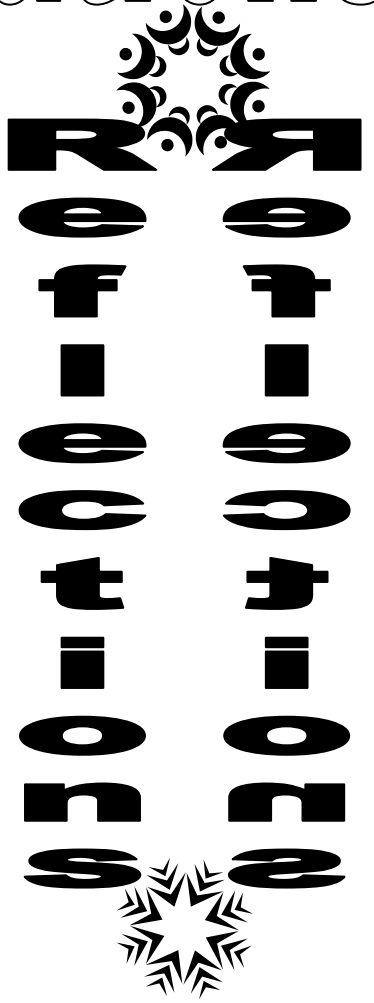
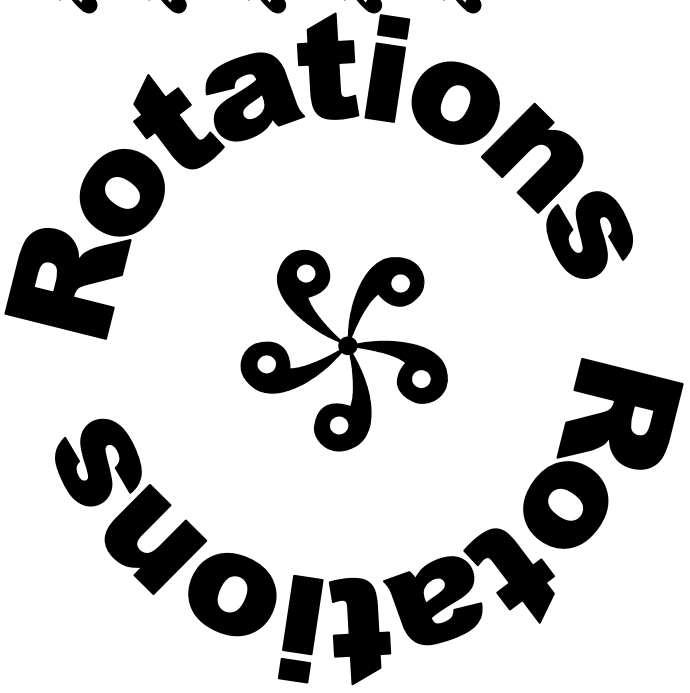
Unit 7
Beaumont Middle School
8th Grade, 2015-2016
Introduction to Algebra

Name: _____

Transformations





- I can recognize and create **reflections** on a coordinate grid.
- I can recognize and create **translations** on a coordinate grid.
- I can recognize and create **rotations** on a coordinate grid.
- I can identify congruency within reflections, translations, and rotations.
- I can recognize and create **dilation**s on a coordinate grid.
- I can identify similarity within dilations.
- I can write a general rule for transformations on a coordinate grid.
- I can recognize and create combined transformations.

Reflectional Symmetry

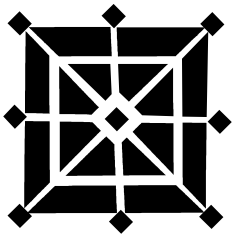
An image has **Reflectional Symmetry** if there is at least one line which splits the image in half so that one side is the mirror image of the other. Reflectional symmetry is also called **line symmetry** or **mirror symmetry** because there is a line in the figure where a mirror could be placed, and the figure would look the same.

Think of a figure on a piece of paper, then folding the paper in two so that the two halves match up, or actually placing a mirror on the line of symmetry.

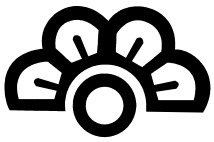
It is possible to have more than one line of reflectional symmetry.

Draw all of the **lines of symmetry** for each figure. Indicate the number of lines of symmetry for each figure. If the figure does not have reflectional symmetry, write "none."

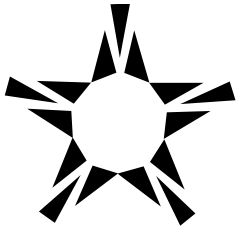
1. #of lines: _____



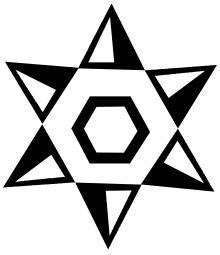
2. #of lines: _____



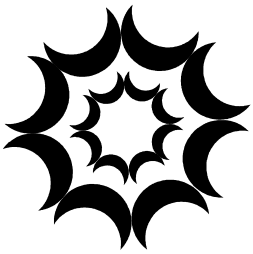
3. #of lines: _____



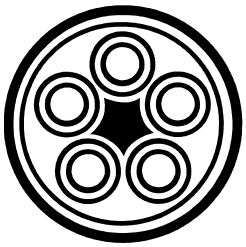
4. #of lines: _____



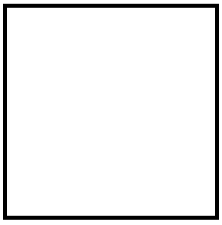
5. #of lines: _____



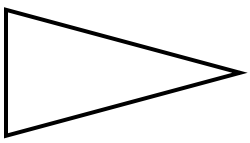
6. #of lines: _____



7. #of lines: _____



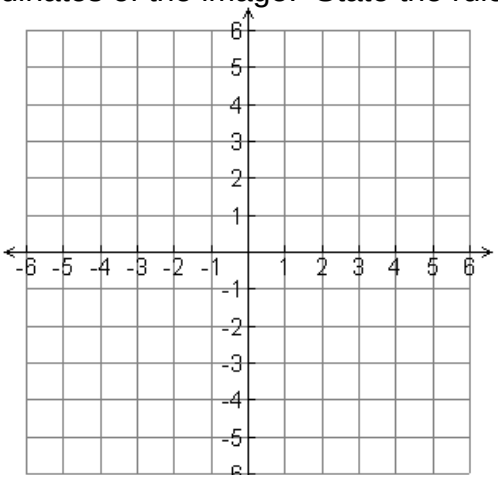
8. #of lines: _____



9. #of lines: _____

Notes for Reflectional Symmetry on a Coordinate Grid

The vertices of a polygon are listed. Graph and label each polygon and its image after a reflection over the given line. Name the coordinates of the image. State the rule for the transformation.



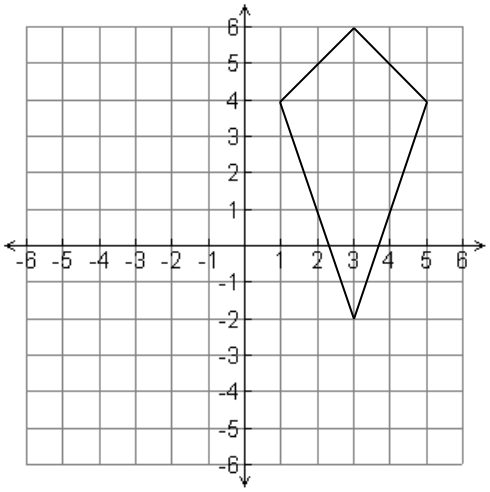
1. Reflect over the **x-axis**. (The x-axis can also be described as the line $y = 0$.)

   A (0, 2) → A' _____

   B (-2, 5) → B' _____

   C (-5, 1) → C' _____

   General rule: _____



2. Reflect over the **y-axis**. (The y-axis can also be described as the line $x = 0$.)

   E (1, 4) → E' _____

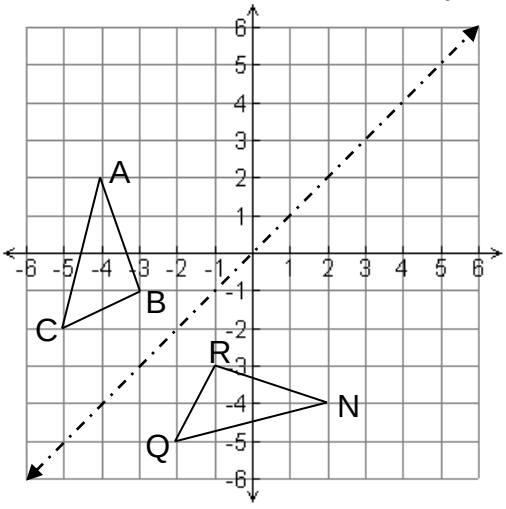
   F (3, -2) → F' _____

   G (5, 4) → G' _____

   H (3, 6) → H' _____

   General rule: _____

A reflectional transformation results in a congruent figure. All angles and segments maintain the same measurements. Identify the congruent parts for the following triangle that was reflected over the line $y = x$.



$\overline{AB} \cong$ _____ $\angle A \cong$ _____

$\overline{BC} \cong$ _____ $\angle B \cong$ _____

$\overline{CA} \cong$ _____ $\angle C \cong$ _____

$\Delta ABC \cong$ _____

State the coordinates of A and its corresponding vertex:

A: _____ _____

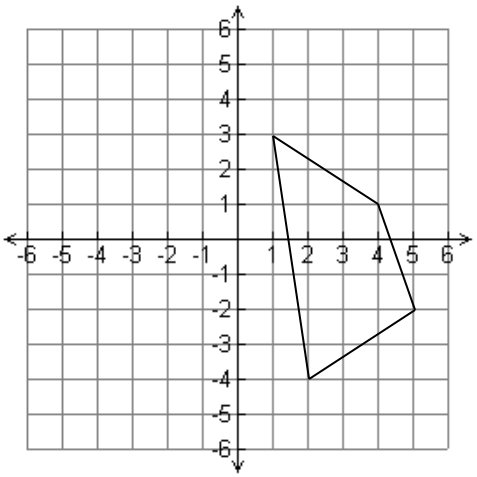
Write the general rule for a reflection over the line $x = y$

_____

Homework for Reflectional Symmetry

The vertices of a polygon are listed. Graph and label each polygon and its image after a reflection over the given line. Name the coordinates of the image. State the rule for the transformation.

1. Reflect over the **y-axis**.



W (2,-4) → W' _____

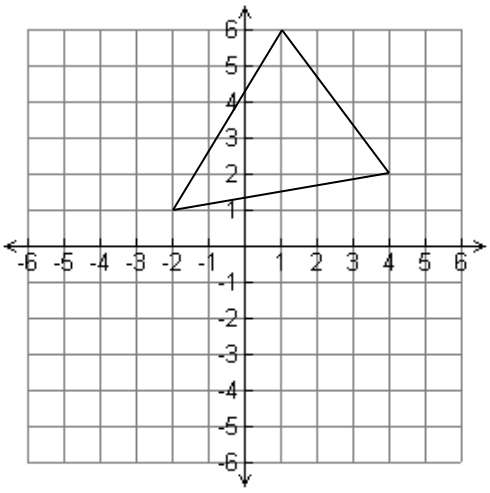
X (1, 3) → X' _____

Y (4, 1) → Y' _____

Z (5, -2) → Z' _____

General rule: _____

2. Reflect over the **x-axis**.



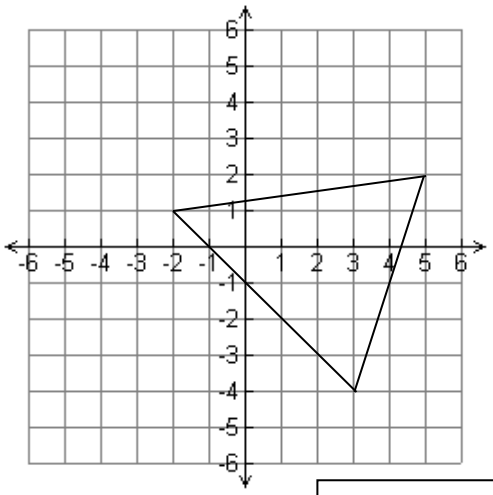
J (-2, 1) → J' _____

K (1, 6) → K' _____

L (4, 2) → L' _____

General rule: _____

3. Reflect over the **x-axis**.



D (-2, 1) → D' _____

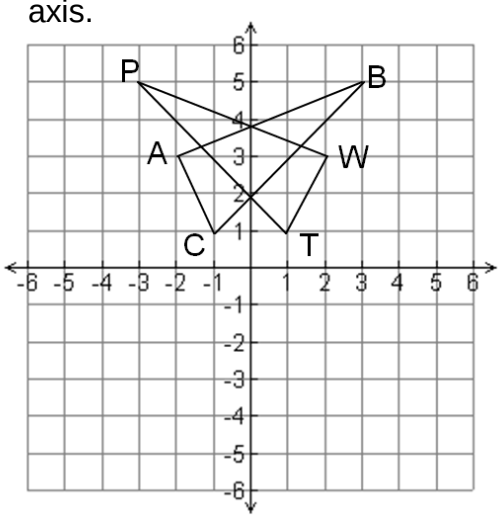
E (5, 2) → E' _____

F (3, -4) → F' _____

General rule: _____

Homework is continued on the next page.

4. Identify the congruent parts for the following triangle that was reflected over the y-axis.



$\overline{AB} \cong$ _____ $\angle A \cong$ _____

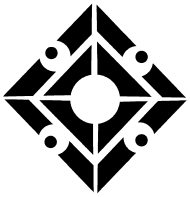
$\overline{BC} \cong$ _____ $\angle B \cong$ _____

$\overline{CA} \cong$ _____ $\angle C \cong$ _____

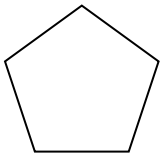
$\Delta ABC \cong$ _____

Draw all of the **lines of symmetry** for each figure. If the figure does not have reflectional symmetry, write "none."

5. #of lines: _____



6. #of lines: _____



7. #of lines: _____

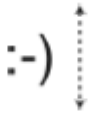
8. #of lines: _____

9. #of lines: _____

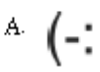
10. #of lines: _____

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

11.



Which of the following shows the image above reflected over the dotted line?

A.  B.  C.  D. 

12. Use the letter in the box to answer the following question.

Which shows the letter after it has been FLIPPED ONCE?

A.  B. 

C.  D. 

Homework is continued on the next page.

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

13.

Anna noticed the following sign on the wall

Which shows the sign after it has been flipped across the line?

A. 

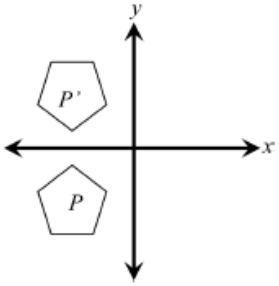
B. 

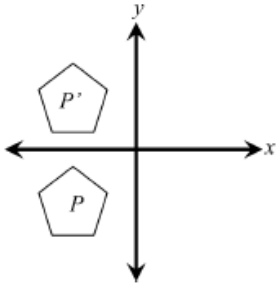
C. 

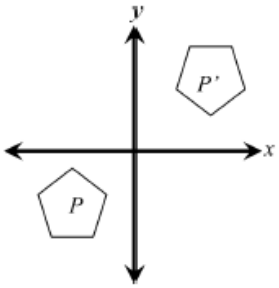
D. 

