-2,-4)$ $S'(10,-4)$

$T(-1,1)$ $T'(9,1)$

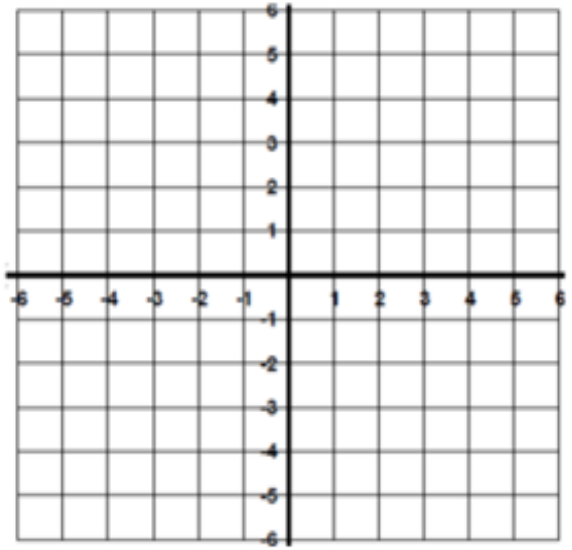
$U(2,1)$ $U'(6,1)$

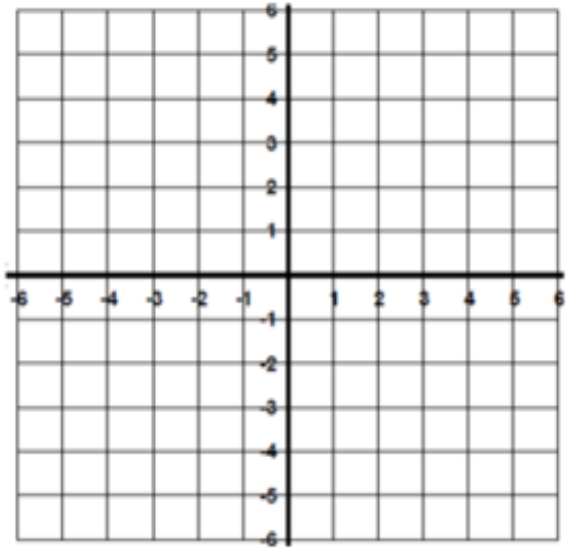
Reflect over the $y = -x$

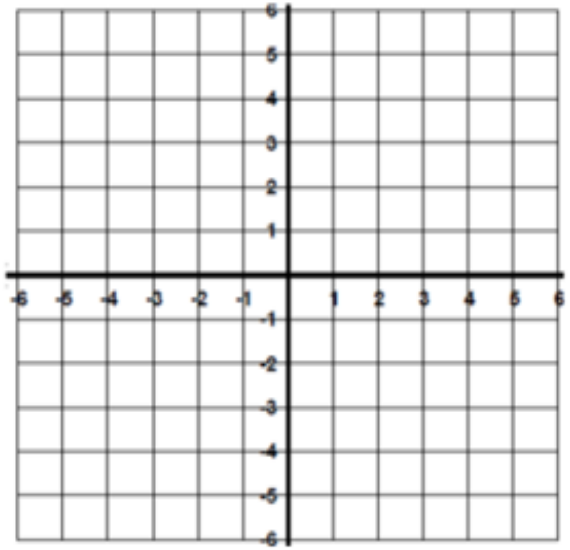
$A(-4,-2)$ $A'(2,4)$

$B(-2,0)$ $B'(0,2)$

$C(-5,1)$ $C'(-1,5)$







Daily Agenda

Today's Date

January 11, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

Unit 1: Transformations in the Coordinate Plane

1.3 Reflections

- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure

Direct Explanation 1

- INDEPENDENT PRACTICE
  - Booklet Pages
- HOMEWORK
  - Booklet Pages

Worktime 2

- How can I apply all that I have learned about **Reflections** to demonstrate mastery of the standards?

