Name___________________________________

Honors Geometry **Ch 9 Notes Packet**

Sec 9.1: Reflections

After this section you will have completed the following Common Core State Standard(s):

- **G.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.**
- **G.CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.**

And will be improving your skills in the following Mathematical Practice(s):

5. Use appropriate tools strategically
7. Look for and make use of structure

Specifically, you should be able to:

- **Draw reflections**
- **Determine coordinates of reflections and draw reflections in the coordinate plane**

A _________________________________ is an operation that maps a pre-image onto an image

______________________ = original figure

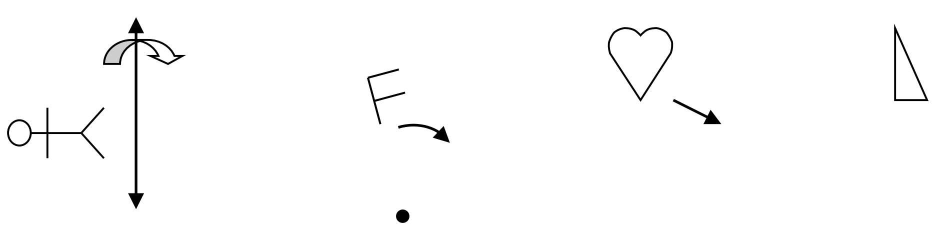
______________________ = new figure after the transformation

Notation:

Types of transformations

Type	REFLECTION	ROTATION	TRANSLATION	DILATION
Description	in a line	about a point	(left/ right, up/down)	scale factor determines reduction v. enlargment

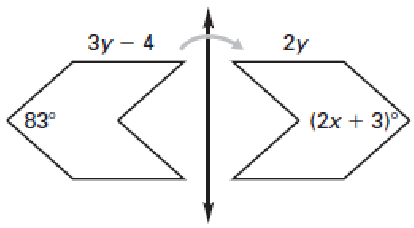
Sketch



isometries

An ______________________(aka RIGID TRANSFORMATION) is a transformation that preserve lengths, angle measures, parallel lines, and distance between points. [DISTANCE FORMULA!!]

Examples:

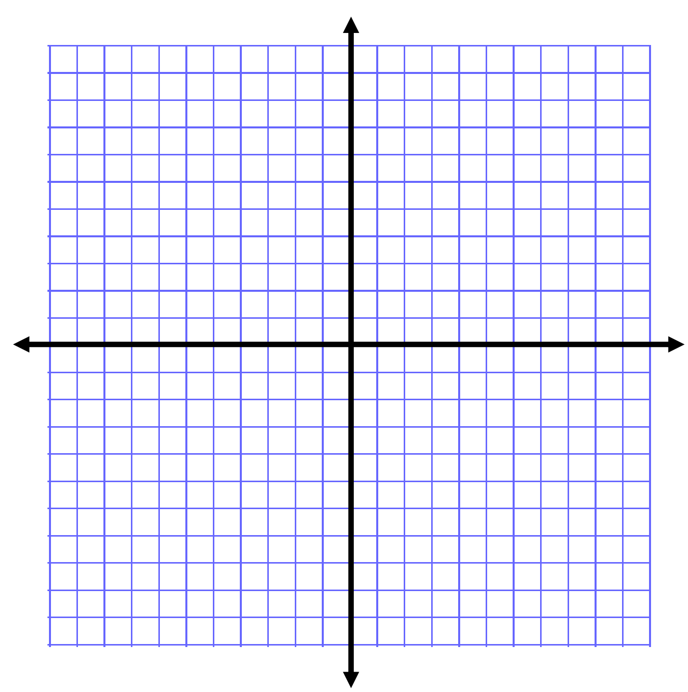


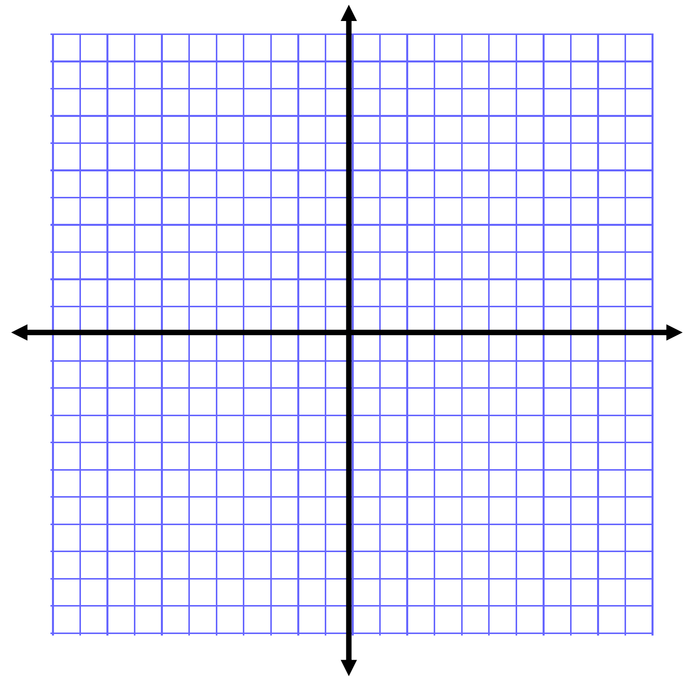
__________________________ are rigid transformations (that means reflections are ISOMETRIES) where an image is mirrored across a line called the ________________________. Remember: Isometries are transformations that preserve LENGTH

A reflection in a line is a function that maps every preimage point P across line m to its image point P' so that:

- If the preimage P is on line *m*, the preimage and image _________________________
- If P is not on line *m*, then line m is the perpendicular bisector of ___________________ _______________________________________

Examples:





Exit Ticket:

How would you find a:

A. Reflection in x-axis
B. Reflection in y-axis
C. Reflection in y = x
D. Reflection over any horizontal line
E. Reflection over any vertical line

Sec 9.2: Translations

After this section you will have completed the following Common Core State Standard(s):

- **G.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.**
- **G.CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.**

And will be improving your skills in the following Mathematical Practice(s):

5. Use appropriate tools strategically

4. Model with mathematics

Specifically, you should be able to:

- **Draw translations**
- **Determine coordinates of translations and draw translations in the coordinate plane**

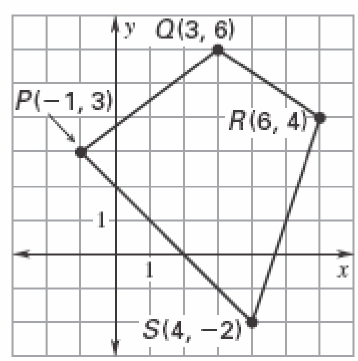
A **TRANSLATION** (aka ____________) is a transformation that maps points each point to its image along a ______________________________ such that:

- Each segment connecting a preimage point to an image point has the same length as the vector
- The connecting segment is parallel to the vector

Examples:

1.

2.



Sec 9.3: Rotations

After this section you will have completed the following Common Core State Standard(s):

- **G.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.**
- **G.CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.**

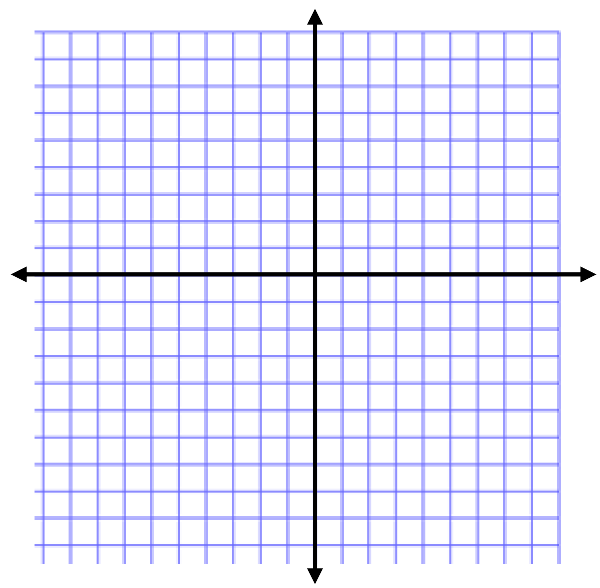
And will be improving your skills in the following Mathematical Practice(s):

5. Use appropriate tools strategically
2. Reason abstractly and quantitatively

Specifically, you should be able to:

- **Draw rotations**
- **Determine coordinates of rotations and draw rotations in the coordinate plane**

____________________are rigid transformations (**ISOMETRIES**!) where a figure is turned about a fixed point called _________________________. The rays connecting a point to the center and the image point to the center create and angle called the ____________________.