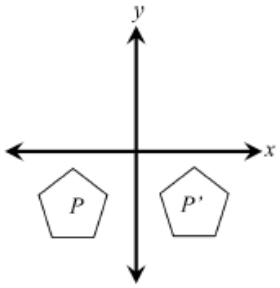
14.

Which figure is a reflection of figure P in respect to the x-axis?

A. 

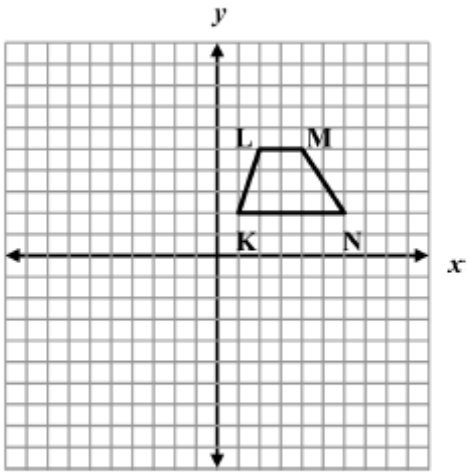
B. 

C. 

D. 

15.

If trapezoid KLMN shown below is reflected across the x-axis to form trapezoid K'L'M'N', what are the apparent coordinates of M'?



A. $(-4, 5)$

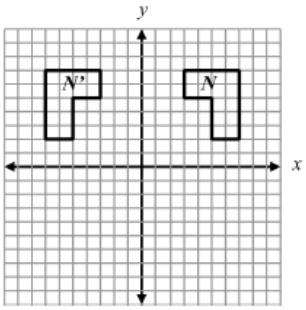
B. $(-4, -5)$

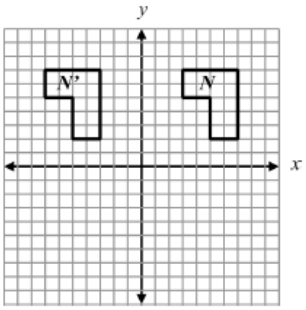
C. $(4, -5)$

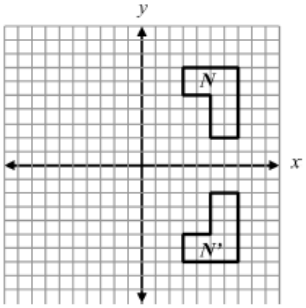
D. $(4, 5)$

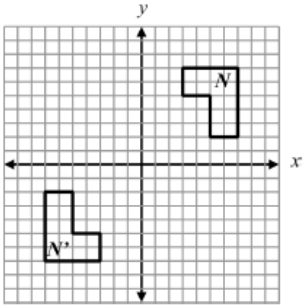
16.

Which of the following is a single reflection of figure N over the y-axis to form N'?

A. 

B. 

C. 

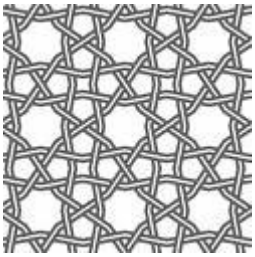
D. 

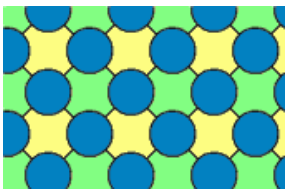
Translational Symmetry

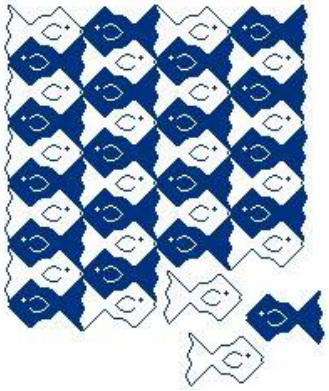
An image has **Translational Symmetry** if it can be divided by straight lines into a sequence of identical figures. Translational symmetry results from moving a figure a certain distance in a certain direction also called translating (moving) by a vector (length and direction).

A tessellation is created when a shape is repeated over and over again covering a plane without any gaps or overlaps.

Another word for a tessellation is a **tiling**.







NOTES for Translational Symmetry

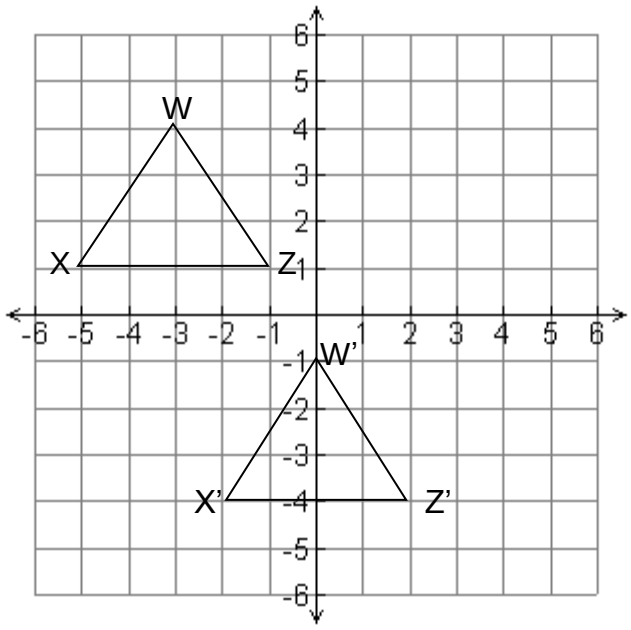
1. Name the coordinates of the image and its translation. State the rule for the transformation.

W _____ → W' _____

X _____ → X' _____

Z _____ → Z' _____

General rule: _____



NOTES for Translational Symmetry, continued

2. The vertices of a polygon are listed. Name the coordinates of the image's translation given the general rule for the transformation. Graph and label the original polygon and its image.

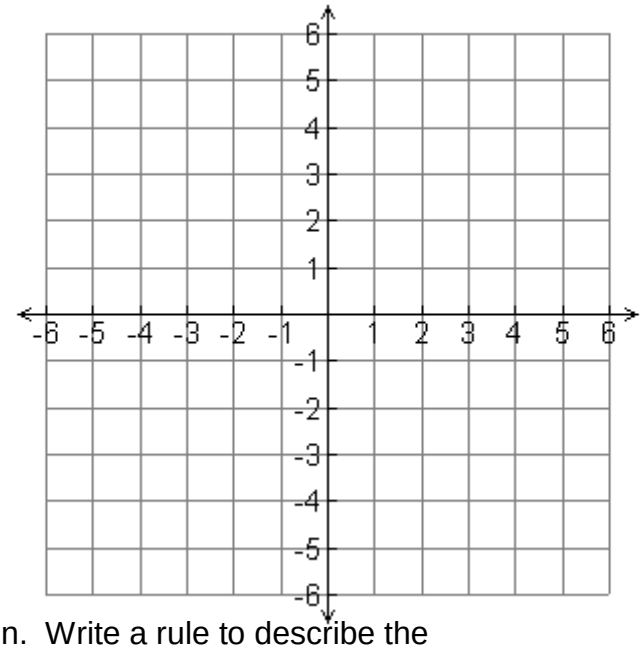
General rule: (x, y) → (x – 5, y + 2)

D (4, 2) → D' _____

E (6, -3) → E' _____

F (0, -3) → F' _____

G (2, 2) → G' _____

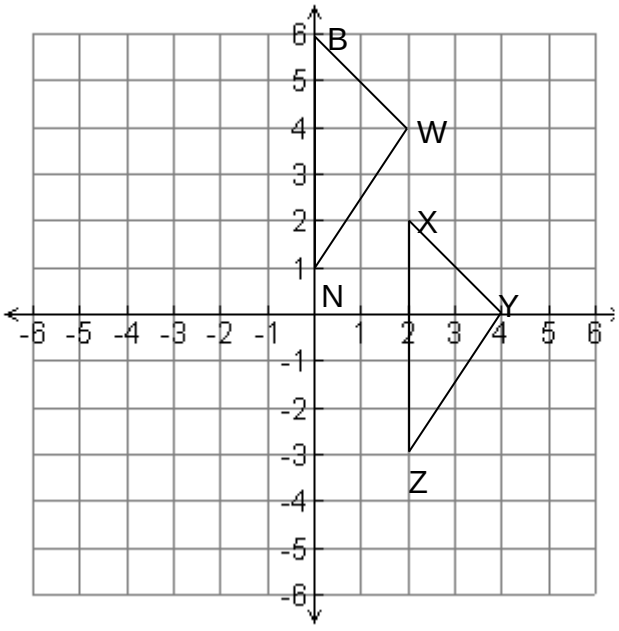


3. A point and its image after a translation are given. Write a rule to describe the translation.

a. The translation that takes A(8, -6) to A'(9, -3) (x, y) → _____

b. The translation that takes B(2, -10) to B'(2, -12) (x, y) → _____

4. A translational transformation also results in a congruent figure. Identify the congruent parts for triangle XYZ that was translated 2 units to the left and 4 units up.



$\overline{XY} \cong$ _____ $\angle W \cong$ _____

$\overline{YZ} \cong$ _____ $\angle N \cong$ _____

$\overline{ZX} \cong$ _____ $\angle B \cong$ _____

$\Delta XYZ \cong$ _____

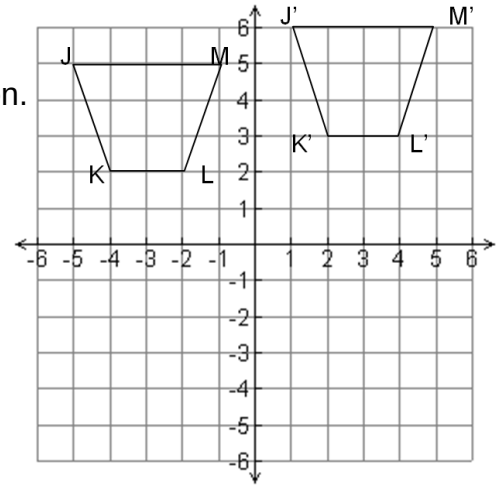
State the coordinates of W and its corresponding vertex:

W: _____ _____

Write the general rule for the translation

_____

HOMEWORK for Translational Symmetry



1. Name the coordinates of the image and its translation. State the rule for the transformation.

J _____ → J' _____

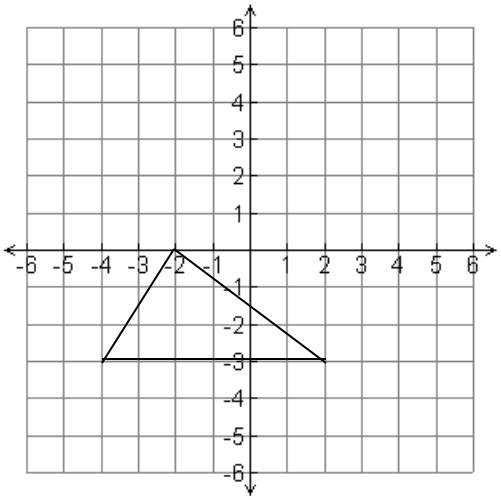
K _____ → K' _____

L _____ → L' _____

M _____ → M' _____

General rule: _____

2. The vertices of a polygon are listed. Name the coordinates of the image's translation given the general rule for the transformation. Graph and label the original polygon and its image.



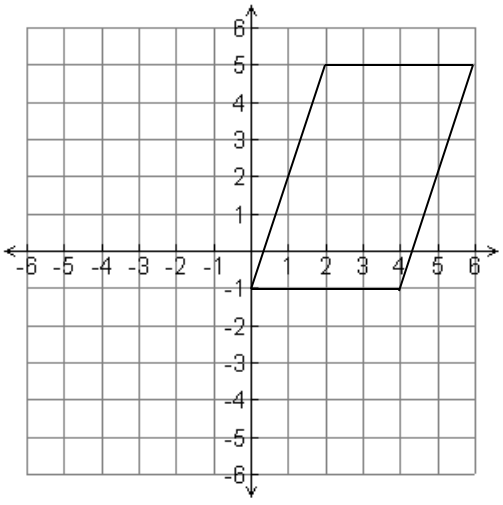
General rule: (x, y) → (x + 4, y – 2)

D (-2, 0) → D' _____

E (2, -3) → E' _____

F (-4, -3) → F' _____

3. The vertices of a polygon are listed. Name the coordinates of the image's translation given the general rule for the transformation. Graph and label the original polygon and its image.



General rule: (x, y) → (x – 6, y)

R (6, 5) → R' _____

S (4, -1) → S' _____

T (0, -1) → T' _____

U (2, 5) → U' _____

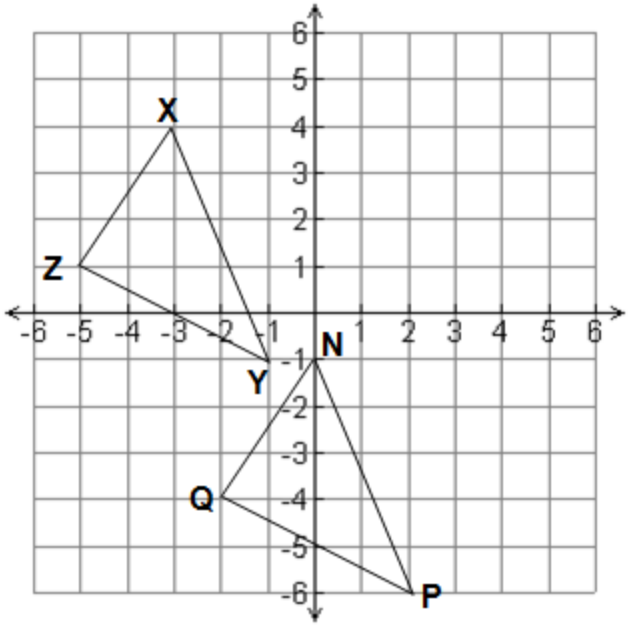
Homework is continued on the next page.

4. A point and its image after a translation are given. Write a rule to describe the translation.

a. The translation that takes A$(10, -5)$ to A'$(-5, -3)$ (x, y) → _____

b. The translation that takes B$(2, -3)$ to B'$(7, -8)$ (x, y) → _____

5. Identify the congruent parts for triangle XYZ that was translated 3 units to the right and 5 units down.



$\overline{XY} \cong$ _____ $\angle X \cong$ _____

$\overline{YZ} \cong$ _____ $\angle Y \cong$ _____

$\overline{ZX} \cong$ _____ $\angle Z \cong$ _____

$\Delta XYZ \cong$ _____

State the coordinates of X and its corresponding vertex:

X: _____ _____

Write the general rule for the translation

_____

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

6. Which pair of shapes shows a translation (slide)?

A.

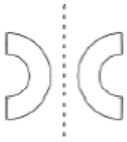
B.

C.

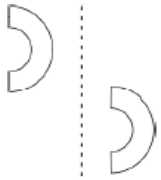
D.

7. Which shows a slide of  ?

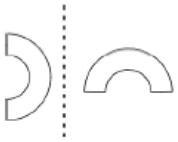
A.



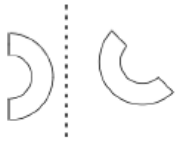
B.



C.