Closing 3

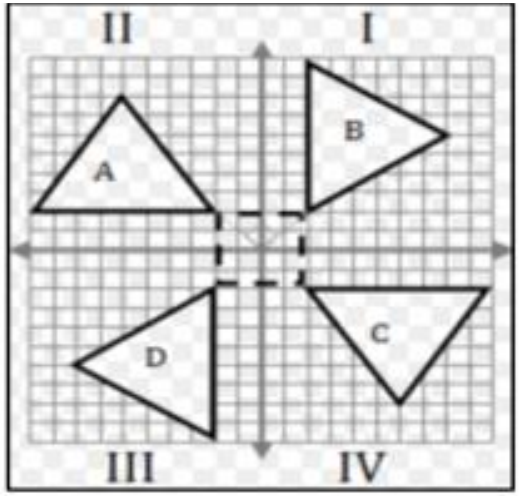
Unit 1: Transformations in the Coordinate Plane

1.4 Rotations

1.4 Rotations

A **rotation** is a transformation that turns a figure around a point, called the center of rotation.

counter-clockwise is considered the *positive* direction, so clockwise is considered the *negative* direction.



Daily Agenda

Today's Date

January 13, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.4 Rotations

A 90° rotation is equivalent to a 270° CW rotation and has the function:

$$R_{90°}(x, y) = (-y, x)$$

A 180° rotation is equivalent to a 180° CW rotation and has the function:

$$R_{180°}(x, y) = (-x, -y)$$

A 270° rotation is equivalent to a 90° CW rotation and has the function:

$$R_{270°}(x, y) = (y, -x)$$

Daily Agenda

Today's Date

January 13, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

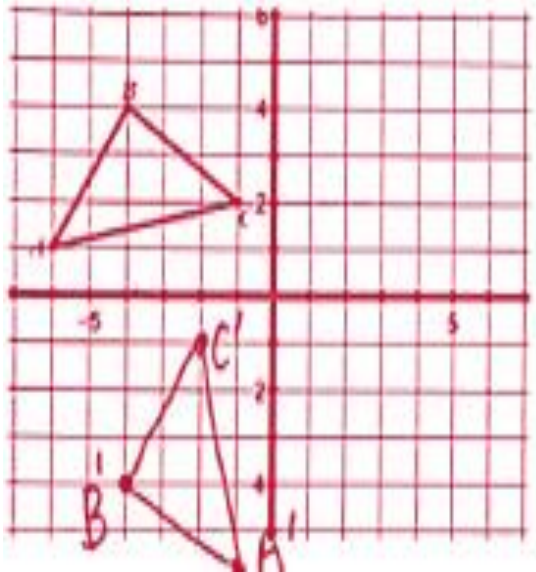
What's for homework?

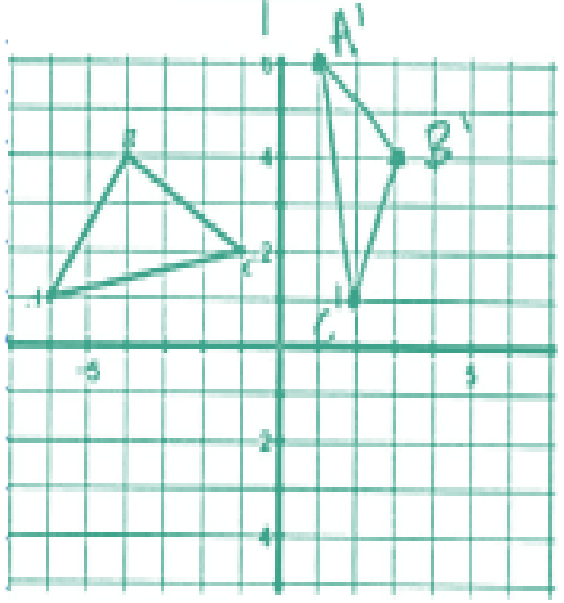
Booklet pg.

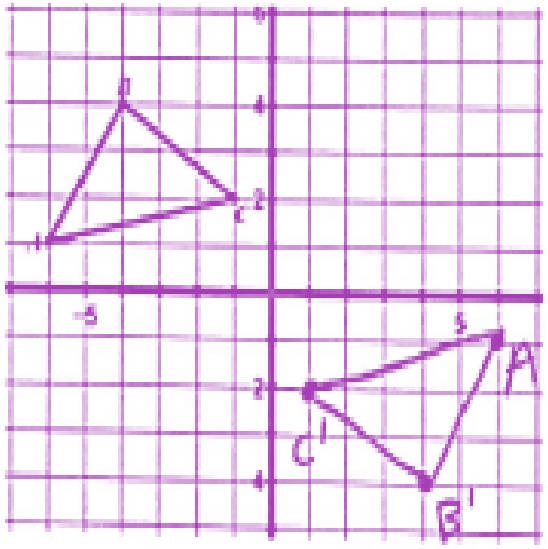
1.4 Rotations

Rotation in the Coordinate

- 90° CCW: $(x, y) \rightarrow (-y, x)$
- 90° CW: $(x, y) \rightarrow (y, -x)$
- 180° CW: $(x, y) \rightarrow (-x, -y)$