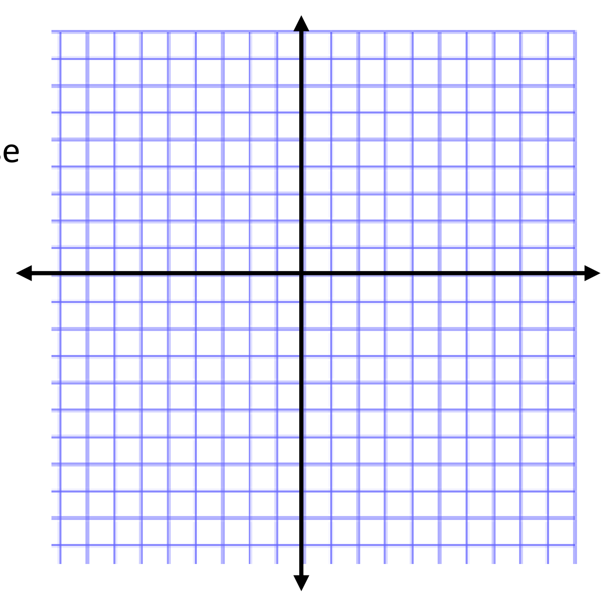


Plot

A(2, -2)   B(4, 1)   C(5, 1)   D(5, -1)

Find the image points when Fig. ABCD is rotated clockwise 90º about the origin

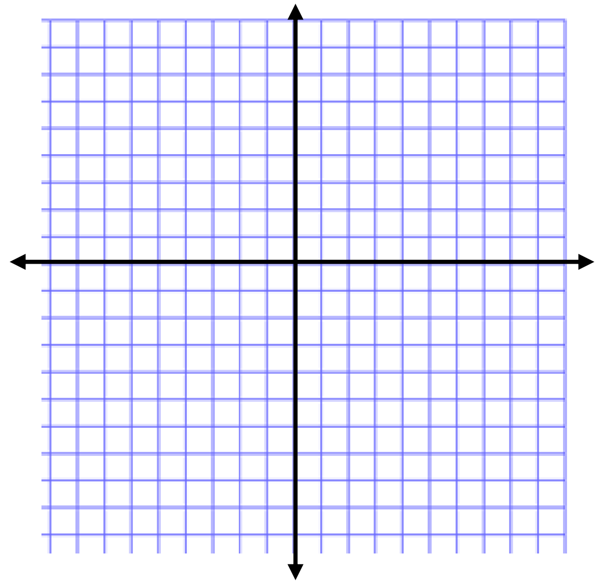
Find the image points when Fig. ABCD is rotated counter-clockwise 90º about the origin



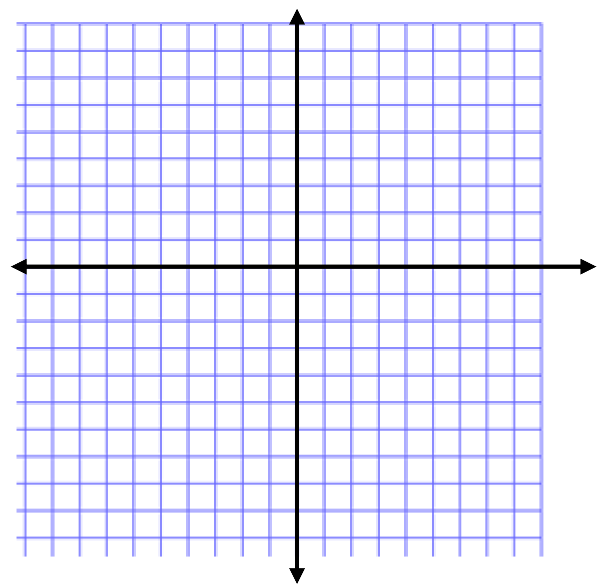
To rotate figures in an angle other than 90 degrees, use the rotation matrix:

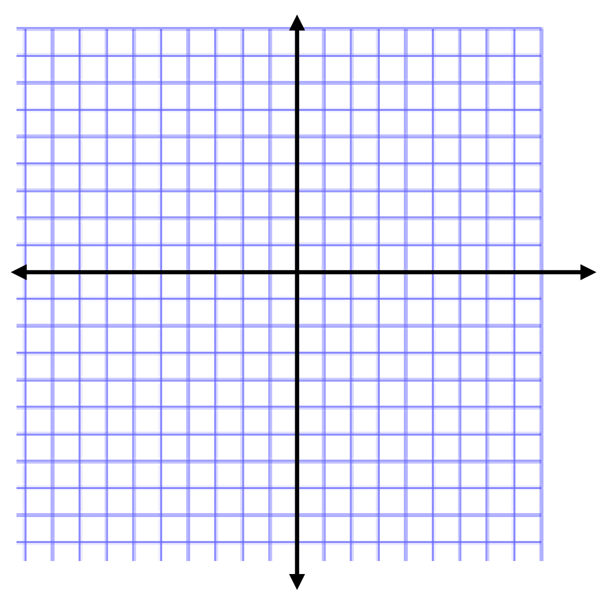
$$\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$

To rotate figures around a point other than the origin:



Examples:





Sec 9.4: Compositions of Functions

After this section you will have completed the following Common Core State Standard(s):

- **G.CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).**
- **G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.**

And will be improving your skills in the following Mathematical Practice(s):

1. Make sense of problems and persevere in solving them

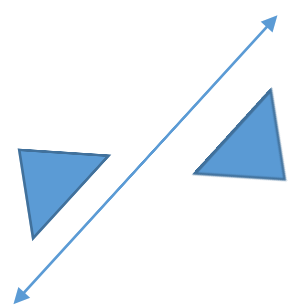
4. Model with mathematics

Specifically, you should be able to:

- **Draw and determine coordinates of glide reflections and other compositions of isometries in the coordinate plane**
- **Draw and determine coordinates of reflections in parallel and intersecting lines**

When a translation is applied to a figure and then another translation is applied to is image a COMPOSITION OF TRNASFORMATIONS is the result.

A GLIDE REFLECTION is composition of a translation and THEN a reflection in a line that is parallel to translation vector.



Thm 9.1:(Composition Theorem) The composition of two or more isometries is an isometry.

Thm 9.2: The composition of 2 reflections in 2 parallel lines can be described by a translation vector that is:

- ______________________ to the 2 lines
- ___________________________between the 2 lines

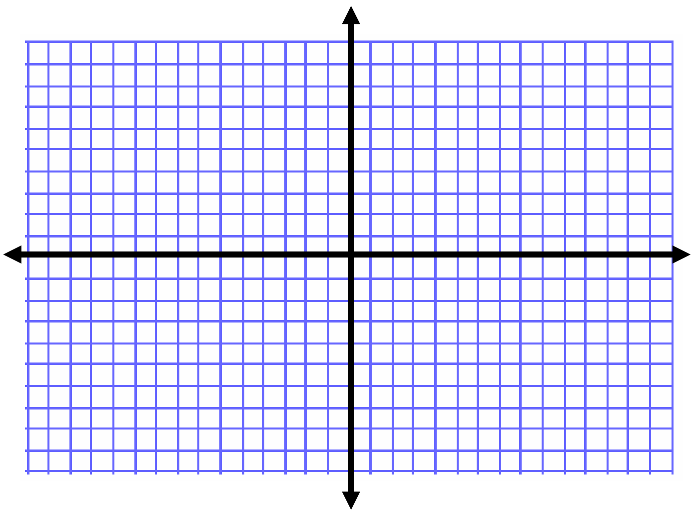
Thm 9.3: The composition of 2 reflections in intersecting lines can be described by a rotation:

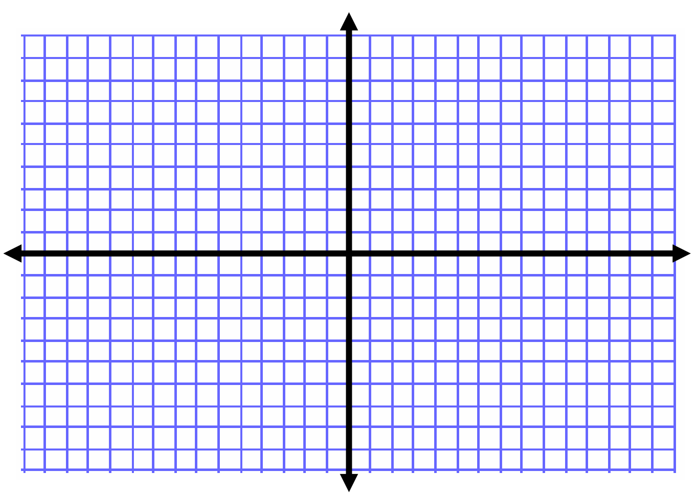
- Around ______________________________
- Through an angle that is ________________

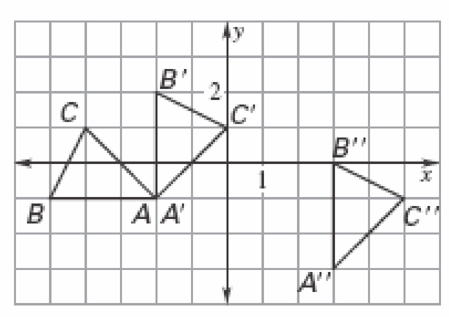
  ____

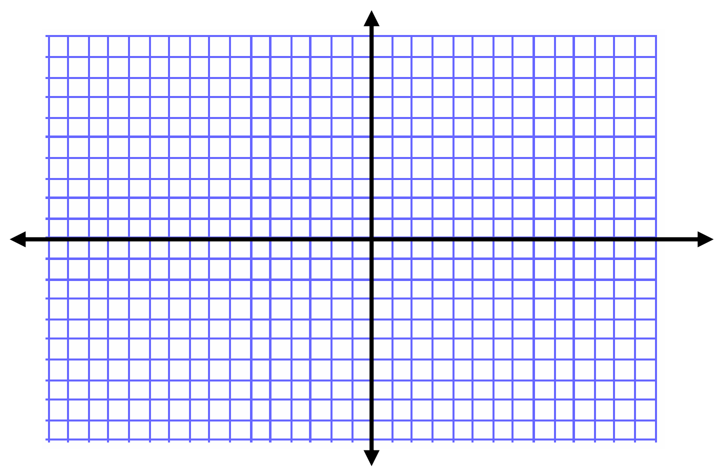
Examples:

1. Does the order of application of transformation in a composition matter?






y
B′
2
C
C′
B′′
1
x
B
A
A′
C′′
A′′



Sec 9.5: Symmetry

After this section you will have completed the following Common Core State Standard(s):

- **G.CO.3: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.**

And will be improving your skills in the following Mathematical Practice(s):

4. Model with mathematics

8. Look for and express regularity in repeated reasoning

Specifically, you should be able to:

- **Identify line and rotational symmetry details in 2 dimensional objects**
- **Identify line and rotational symmetry details in 3 dimensional objects**

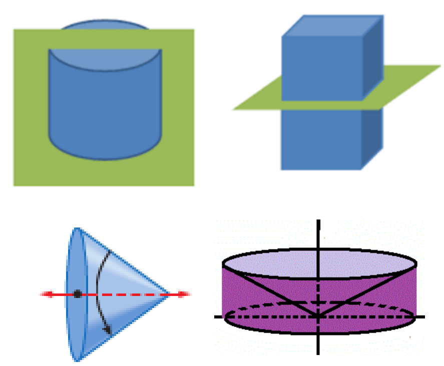
A figure has ____ if you can map the figure onto itself by reflecting over a line called the ____.