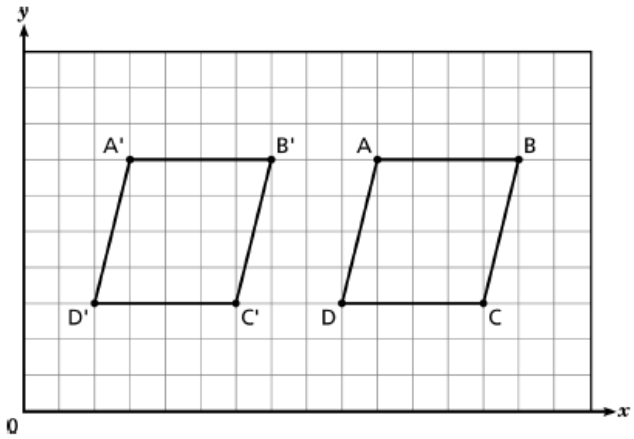
D.



Homework is continued on the next page.

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

8 Parallelogram $ABCD$ was translated to parallelogram $A'B'C'D'$.

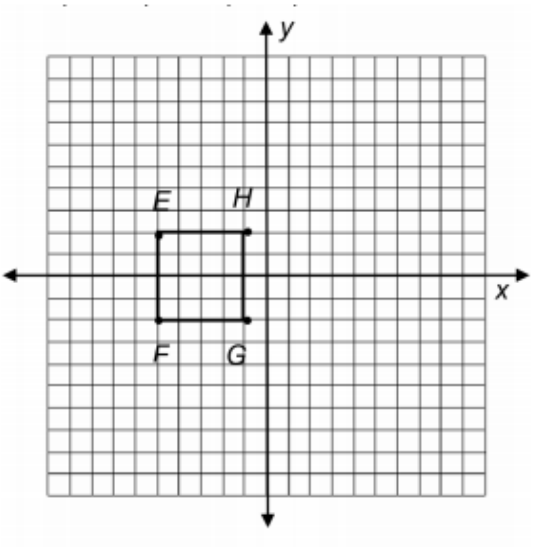


How many units and in which direction were the x-coordinates of parallelogram $ABCD$ moved?

A. 3 units to the right B. 3 units to the left

C. 7 units to the right D. 7 units to the left

9 Figure $EFGH$ in the coordinate plane has vertices at (−5, 2), (−5, −2), (−1, −2), and (−1, 2).



If the figure is translated 5 units to the right and 2 units up, what are the coordinates of the $E'F'G'H'$?

A. (0, 4), (0, 0), (4, 0), (4, 4)

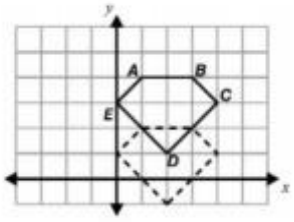
B. (−3, 7), (−3, 3), (1, 3), (1, 7)

C. (−10, 0), (−10, 4), (−6, −4), (−6, 0)

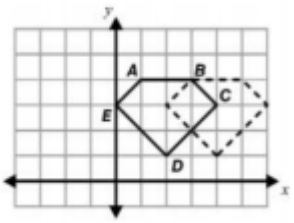
D. (−7, −3), (−7, −7), (−3, −7), (−3, −3)

10. Which shows the translation of pentagon $ABCDE$ two units to the left?

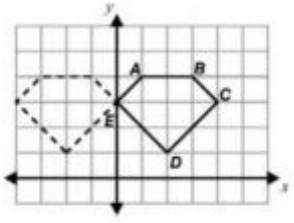
A.



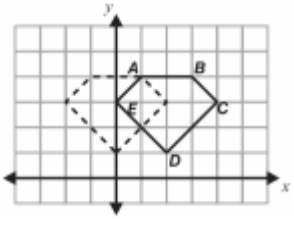
B.



C.

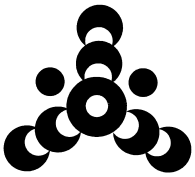


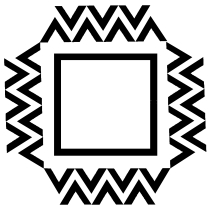
D.



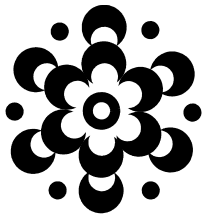
Review Reflectional and Translational Symmetry

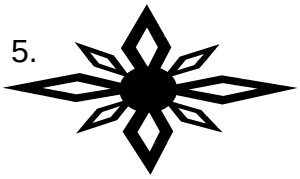
Draw all of the **lines of symmetry** for each figure. If the figure does not have reflectional symmetry, write "none."

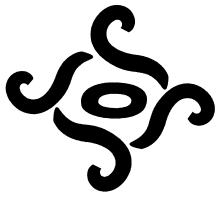
1. 

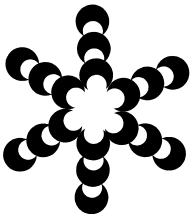
2. 

3. 

4. 

5. 

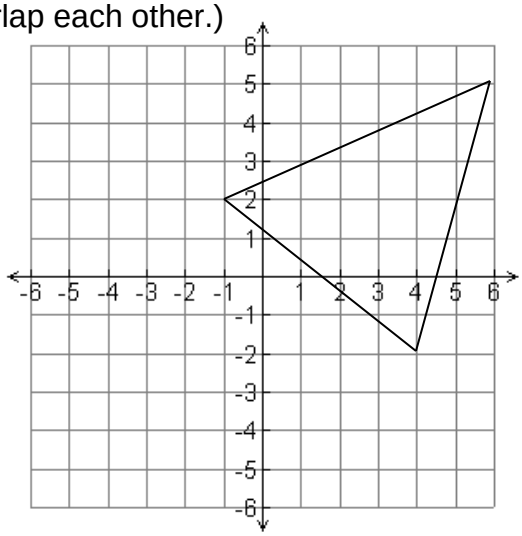
6. 

7. 

8. 

The vertices of a polygon are listed. Graph and label each polygon and its image after a reflection over the given line. Name the coordinates of the image. State the rule for the transformation. (It is okay for the images to overlap each other.)

9. Reflect over the **x-axis**.



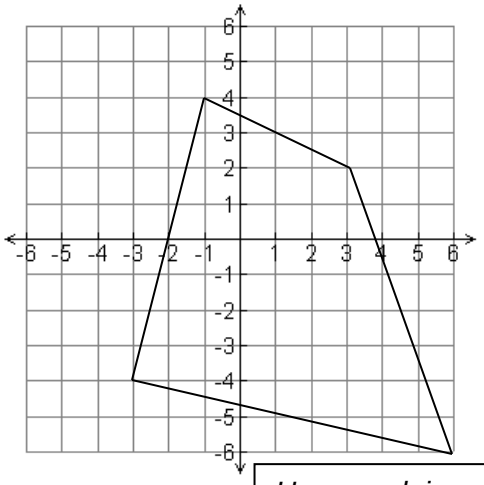
A (-1, 2) → A' _____

B (4, -2) → B' _____

C (6, 5) → C' _____

General rule: _____

10. Reflect over the **y-axis**.



E (-1, 4) → E' _____

F (3, 2) → F' _____

G (6, -6) → G' _____

H (-3, -4) → H' _____

General rule: _____

Homework is continued on the next page.

11. Name the coordinates of the image and its translation. State the rule for the transformation.

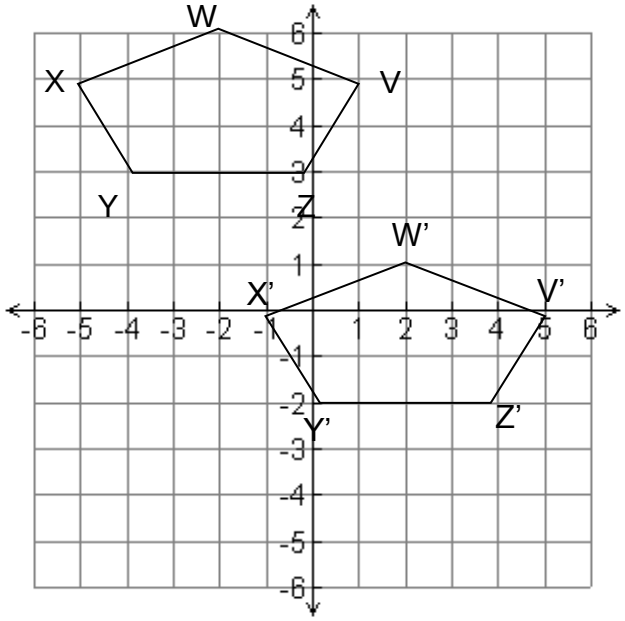
V _____ → V' _____

W _____ → W' _____

X _____ → X' _____

Y _____ → Y' _____

Z _____ → Z' _____



General rule: _____

12. The vertices of a polygon are listed. Name the coordinates of the image's translation given the general rule for the transformation. Graph and label the original polygon and its image.

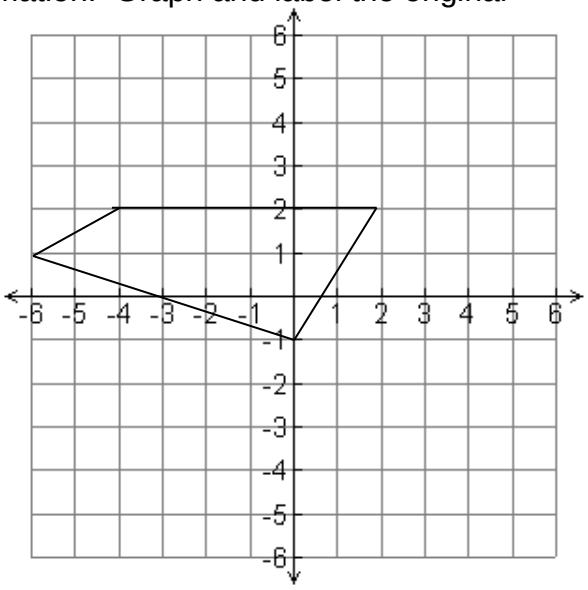
General rule: $(x, y) \rightarrow (x + 3, y - 5)$

D (-4, 2) → D' _____

E (-6, 1) → E' _____

F (0, -1) → F' _____

G (2, 2) → G' _____



A point and its image after a translation are given. Write a rule to describe the translation.

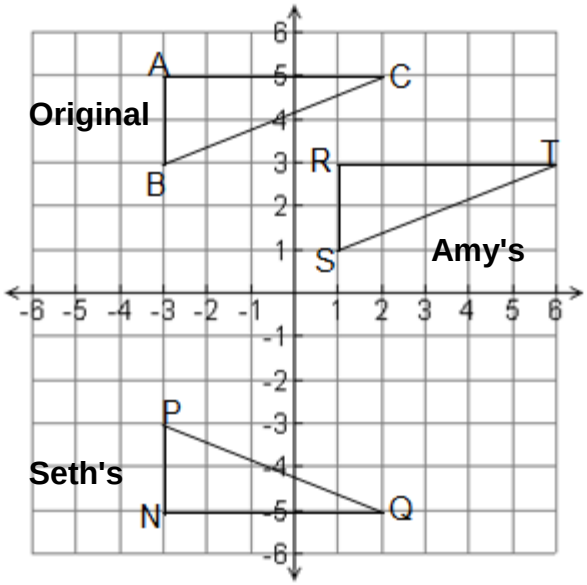
13. The translation that takes A(-8, -6) to A'(2, 3) (x, y) → _____

14. The translation that takes B(5, -1) to B'(-9, -5) (x, y) → _____

Homework is continued on the next page.

15.

Amy transformed triangle ABC to create triangle RST. State the type of transformation and give the general rule.	Seth transformed triangle ABC to create triangle NPQ. State the type of transformation and give the general rule.
Type: _____	Type: _____
Rule: _____	Rule: _____



Name the corresponding parts for the triangles.

For Amy's transformation…

$\overline{AB} \cong$ _____ $\angle A \cong$ _____

$\overline{BC} \cong$ _____ $\angle B \cong$ _____

$\overline{CA} \cong$ _____ $\angle C \cong$ _____

$\Delta ABC \cong$ _____

For Seth's transformation…

$\overline{AB} \cong$ _____ $\angle A \cong$ _____

$\overline{BC} \cong$ _____ $\angle B \cong$ _____

$\overline{CA} \cong$ _____ $\angle C \cong$ _____

$\Delta ABC \cong$ _____

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

16.

Point P has coordinates $(2, 5)$. After a translation, the coordinates of its image P' are $(4, -1)$.

Which of the following best describes the translation?

A. right 1 unit, down 4 units

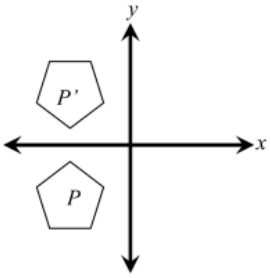
B. right 2 units, down 4 units

C. right 2 units, down 6 units

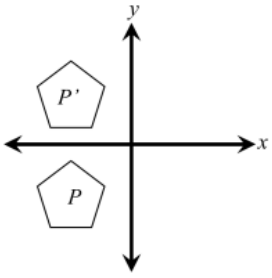
D. right 4 units, down 1 unit

17. Which figure is a reflection of figure P in respect to the x-axis?

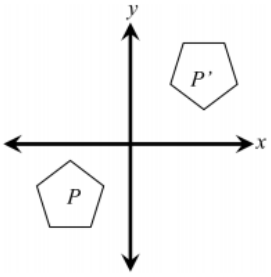
A.



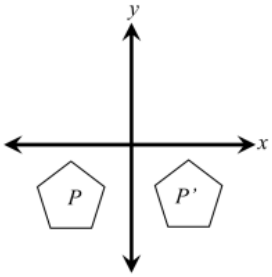
B.



C.

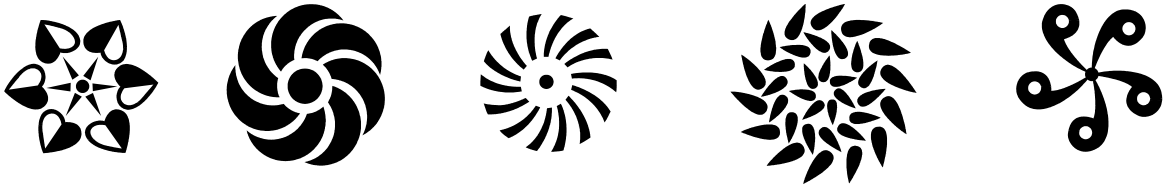


D.



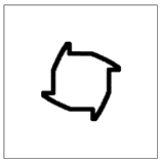
Rotational Symmetry

An image has **Rotational Symmetry** if there is a center point where an object is turned a certain number of degrees and still look the same. A rotation is sometimes called a TURN. These examples have rotational symmetry, but no reflectional symmetry.

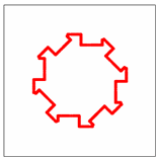


How many **matches** there are as you go **once around** is called the **Order**.

Examples of Different Rotational Symmetry Order

Order	Example Shape	Angle of Rotation
		360º÷2 = **180º**
		360º÷3 = **120º**
		360º÷4 = **90º**

... and there is also Order 5, 6, 7, and ...

		360º÷8 = **45º**

... and then there is Order 9, 10, and so on ...

Is there Rotational Symmetry of Order 1 ?
Not really! If a shape only matches itself **once** as you go around (ie it matches itself after one full rotation) there is really no symmetry at all, because the word "Symmetry" comes from *syn-* ***together*** and *metron* ***measure****,* and there can't be "together" if there is just one thing.

Practice: For each figure state the order and the angle of rotation.

1. 

Order: _____

Angle : _____

2. 

Order: _____

Angle : _____

3. 

Order: _____

Angle : _____

4. 

Order: _____

Angle : _____

Notes for Rotational Symmetry on a Coordinate Grid

The vertices of a polygon are listed. Graph and label each polygon and its image after a given rotation. Name the coordinates of the image.