Daily Agenda

Today's Date

January 13, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

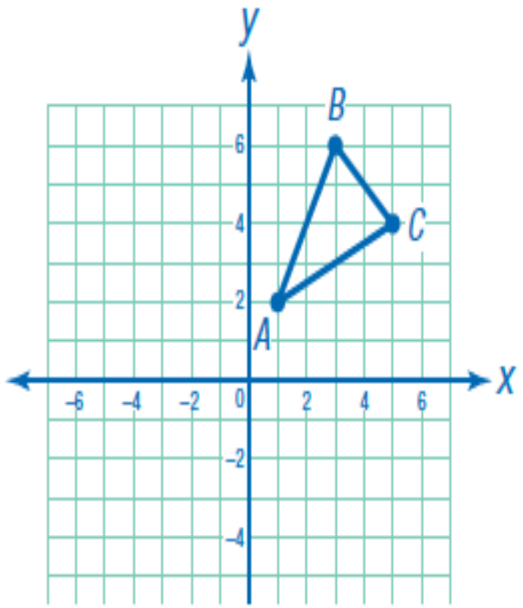
What's for homework?

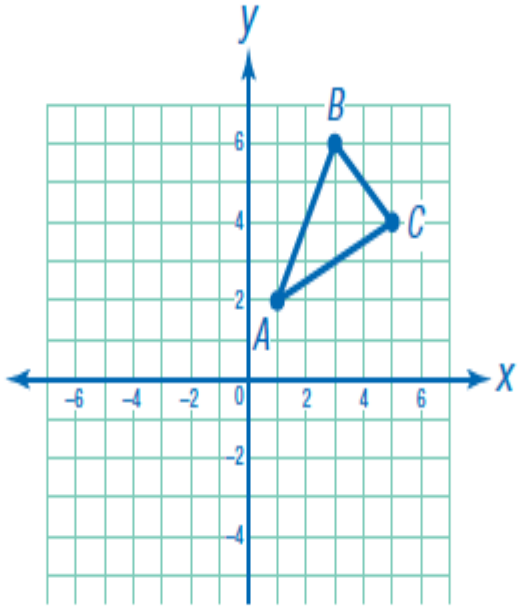
Booklet pg.

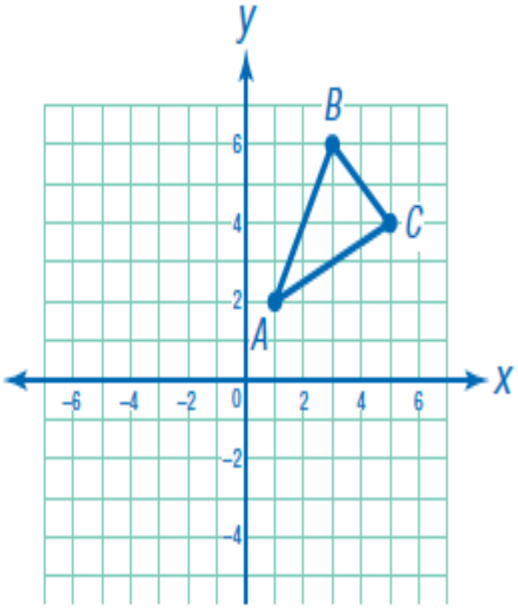
1.4 Rotations

☑ Check for Understanding

Triangle ABC is graphed on the coordinate plane. Draw the image of this triangle after counterclockwise rotations of 90°, 180°, and 270° about the origin.







Daily Agenda

Today's Date

January 13, 2017

What are we learning today?

MGSE9 – 12.G.CO.4 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

Unit 1: Transformations in the Coordinate Plane

1.4 Rotations

- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure

Direct Explanation 1

- INDEPENDENT PRACTICE
  - Booklet Pages
- HOMEWORK
  - Booklet Pages

Worktime 2

- How can I apply all that I have learned about **Rotations** to demonstrate mastery of the standards?

Closing 3

Unit 1: Transformations in the Coordinate Plane

1.5 Symmetry

1.5 Symmetry

A ___Regular___ ___polygon___ is a polygon with all sides equal in length and all angles equal in measure.

If a regular polygon has n sides, then it also has n ___Line___ ___of___ ___Symmetry___.

When you reflect a figure over line of symmetry, the image is ___congruent___ to and in the same location as the original ___Pre-image___.