A figure has ______________________________ if the figure can be mapped onto itself by a rotation of ________________________ degrees.

The ___________________________________ is the number of times the figure maps onto itself in a full 360 degree rotation.

The ____ (AKA _____________________________) is the smallest angle the figure can be rotated so it maps onto itself.

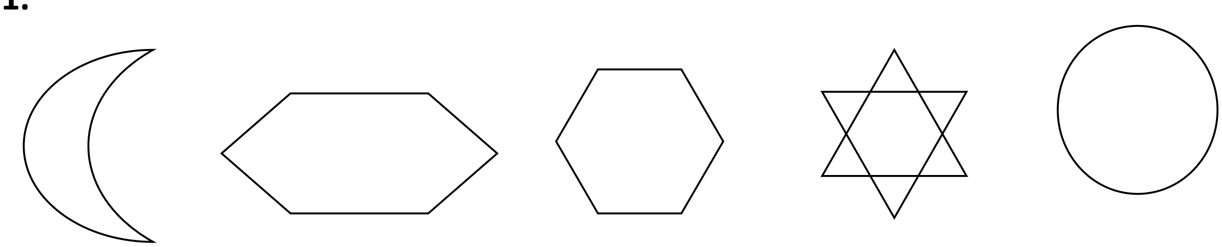
3-D symmetry can also occur in 2 ways:

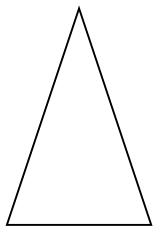


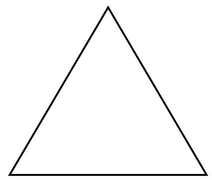
- _____________________________: when the figure maps onto itself by a reflection in the plane
- _____________________________ : when the figure maps onto itself by a 0 to 360 rotation in a line

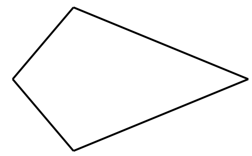
Examples:

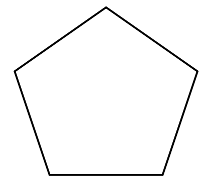
1.











Sec 9.6: Dilations

After this section you will have completed the following Common Core State Standard(s):

- **G.CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).**
- **G.SRT.1: Understand similarity in terms of similarity transformations. Verify experimentally the properties of dilations given by a center and a scale factor:**
  - **a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.**
  - **b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.**

And will be improving your skills in the following Mathematical Practice(s):

1. Make sense of problems and persevere in solving them

5. Use appropriate tools strategically

Specifically, you should be able to:

- **Draw dilations**
- **Determine coordinates of translations and draw dilations in the coordinate plane**

A DILATION/Scaling is a ______________________ transformation where the IMAGE and

PREIMAGE are ___________________. Each dilation has a center C and a scale factor k that maps every point in the preimage to a point in the image.

A dilation with center C and positive scale factor k, where k ≠ 1, is a function that maps preimage point P to its image P' so:

- If the preimage point P and center C coincide then the preimage P and image P' are the same point

OR

- If the preimage point P is NOT the center of the dilation, the P' lies on $\overrightarrow{CP}$ and CP' = k(CP)

Reduction: ____________________

Enlargement: __________________

Dilations in the coordinate plane –

- If the center is at the origin:

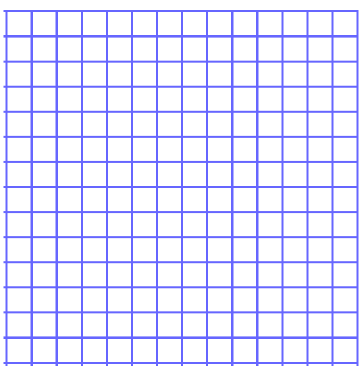
- If the center is NOT at the origin:

Examples:

1.

2. Draw a dilation of ΔABC with A(-2, 1), B(-6,0), and C(-1,-1) when the scale factor is 3/2. A.

A. Center = origin



B. Center = (-3, 1)