1. Rotate figure STU about the origin 90° clockwise.

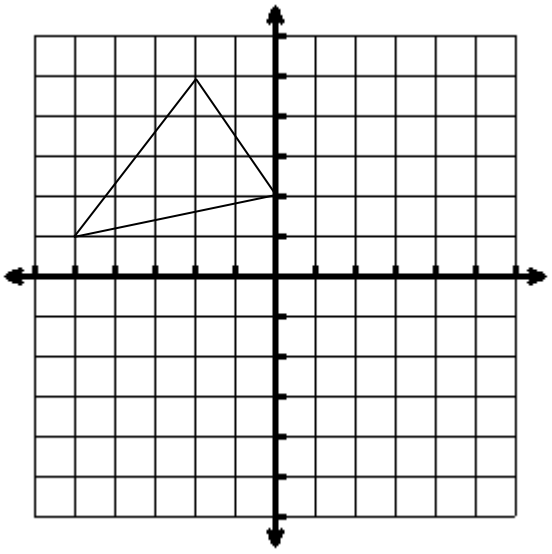
S (0, 2) → S' _____

T (-2, 5) → T' _____

U (-5, 1) → U' _____

Write the general rule:

_____



2. Rotate figure EFG about the origin 180° .

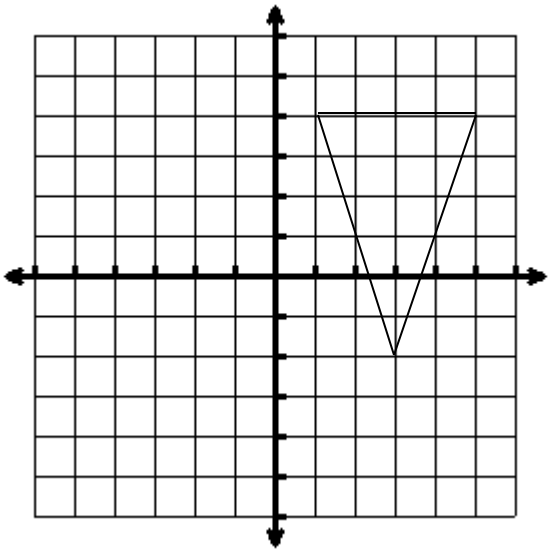
E (1, 4) → E' _____

F (3, -2) → F' _____

G (5, 4) → G' _____

Write the general rule:

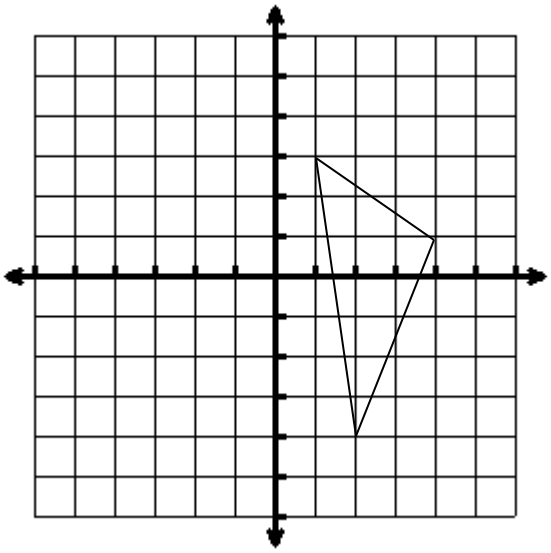
_____



Homework for Rotational Symmetry

The vertices of a polygon are listed. Graph and label each polygon and its image after a given rotation. Name the coordinates of the image.

1. Rotate figure WXY about the origin 90° counterclockwise.



W (2,-4) → W' _____

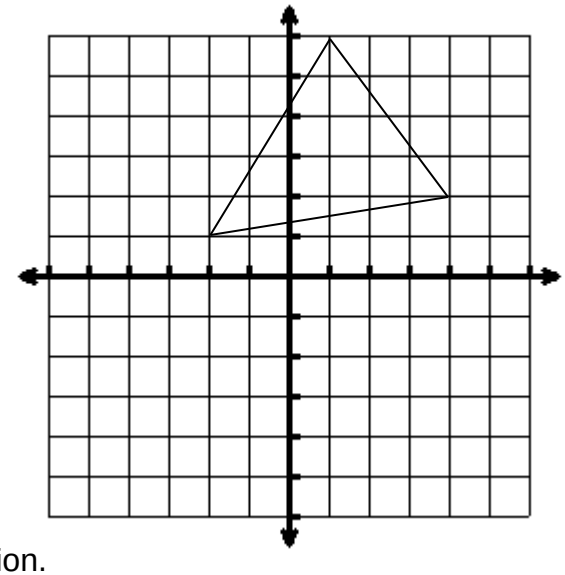
X (1, 3) → X' _____

Y (4, 1) → Y' _____

Write the general rule:

_____

2. Rotate figure JKL about the origin 90° clockwise



J (-2, 1) → J' _____

K (1, 6) → K' _____

L (4, 2) → L' _____

Write the general rule:

_____

For each figure state the order and the angle of rotation.

3. 
Order: _____
Angle : _____

4. 
Order: _____
Angle : _____

5. 
Order: _____
Angle : _____

6. 
Order: _____
Angle : _____

7. 
Order: _____
Angle : _____

8. 
Order: _____
Angle : _____

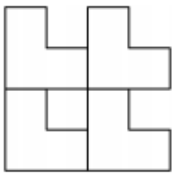
Homework is continued on the next page.

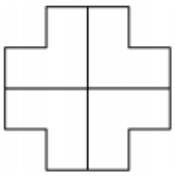
Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

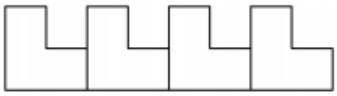
9. Irene is making a tessellation using the shape shown below.

Which of the following tessellations can be made using only a clockwise rotation?

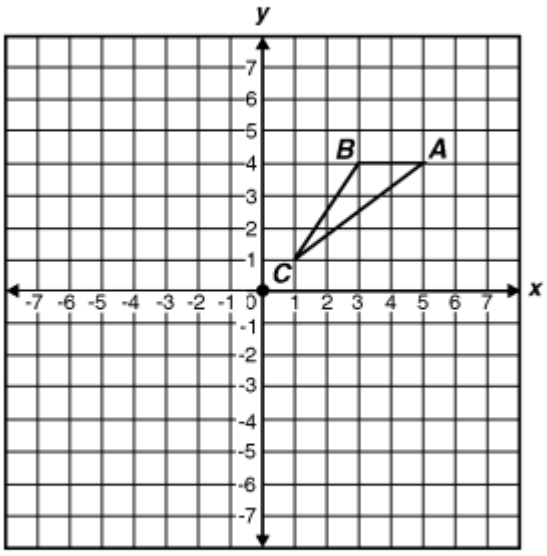
A.


B.


C.


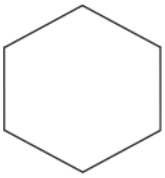
D.


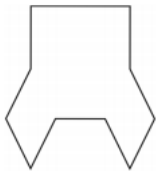
10. If triangle *ABC* is rotated 180 degrees about the origin, what are the coordinates of *A′*?

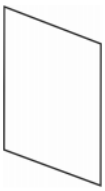


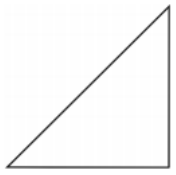
A. (−5, −4)
B. (−5, 4)
C. (−4, 5)
D. (−4, −5)

11. Which figure has a line of symmetry and rotational symmetry?

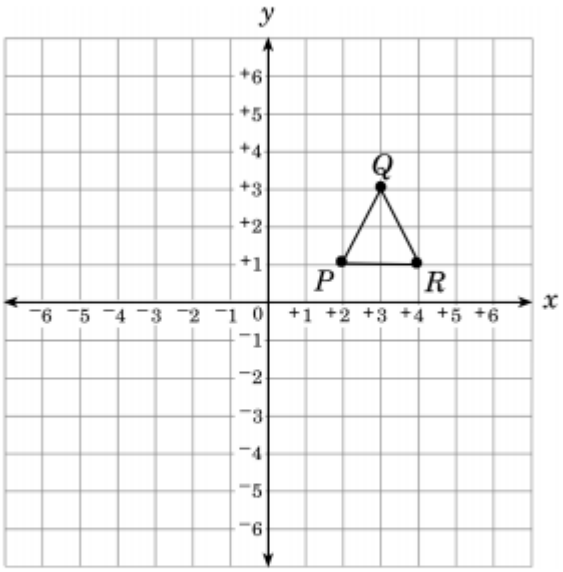
A.


C.


B.


D.


12. Triangle *PQR* will be rotated 90° counterclockwise about the origin.

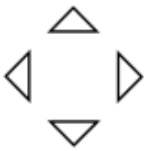


What will be the coordinates of *R′*?

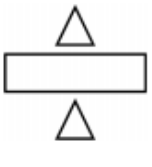
A. (4, 1)
B. (0, 4)
C. (−1, −4)
D. (−1, 4)

13. Which figure below has line symmetry but *does not* have rotational symmetry?

A.


B.


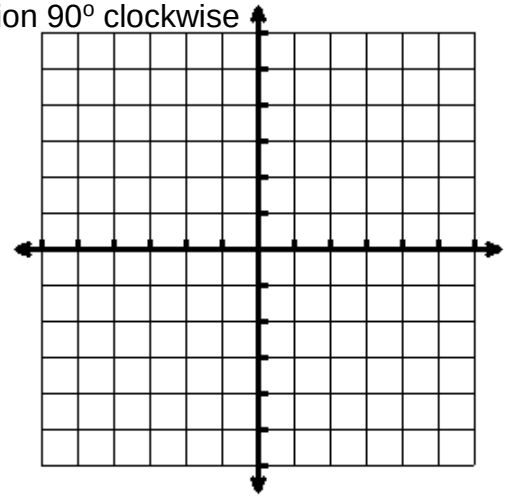
C.


D.


More Rotational Symmetry

Plot and label the figure on each coordinate grid. Make the transformation that is indicated. State the transformed coordinates and the general rule.

1. Rotation 90º clockwise



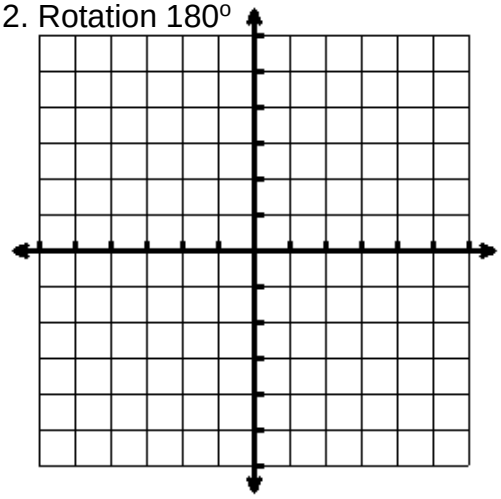
A (-2, -1) A' _____

B (-2, 3) B' _____

C (-5, 3) C' _____

General Rule: _____

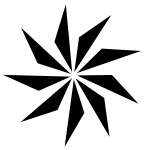
2. Rotation 180º



D (-4, 5) D' _____

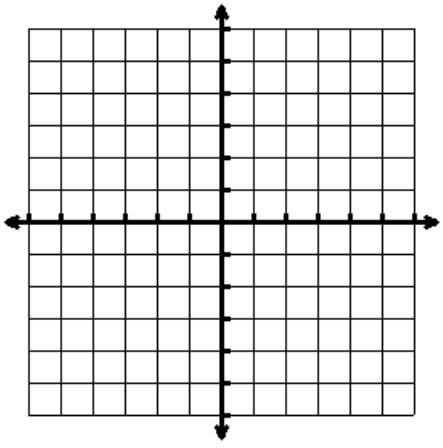
E (-6, -4) E' _____

F (-2, -1) F' _____



General Rule: _____

3. Rotation 90º counterclockwise



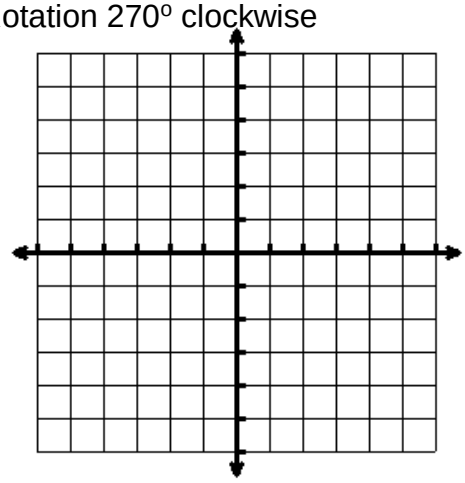
G (2, -4) G' _____

H (4, 3) H' _____

I (6, -4) I' _____

General Rule: _____

4. Rotation 270º clockwise



J (-1, 4) J' _____

K (-6, 1) K' _____

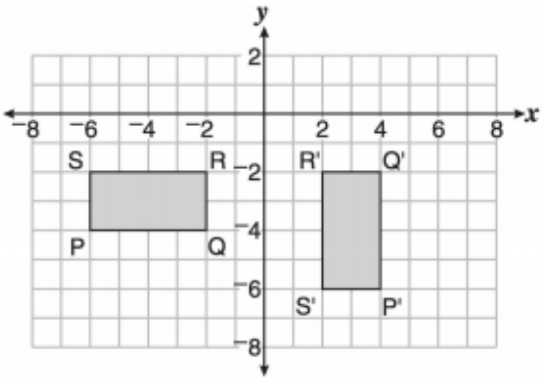
L (-1, 1) L' _____

General Rule: _____

Homework is continued on the next page.

Multiple c hoice: The following are multiple choice questions. Circle the letter next to the answer.

5. The figure below depicts a coordinate plane, rectangle PQRS, and the image of rectangle PQRS after a transformation. Point P' is the image of point P, Q' is the image of Q, R' is the image of R, and S' is the image of S.



Which transformation produced the image P'Q'R'S'?

A. a 180-degree counterclockwise rotation about the point (0, 0)

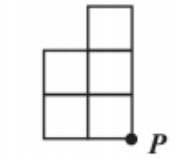
B. a translation of four units to the right

C. a 90-degree counterclockwise rotation about the point (0, 0)

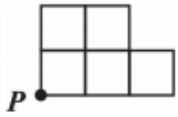
D. a reflection over the *y*-axis

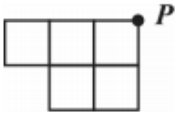
6. Betty drew the figure shown below.

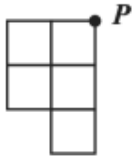
Betty's Figure

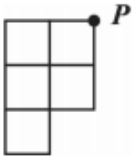


Which of the following shows Betty's figure after it has been rotated 90° *clockwise* about point *P*?

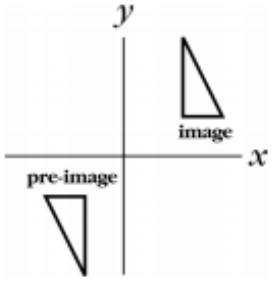
A. 

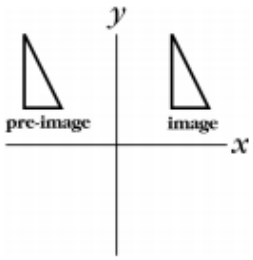
B. 