When this happens, we say that the reflection maps the figure onto itself.

This type of symmetry is called ___Line___ ___symmetry___ or ___Reflectional___ ___symmetry___. A figure that has ___Rotational___ ___symmetry___ will map onto itself more than once during a 360° turn. To find the rotational symmetry, divide ___360°___ by the number of sides.

Daily Agenda

Today's Date

January 17, 2017

What are we learning today?

MGSE9 – 12.G.CO.3 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.5 Symmetry

Example 1

Tell whether each figure has line symmetry.

a)

8

b)

1

☑ Check for Understanding

Tell whether the figure has line symmetry.

4

Daily Agenda

Today's Date

January 17, 2017

What are we learning today?

MGSE9 – 12.G.CO.3 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

1.5 Symmetry

Example 2

Determine whether each figure has rotational symmetry. If so, describe the rotation that maps the figure onto itself.

a)

$360° \div 4 = 90°$

$90°, 180°, 270°$

b)

$360° \div 6 = 60°$

$60°, 120°, 180°, 240°, 300°$

☑ Check for Understanding

Determine whether the figure has rotational symmetry. If so, describe the rotation that maps the figure onto itself.

$360° \div 8 = 45°$

$45°, 90°, 135°, 180°, 225°, 270°$

Daily Agenda

Today's Date

January 17, 2017

What are we learning today?

MGSE9 – 12.G.CO.3 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

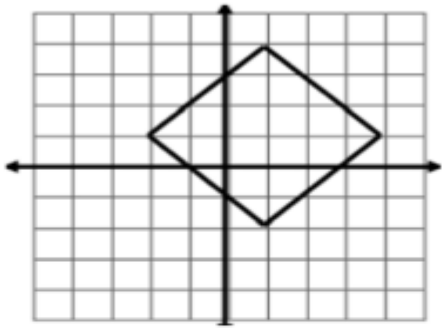
Booklet pg.

1.5 Symmetry

Example 3

List all the transformations that map the following graphs onto itself.

a)



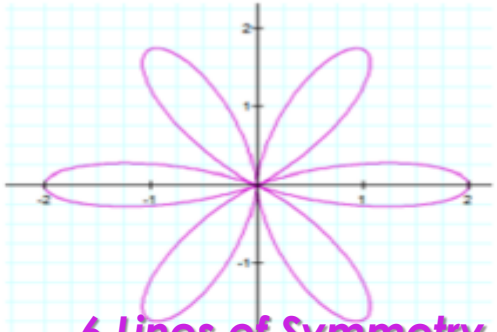
4 Lines of Symmetry

$x = 1, y = 1$

Rotational @ (1,1)

$90^\circ, 180^\circ, 270^\circ$

b)



6 Lines of Symmetry

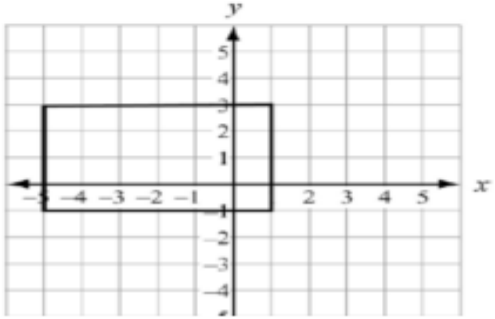
$x - axis, y - axis$

Rotational @ (0,0)

$60^\circ, 120, 180^\circ, 240^\circ\ 240^\circ, 300^\circ$

☑ Check for Understanding

List all the transformations that map the following graphs onto itself.



2 Lines of Symmetry

$x = -2, y = 1$

Rotational @ (-2,1)

180°

Daily Agenda

Today's Date

January 17, 2017

What are we learning today?

MGSE9 – 12.G.CO.3 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

Unit 1: Transformations in the Coordinate Plane

1.5 Symmetry

- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure

Direct Explanation 1

- INDEPENDENT PRACTICE
  - Booklet Pages
- HOMEWORK
  - Booklet Pages

Worktime 2

- How can I apply all that I have learned about **Symmetry** to demonstrate mastery of the standards?

Closing 3

Unit 1: Transformations in the Coordinate Plane

1.6 Sequence of Transformations

1.6 Sequence of Transformations

Sometimes, more than one transformation is needed to produce a particular image from a given pre-image.

To determine the necessary sequence of transformations, compare the ___image___ to the ___Pre-image___. If the orientation of the figure has changed, then a ___rotation___ or ___reflection___ has probably taken place.