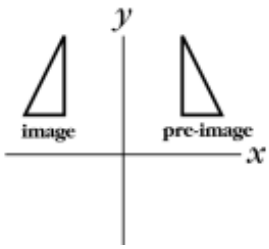
C. 

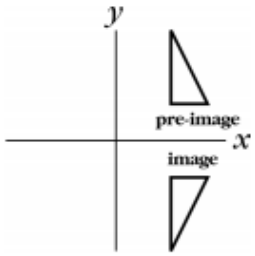
D. 

7. Which diagram below best shows a *rotation* of the pre-image to the image?

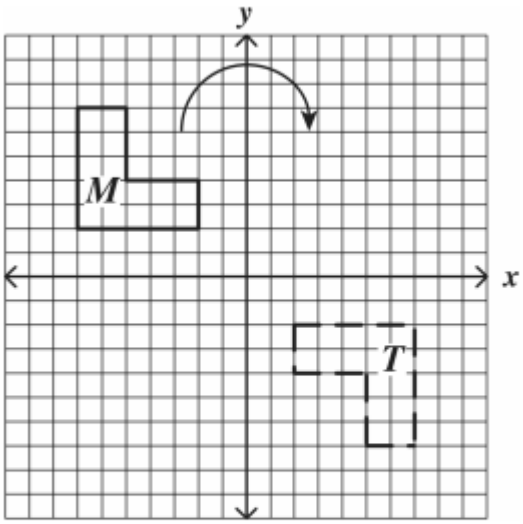
A. 

C. 

B. 

D. 

8. In the graph below, figure *M* was rotated clockwise about the origin to generate figure *T*.



What was the angle of rotation of figure *M* about the origin?

A. 90° B. 180°

C. 270° D. 360°

Homework is continued on the next page.

9. A polygon has been rotated about the origin. Which statement must be true?

   A. The lengths of the sides are doubled.

   B. The area of the polygon did not change.

   C. The coordinates of the vertices did not change.

   D. The area of the polygon is 4 Times its original area.

10. The following figure is to be rotated 90° clockwise.

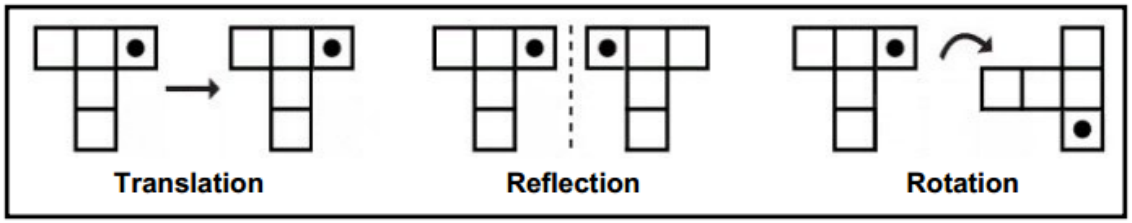
What will the figure look like after the rotation?

A. 

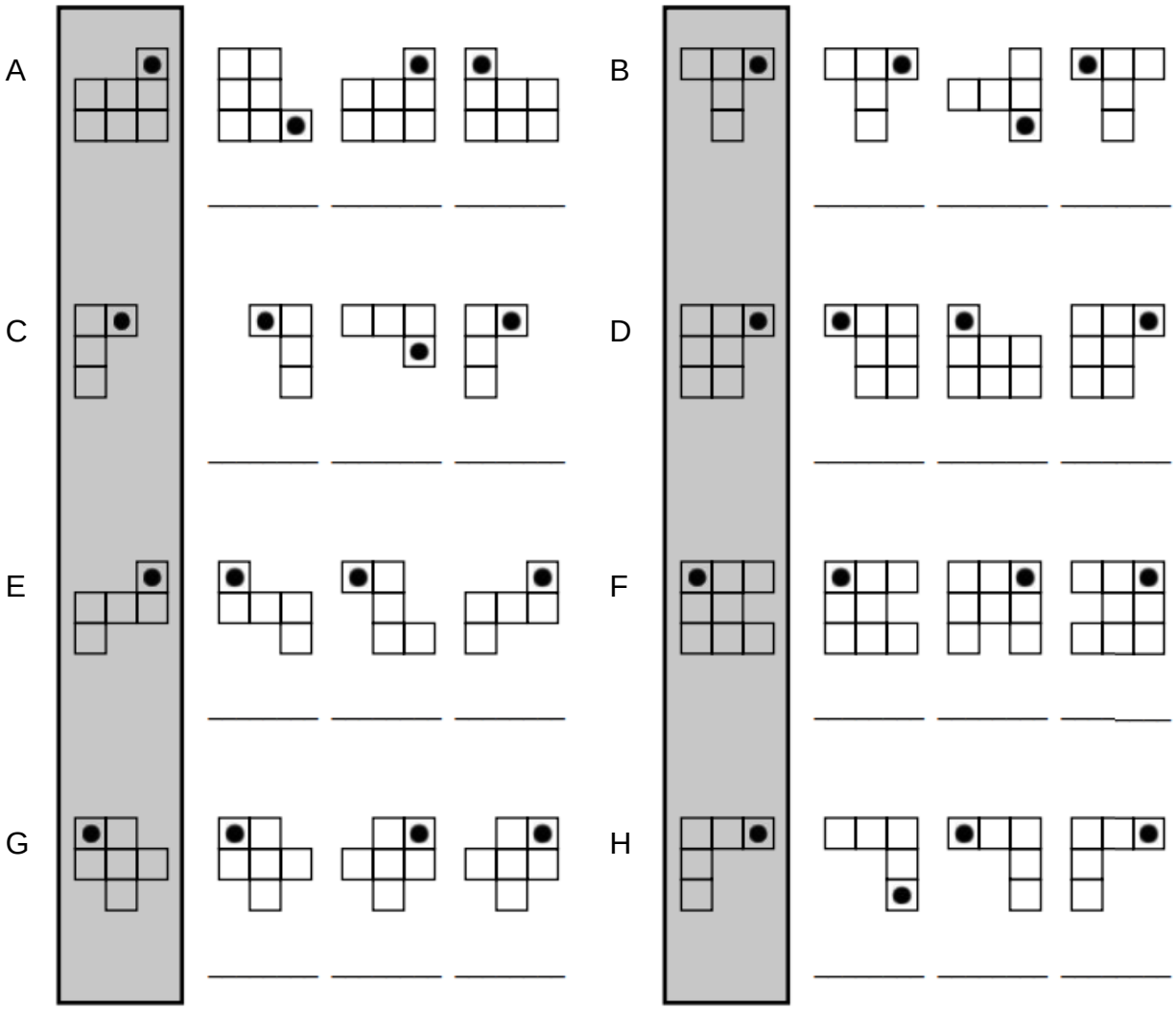
B. 

C. 

D. 

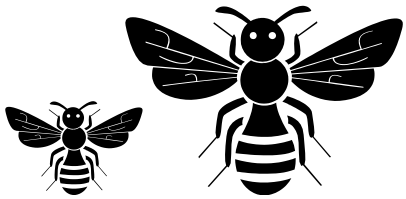


11. Identify each shape as translation, rotation, and reflection.



Dilations

Dilations



A transformation in which a polygon is enlarged or reduced by a given factor around a given center point.

Dilation is where the polygon grows or shrinks but keeps the same overall shape. It's a little like zooming in or out on a camera.

The transformed figure is called the dilated image of the original

Scale factor

The amount by which the image grows or shrinks is called the "Scale Factor".

- If the scale factor is say 2, the image is enlarged to twice the size of the original.
- If it is 0.5, the image is reduced to half the size.
- When the scale factor is 1, the image is the exact same size as the original.

Remember: In dilation, **multiply** the dimensions of the original by the scale factor to get the dimensions of the image.

Original and image are similar

In dilation, the image and the original are <u>similar</u>, in that they are the same shape but not necessarily the same size. They are **not** <u>congruent</u> because that requires them to be the same shape **and** the same size, which they are not (unless the scale factor happens to be 1.0).

NOTES for Dilations

1. Dilate figure WXY by a **scale factor of 2**.

Plot and label the original and the dilated figure.

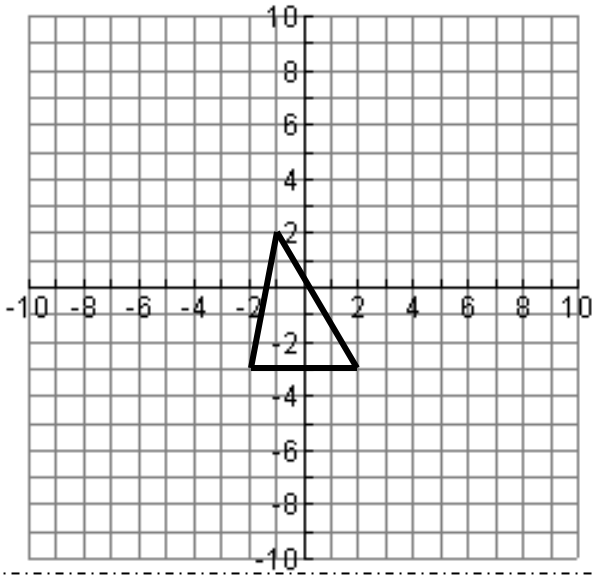
W (-1, 2) → W' _____

X (-2, -3) → X' _____

Y (2, -3) → Y' _____

Find the area of the original figure: _____

Find the area of the dilated figure: _____

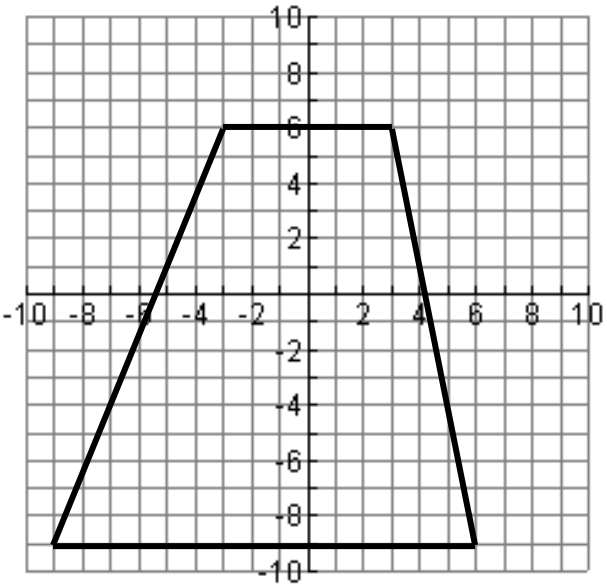


Write a general rule for the dilation:

_____

NOTES for Dilations

2. Dilate figure ABCD by a **scale factor of $\frac{1}{3}$.**
Plot and label the original and the dilated figure.



A (-3, 6) → A' _____

B (-9, -9) → B' _____

C (6, -9) → C' _____

D (3, 6) → D' _____

Find the area of the original figure: _____

Write a general rule for the dilation:

_____

Find the area of the dilated figure: _____

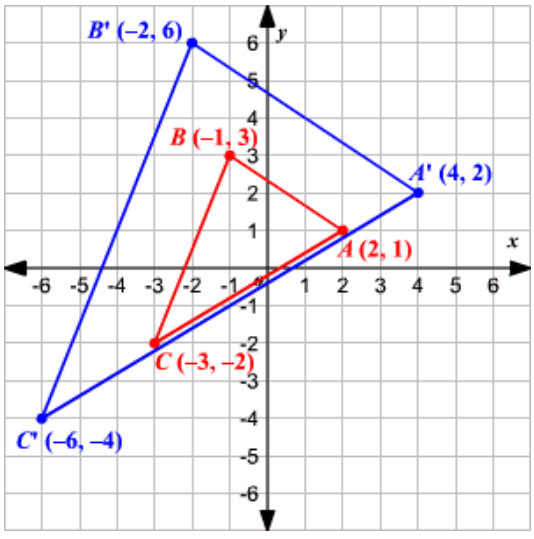
State the scale factor of the following dilations:

3. (2, 4) → (10, 20) ____ 4. (-15, 27) → (-5, 9) _____ 5. (3, 7) → (12, 28) _____

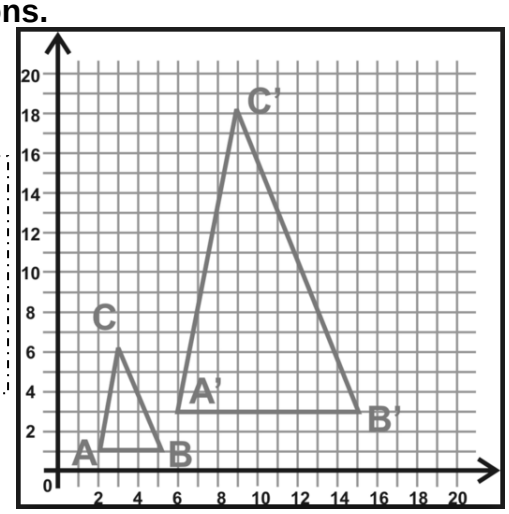
Write the general rule for the transformation.

6. (14, 6) → (7, 3) _____ 7. (-1, 3) → (-5, 15) _____

Name the scale factor for the folowing dilations.



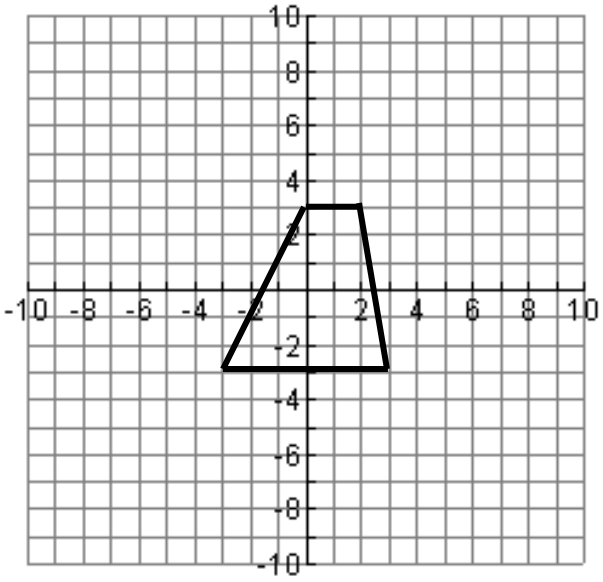
#8. Scale Factor: _____



#9 Scale Factor: _____

Homework for Dilations

1. Dilate figure WXYZ by a **scale factor of 3**.
Plot and label the original and the dilated figure.



W (0, 3) → W' _____

X (2, 3) → X' _____

Y (3, -3) → Y' _____

Z (-3, -3) → Z' _____

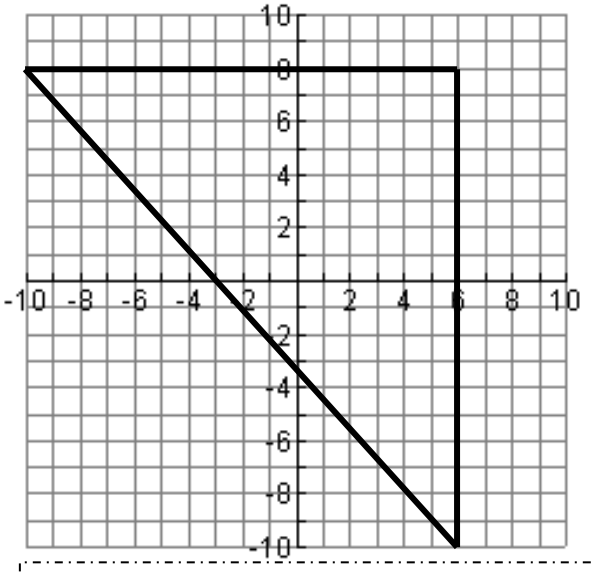
Find the area of the original figure: _____

Find the area of the dilated figure: _____

Write a general rule for the dilation:

_____

2. Dilate figure ABC by a **scale factor of $\frac{1}{2}$.**
Plot and label the original and the dilated figure.



A (-10, 8) → A' _____

B (6, 8) → B' _____

C (6, -10) → C' _____

Find the area of the original figure: _____

Find the area of the dilated figure: _____

Write a general rule for the dilation:

_____

State the scale factor of the following dilations:

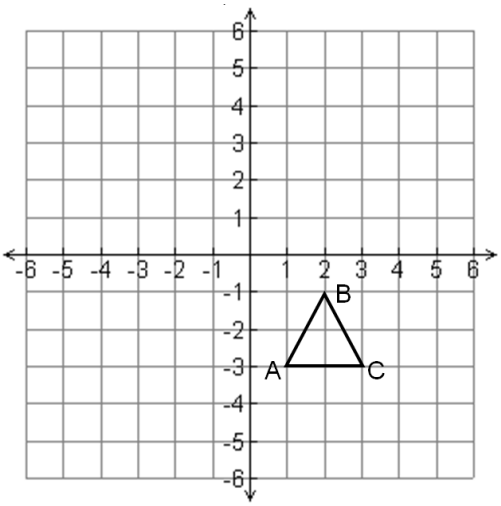
3. (3, 4) → (12, 16) ____ 4. (-15, 50) → (-3, 10) _____ 5. (1, 9) → (6, 54) _____

Write the general rule for the dilation.

6. (21, 6) → (7, 2) _____ 7. (2, 15) → (4, 30) _____

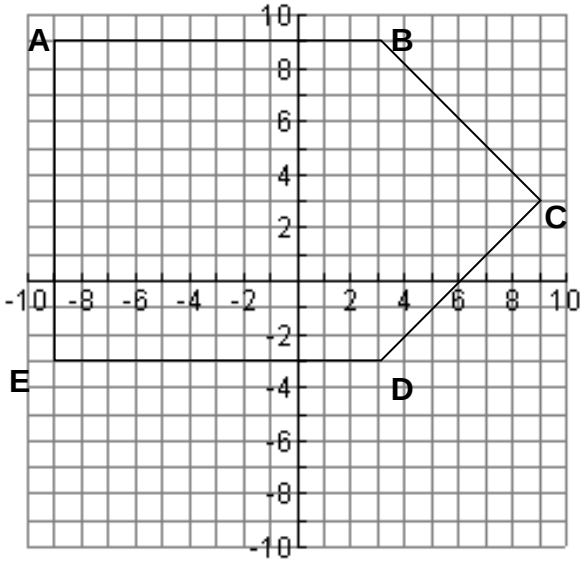
Homework is continued on the next page.

8. Draw the dilation image of triangle ***ABC*** with the center of dilation at the origin and a scale factor of 2. (Hint: write down the coordinates first.)



Is the dilation an enlargement or reduction?

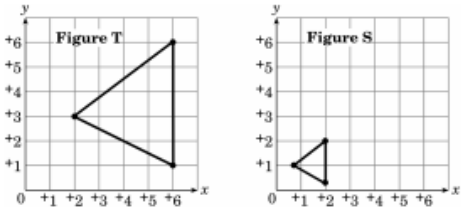
9. Draw the dilation image of pentagon ***ABCDE*** with the center of dilation at the origin and a scale factor of 1/3. (Hint: write down the coordinates first.)



Is the dilation an enlargement or reduction?

Multiple choice: The following are mu ltiple choice questions. Circle the letter next to the answer.

10. Figure *S* is the result of a dilation of Figure *T*.



What is the scale factor of the dilation?

A. $\frac{1}{3}$ B. $\frac{1}{2}$ C. 2 D. 3

11. A triangle has the following vertices: (–1, 1), (6, –2), and (3, 5). If the triangle undergoes a dilation with a scale factor of 3, what will be the vertices of the image?

A. (–3, 3), (18, –6), (9, 15)

B. (3, 3), (18, 6),(9, 15)

C. (–3, 3), (18, 6), (9, 15)

D. (3, 3), (18, –6), (9, 15)

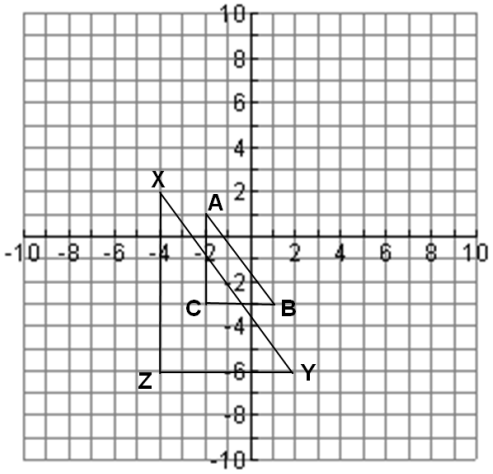
Dilations and Similar Figures

Under a transformation of a dilation, a figure will be similar to the pre-image. This means…

- **the angle measures will remain the same (be congruent)**
- **parallel lines remain parallel**
- **BUT lengths of segments are NOT congruent, but be in equal ratio**

Note: $\cong$ ***means congruent to***
$\sim$ ***means similar to***

Triangle ABC was dilated by a factor of 2 to create triangle XYZ



$\Delta ABC \sim \Delta XYZ$

$\overline{CA} = 4 units$ $\quad\quad$ $\overline{XZ} = \_\_\_\_ units$

$\overline{BC} = 3 units$ $\quad\quad$ $\overline{YZ} = \_\_\_\_ units$

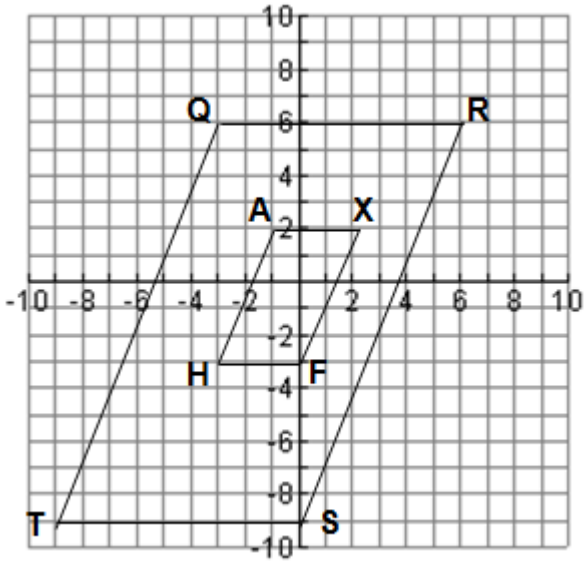
$\overline{AB} = 5\ units$ $\quad\quad$ $\overline{XY} = \_\_\_\_ units$

Name the congruent angles.

$\angle A \cong \_\_\_\_\_$ $\quad$ $\angle B \cong \_\_\_\_\_$ $\quad$ $\angle C \cong \_\_\_\_\_$

Notice the ratio of all the segment measures remains the same.

$Parallelogram\ QRST$ was dilated by a scale factor of $\frac{1}{3}$. Fill in the missing values.



$Parallelogram\ QRST \sim Parallelogram\_\_\_\_\_$

$\overline{QR} = \_\_\_\_ units$ $\quad\quad$ $\overline{AX} = \_\_\_\_ units$

$\overline{TS} = \_\_\_\_ units$ $\quad\quad$ $\overline{HF} = \_\_\_\_ units$

$\overline{QT} \approx 16\ units$ $\quad\quad$ $\overline{SR} \approx \_\_\_\_ units$

$\overline{SR} \approx 16\ units$ $\quad\quad$ $\overline{FX} \approx \_\_\_\_ units$

Name the congruent angles in the smaller parallelogram.

$\angle Q \cong \_\_\_\_$ $\quad$ $\angle R \cong \_\_\_\_$ $\quad$ $\angle S \cong \_\_\_\_$ $\quad$ $T \cong \_\_\_\_$

If $\overline{QR} \parallel \overline{TS}$, then $\overline{AX} \parallel \overline{HF}$. Therefore if $\overline{QT} \parallel \overline{RS}, then$ name two other parallel segments.

_____

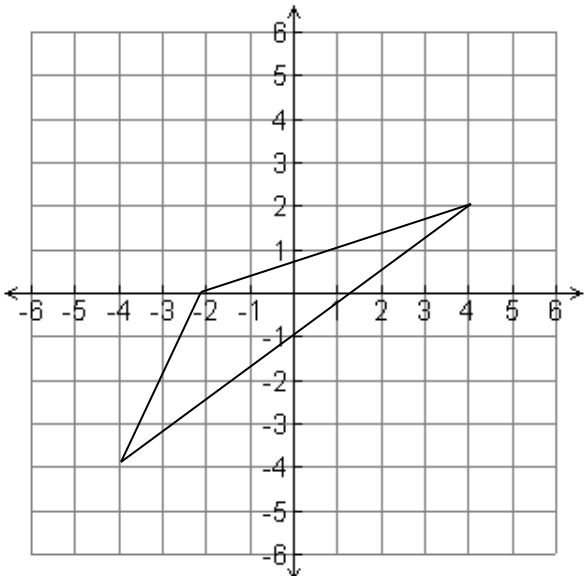
Dilate figure ABC by a **scale factor of $\frac{3}{2}$.**
Plot and label the original and the dilated figure.

A (-2, 0) → A' _____

B (4, 2) → B' _____

C (-4, -4) → C' _____

State the general rule: _____



Homework

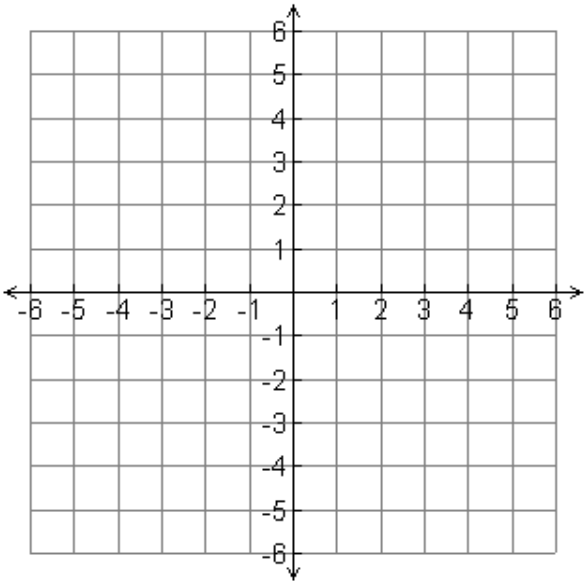
1) Dilate figure ABC by a **scale factor of 2.**
Plot and label the original and the dilated figure.

A (-2, 1) → A' _____

B (-2, 3) → B' _____

C (3, 2) → C' _____

State the general rule: _____



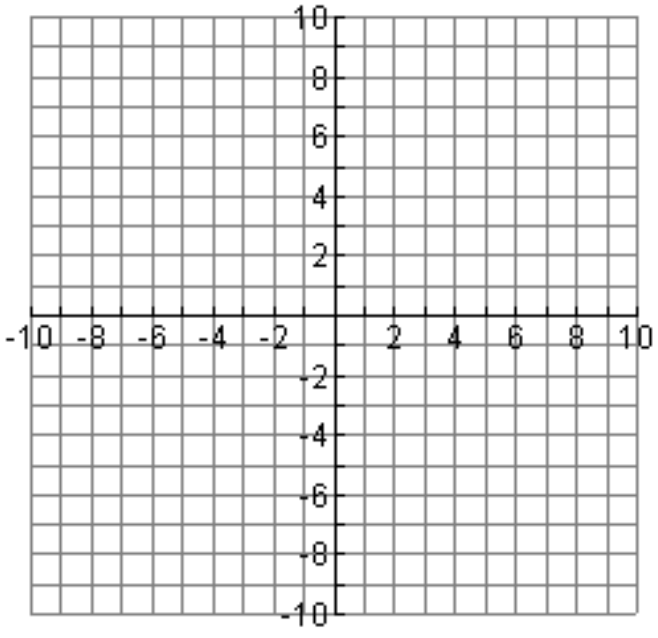
2) Dilate figure ABC by a **scale factor of $\frac{1}{2}$.**
Plot and label the original and the dilated figure.

A (-10, 8) → A' _____

B (-8, 6) → B' _____

C (-6, -10) → C' _____

State the general rule: _____



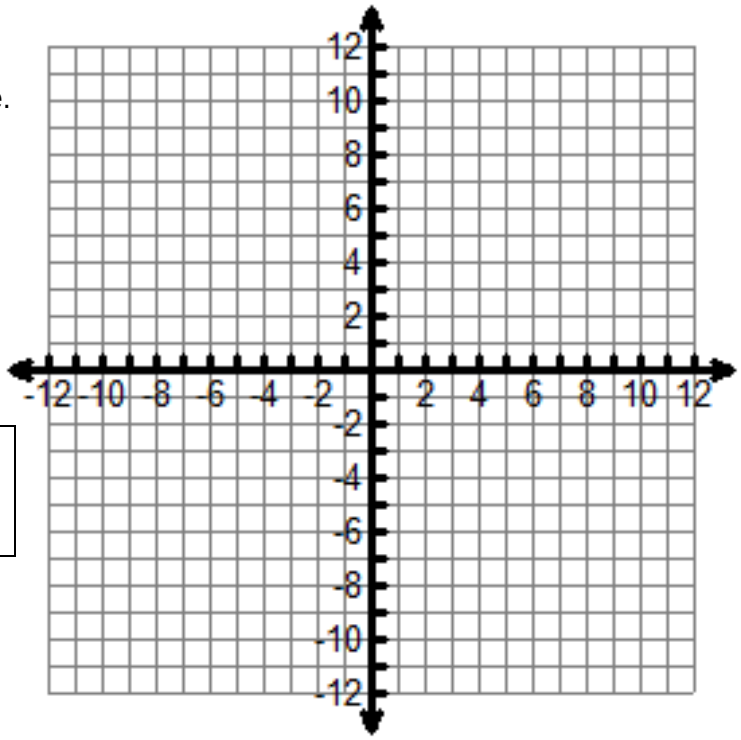
Homework is continued on the next page.

3) Dilate figure ABC by a **scale factor of $\frac{2}{3}$.**
Plot and label the original and the dilated figure.

A (-12, 9) → A' _____

B (9, 6) → B' _____

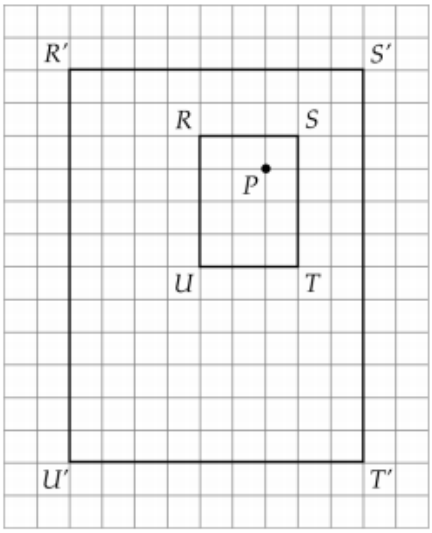
C (6, -12) → C' _____



State the
general rule: _____

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

1. A dilation with center P maps the rectangle $RSTU$ to the rectangle $R'S'T'U'$ as shown below.



What is the scale factor of this dilation?