A ___Composition___ ___of___ ___transformation___ is one transformation followed by another. A ___glide___ ___reflection___ is the composition of a translation and a reflection across a line parallel to the vector of translation.

Daily Agenda

Today's Date

January 18, 2017

What are we learning today?

MGSE9 – 12.G.CO.3 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

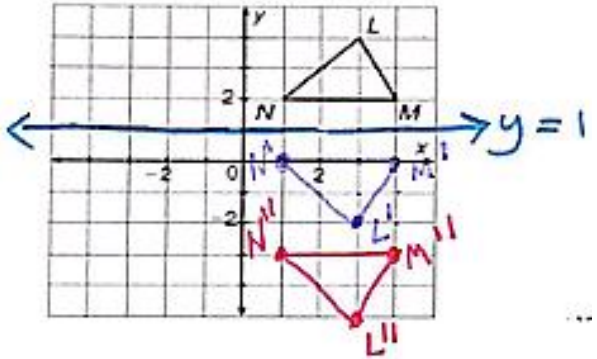
What's for homework?

Booklet pg.

1.6 Sequence of Transformations

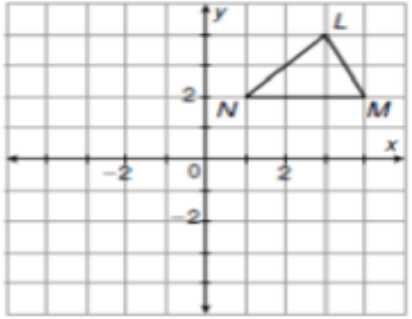
Example 1

Draw the result of each composition of transformations.
Reflect the triangle over the line $y = 1$, then translate 3 units down.



☑ Check for Understanding

Draw the result of each composition of transformations.
Reflect the triangle over the x-axis, then translate 3 units to the left.



Daily Agenda

Today's Date

January 18, 2017

What are we learning today?

MGSE9 – 12.G.CO.3 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

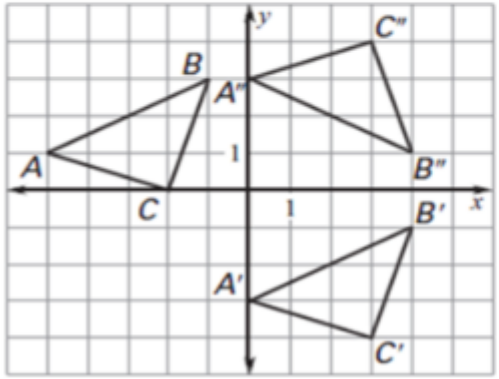
What's for homework?

Booklet pg.

1.6 Sequences of Transformations

Example 2

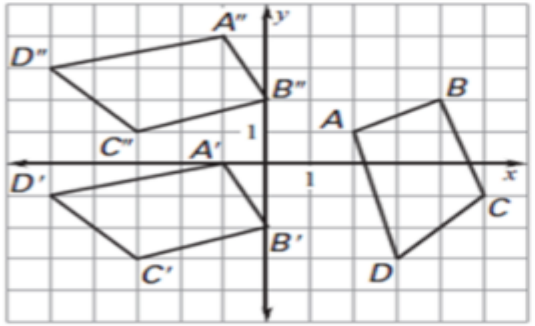
Identify a sequence of transformations that will map each pre-image onto its final image. Use correct transformation notation.



Sequence 1: $T(x, y) = (x + 5, y - 4)$
Sequence 2: R_{x-axis}

☑ Check for Understanding

Identify a sequence of transformations that will map each pre-image onto its final image. Use correct transformation notation.



Sequence 1: $90°\ CW\ Rotation\ (0, 2)$
Sequence 2: $T(x, y) = (x, y + 4)$

Daily Agenda

Today's Date

January 18, 2017

What are we learning today?

MGSE9 – 12.G.CO.3 - Experiment with transformations in the plane

What am I going to do?

Transformations in the Coordinate Plane

How will I show you I learned it?

Daily Exit Tickets

What's for homework?

Booklet pg.

Unit 1: Transformations in the Coordinate Plane

1.6 Sequence of Transformations

- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure

Direct Explanation

1

- INDEPENDENT PRACTICE
  - Booklet Pages
- HOMEWORK
  - Booklet Pages

Worktime

2

- How can I apply all that I have learned about **Sequence of Transformations** to demonstrate mastery of the standards?

Closing

3