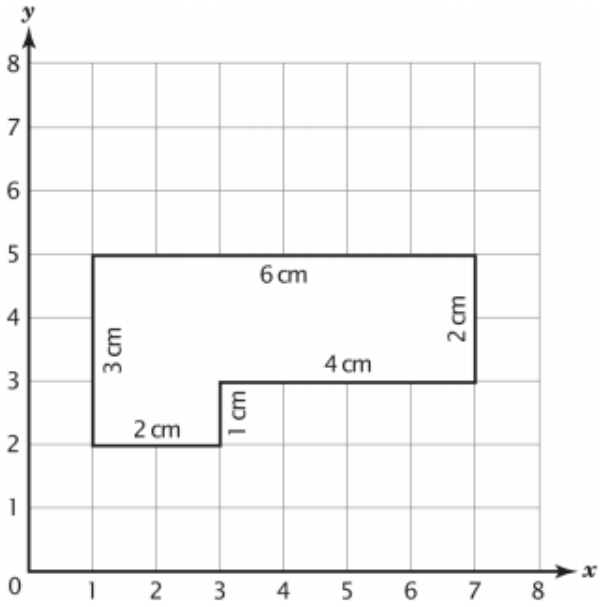
A. 2 B. 3 C. 4 D. 9

2. Which of these transformations can change the area of a polygon?

A. translation B. rotation C. reflection D. dilation

Homework is continued on the next page.

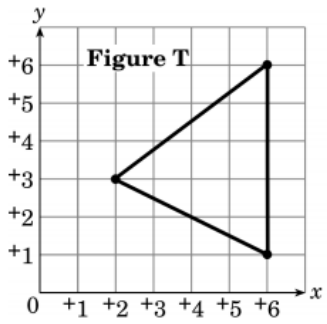
3. Look at the figure on the grid below.

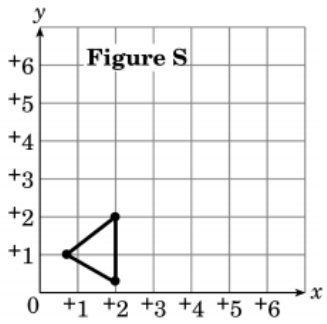


What is the perimeter of the figure after it is dilated (magnified) by a scale factor of 3?

A. 6 centimeters B. 21 centimeters C. 36 centimeters D. 54 centimeters

4. Figure *S* is the result of a dilation of Figure *T*.

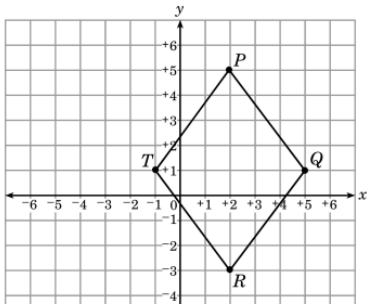




What is the scale factor of the dilation?

A. $\frac{1}{3}$ B. $\frac{1}{2}$ C. 2 D. 3

5. Rhombus *PQRT* is shown

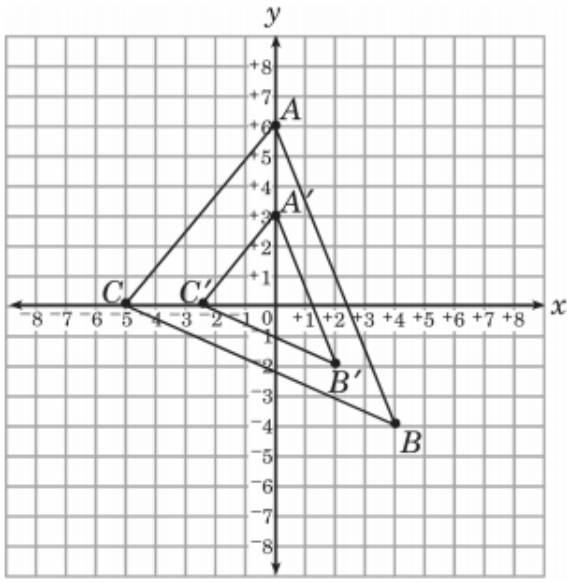


P′Q′R′T′ is the image produced by dilating *PQRT* by a scale factor of 4. What is the length of the diagonal *P′R′*?

A. 2 units B. 8 units C. 12 units D. 32 units

Homework is continued on the next page.

6. In the figure shown below, $\triangle A'B'C'$ is the image produced by applying a dilation to $\triangle ABC$.



What is the scale factor for this dilation?

A. $\frac{1}{3}$ B. $\frac{2}{5}$ C. $\frac{1}{2}$ D. $\frac{5}{2}$

7. A point has the coordinates (4, 8). The point will be dilated by a scale factor of 2. What will be the coordinates of the image point?

A. (6, 8) B. (8, 16) C. (24, 28)

8. Triangle ABC has vertices at $A(2, 2)$, $B(2, 7)$, and $C(6, 3)$. This triangle is dilated by a scale factor of 3. What is the location of point C'?

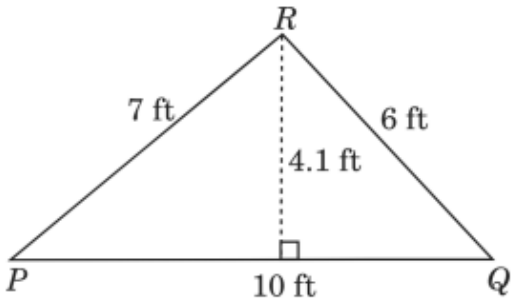
A. (2, 1) B. (6, 6) C. (6, 21) D. (18, 9)

9. The vertices of a rectangle are (0, 0), (0, 4), (2, 4), (2, 0). Which of the following points is a vertex for the image produced by a dilation with a scale factor of $\frac{1}{2}$?

A. (0, 3) B. (0, 2) C. (0, 1) D. (2, 1)

Homework is continued on the next page.

10. What is the perimeter of a triangle whose dimensions are three times the size of $\triangle PQR$?



A. 23 ft B. 27.1 ft C. 69 ft D. 81.3 ft

11. Triangle ABC has vertices at $A(2, 2)$, $B(2, 7)$, and $C(6, 3)$. This triangle is dilated by a scale factor of 3. What is the location of point C'?

A. $(2, 1)$ B. $(6, 6)$ C. $(6, 21)$ D. $(18, 9)$

12. $\triangle GHJ$ with vertices $G(-2, 4)$, $H(3, 6)$,and $J(3, -2)$ is dilated by a factor of $\frac{1}{3}$. What are the coordinates of the vertex of the image $\triangle G'H'J'$ that lies in the second quadrant?

A. $\left(\frac{-7}{3}, \frac{13}{3}\right)$ B. $\left(\frac{-2}{3}, \frac{4}{3}\right)$ C. $\left(1, \frac{-2}{3}\right)$ D. $(1, 2)$

13. $\triangle GHI$ will be dilated by a scale factor of 3, resulting in $\triangle G'H'I$. What rule describes this transformation?

A. $(x', y') = (\frac{1}{3}x, \frac{1}{3}y)$ B. $(x', y') = (3x, 3y)$

C. $(x', y') = (x + 3, y + 3)$ D. $(x', y') = (x - 3, y - 3)$

14. $\triangle XYZ$ is dilated by a factor of $\frac{1}{2}$. What is the ratio of the area of $\triangle XYZ$ to the area of its image, $\triangle X'Y'Z'$?

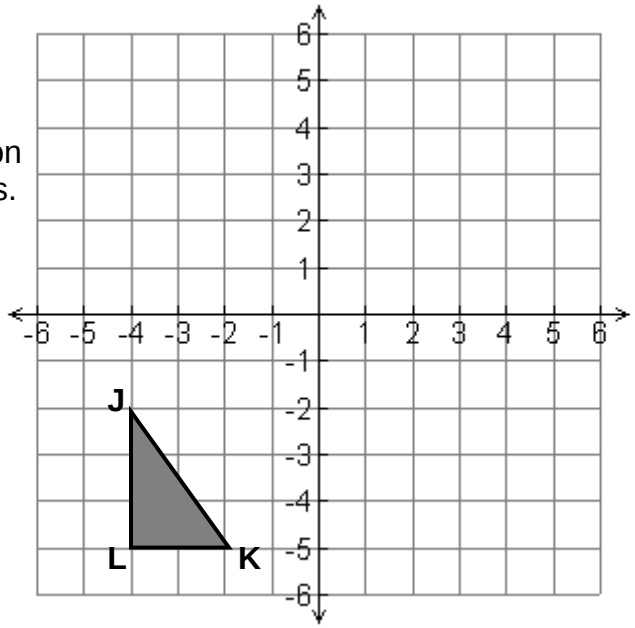
A. 4 : 1 B. 2 : 1 C. 1 : 2 D. 1 : 4

Combined Transformations

A combined transformation is just a series of two or more transformations performed on the same figure.

EXAMPLES of Double Transformations

1. Using triangle JKL, find each point of reflection over the y-axis and then a translation up 5 units.



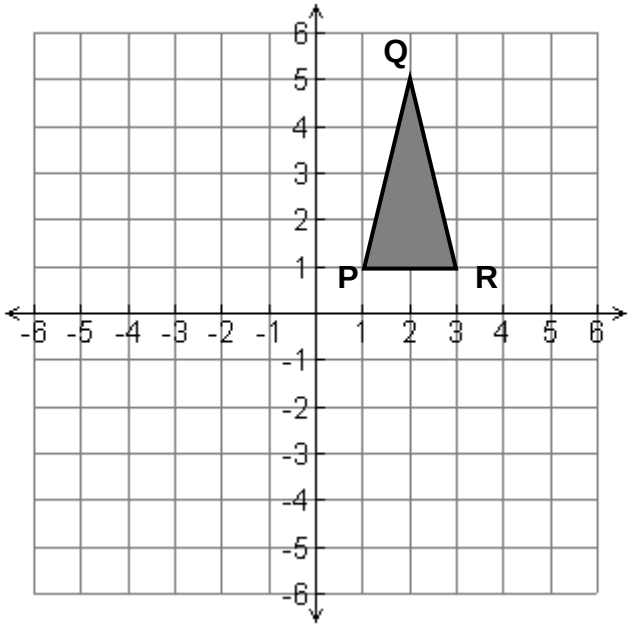
J _____ J' _____ J" _____

K _____ K' _____ K" _____

L _____ L' _____ L" _____

Draw triangle J'K'L' and J"K"L"

2. Using figure PQR, find each point for a rotation 180^{o} about the origin and a translation right 5 units and up 1 units.



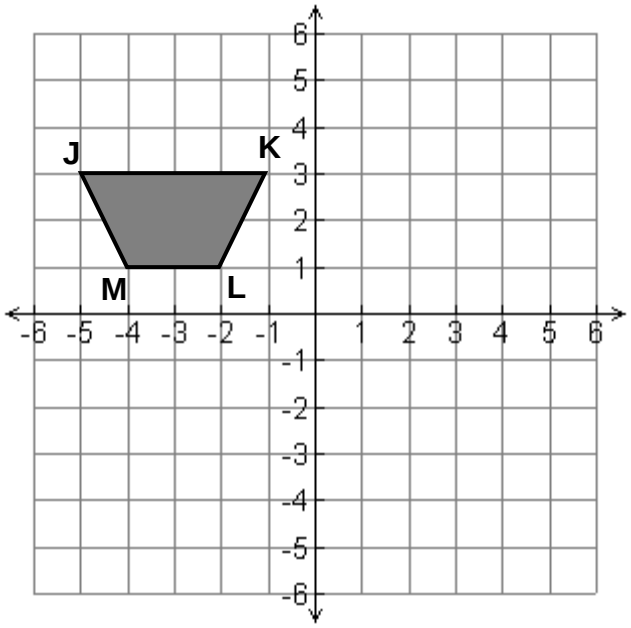
P _____ P' _____ P" _____

Q _____ Q' _____ Q" _____

R _____ R' _____ R" _____

Draw triangle P'Q'R' and P"Q"R"

Homework on Combined Transformations



1. Using figure JKLM, find each point for a reflection over the x-axis and a translation down 3 units.

J _____ J' _____ J" _____

K _____ K' _____ K" _____

L _____ L' _____ L" _____

M _____ M' _____ M" _____

Draw figure J'K'L'M' and J"K"L"M"

Find the area of figure JKLM. Show all work.

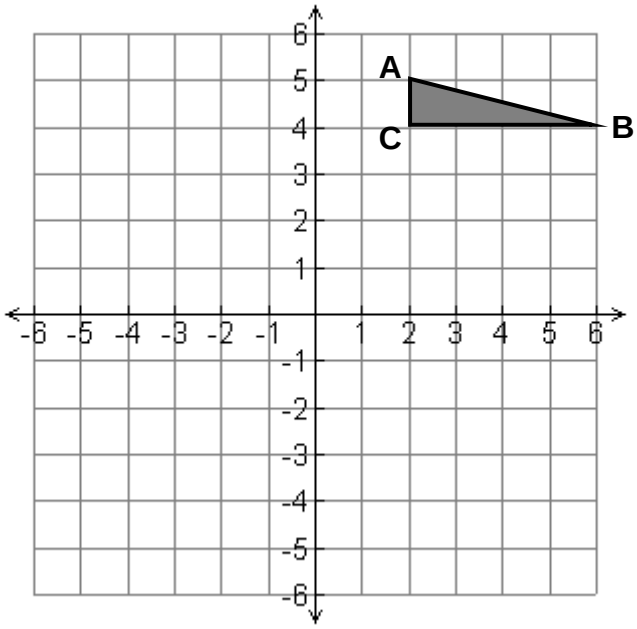
Area: _____

2. Using figure ABC, find each point for a translation left 2 and down 3 and then a rotation of 90ºcounterclock wise.

A _____ A' _____ A" _____

B _____ B' _____ B" _____

C _____ C' _____ C" _____



Draw triangle A'B'C' and A"B"C"

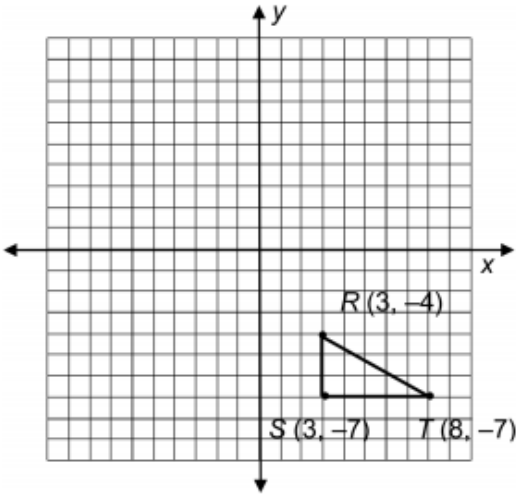
Find the area of figure ABC. Show all work.

Area: _____

Homework is continued on the next page.

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer

3. Triangle *RST* is shown in the coordinate plane.



What are the coordinates of *R′S′T′* if the figure is reflected over the *x*-axis and translated down two units?

A. (1, –6), (1, –9), (6, –9)

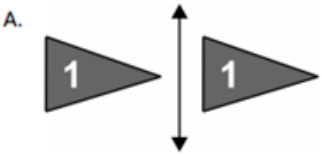
B. (3, 4), (3, 7), (8, 7)

C. (1, 2), (1, 5), (6, 5)

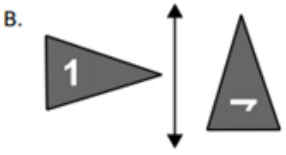
D. (3, 2), (3, 5), (8, 5)

4. Which figure shows the flag on the left after it has been flipped across the line and then rotated 90° clockwise?

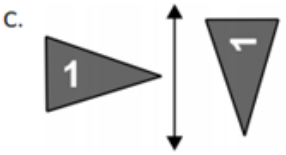
A.



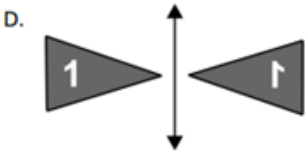
B.



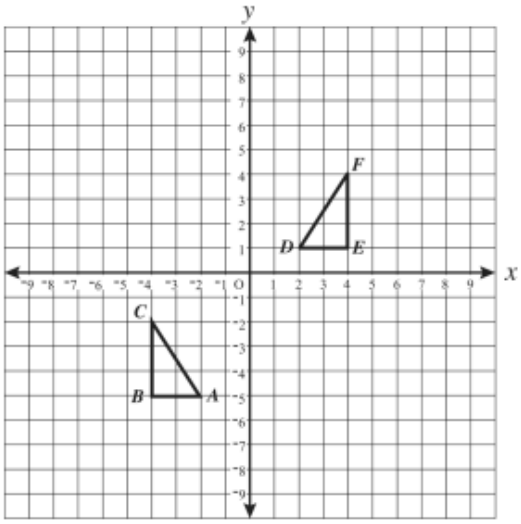
C.



D.



5. △*ABC* and △*DEF* are shown on the grid below.



Which of the following transformations will map △*ABC* onto △*DEF*?

A. Reflect △*ABC* over the *y*-axis and shift up 6 spaces.

B. Reflect △*ABC* over the *x*-axis and shift up 6 spaces.

C. Reflect △*ABC* over the *y*-axis and shift down 6 spaces.

D. Reflect △*ABC* over the *y*-axis, reflect over the *x*-axis, and shift down 4 spaces.

6. Three transformations will be performed on triangle *ABC*. Which set of transformations will always produce a congruent triangle?

A. dilation, rotation, translation

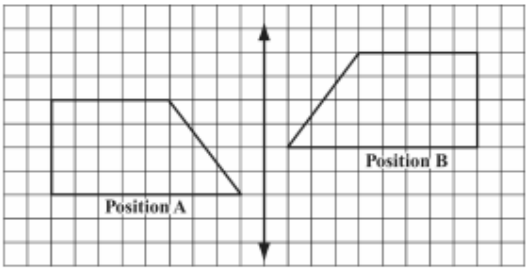
B. reflection, dilation, translation

C. rotation, reflection, dilation

D. rotation, translation, reflection

Homework is continued on the next page.

7. A shape was moved from Position *A* to Position *B*, as shown below.



Which of the following best describes how the shape was moved from Position *A* to Position *B*?

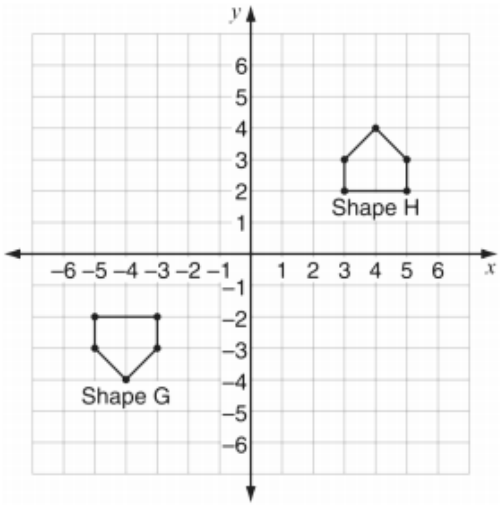
A. flipped over the line, then slid up

B. flipped over the line, then slid down

C. flipped over the line, then turned 90° clockwise

D. flipped over the line, then turned 90° counterclockwise

8. Look at Shape G and Shape H on this grid.



Which transformations will show that Shape G is congruent to Shape H?

A. Translate Shape G right 8 units and then reflect it across the *y*-axis.

B. Translate Shape G right 6 units and then reflect it across the *x*-axis.

C. Translate Shape G right 8 units and then reflect it across the *x*-axis.

D. Translate Shape G up 6 units and then reflect it across the *y*-axis.

9.

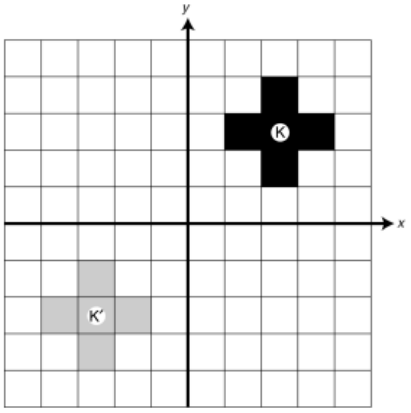


Figure K′ is the result of a sequence of transformations of Figure K. Which of the following does *not* describe a correct possible sequence of transformations?

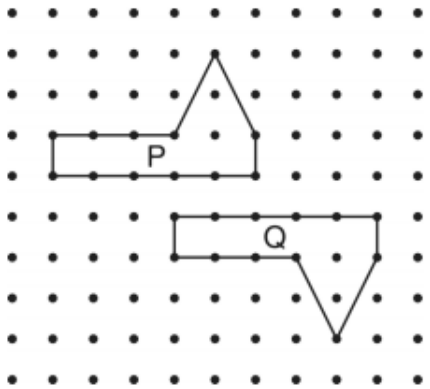
A. a translation of Figure K down 5 units, then a translation to the left 5 units

B. a reflection of Figure K across the *x*-axis, then a translation to the left 5 units

C. a reflection of Figure K across the *y*-axis, then a translation down 4 units

D. a reflection of Figure K across the *x*-axis, then a reflection across the *y*-axis

10. Look at Figure P and Figure Q.



Which motion or motions will result in Figure P exactly covering Figure Q?

A. slides only

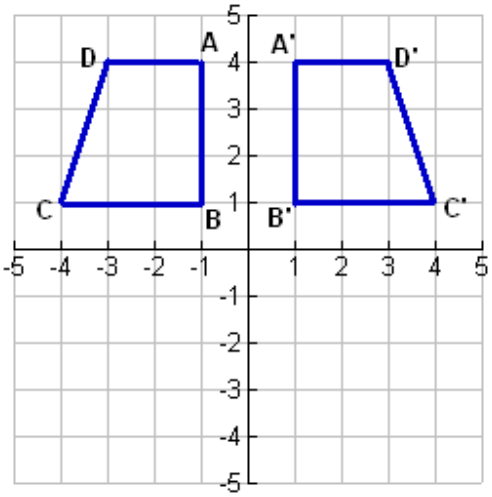
B. turns only

C. flips and turns only

D. flips and slides only

Review for Unit Test

1. Identify the coordinates of the pre-image and the image. State the line of reflection and the general rule for the reflection.



A _____ → A' _____

B _____ → B' _____

C _____ → C' _____

D _____ → D' _____

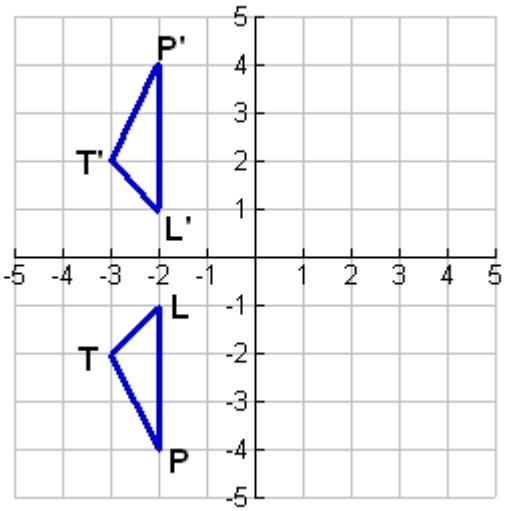
Line of reflection: _____

General rule: _____

What is the area of the pre-image?

Formula:
Work:

2. Identify the coordinates of the pre-image and the image. State the line of reflection and the general rule for the reflection.



P _____ → P' _____

L _____ → L' _____

T_____ → T' _____

Line of reflection: _____

General rule: _____

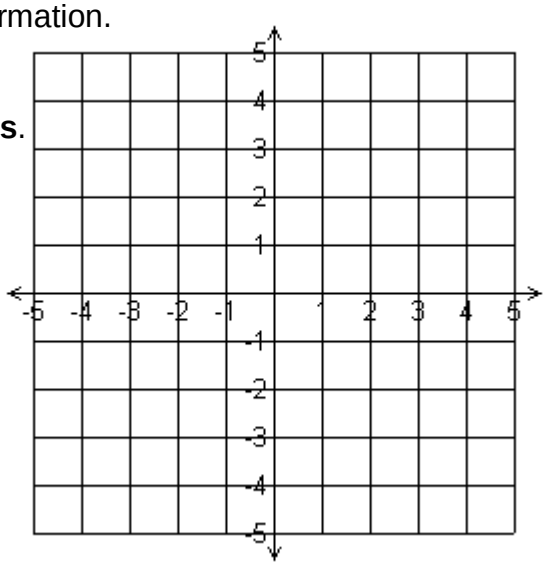
What is the area of the pre-image?

Formula:
Work:

Homework is continued on the next page.

Graph and label each polygon. Reflect the pre-image over the given line. Name the coordinates of the image. State the rule for the transformation.

3. Reflect over **y = 0.** This is also named the **x-axis**.



A (0, 3) → A' _____

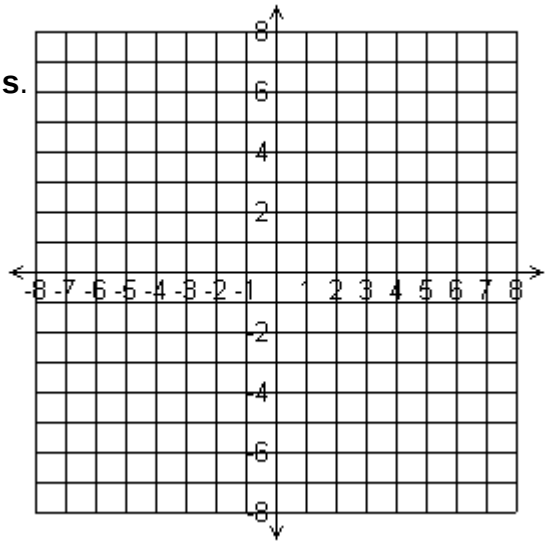
B (4, 3) → B' _____

C (5, 2) → C' _____

D (1, 0) → D' _____

General rule: _____

4. Reflect over **x = 0.** This is also named the **y-axis**.



P (-7, 2) → P' _____

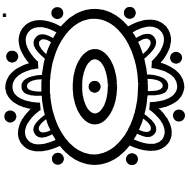
O (-6, -6) → O' _____

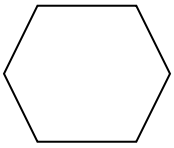
L (-1, -2) → L' _____

General rule: _____

Draw all of the **lines of symmetry** for each figure. If the figure does not have reflectional (or line) symmetry, write "none."

5. 

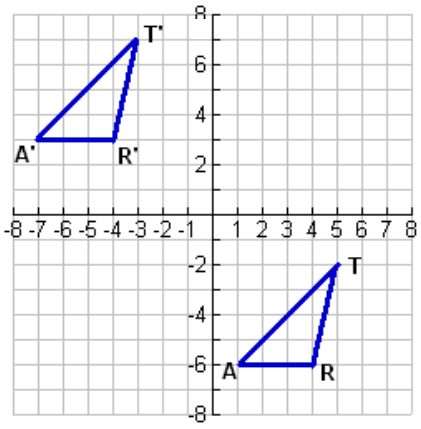
6. 

7. 

(Hint: This is a regular hexagon.)

Homework is continued on the next page.

8. Name the coordinates of the pre-image and its image. State the general rule for the transformation.



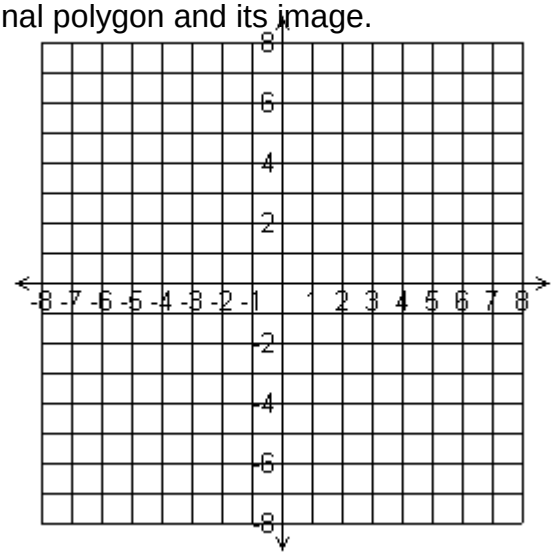
T _____ → T' _____

A _____ → A' _____

R_____ → R' _____

General rule: _____

9. The vertices of a polygon are listed. Name the coordinates of the image given the general rule for the translation. Graph and label the original polygon and its image.



General rule: (x, y) → (x + 3 , y)

D (-4, 1) → D' _____

R (0, 6) → R' _____

A (0, 1) → A' _____

10. A point and its image after a translation are given. Write a rule to describe the translation.

a. The translation that takes A (1, -5) to A' (-5, -2) (x, y) → _____

b. The translation that takes B (7, -3) to B' (7, -8) (x, y) → _____

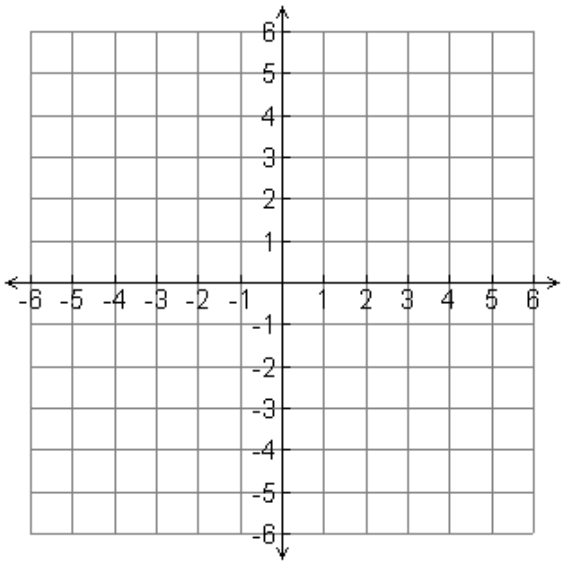
11. A figure is moved on a coordinate plane the number of units indicated below. Write a general rule for the transformation.

a. 3 units down and 5 units to the right
General rule: _____

b. 2 units left and 1 unit up
General rule: _____

Homework is continued on the next page.

12. a. Plot and label these points:
A(1, 1); B(-1, -1); C(1, 2)



b. Using the following transformation
(x, y) → (3x, 3y)

Write the new coordinates:

A' _____ B' _____ C' _____

c. Plot the new points.

d. Name the scale factor: _____

13. A point and its image after a dilation are given. Write a rule to describe the dilation.

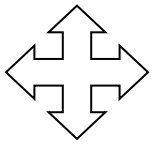
a. The dilation that takes A (1, -5) to A' (5, -25) (x, y) → _____

b. The dilation that takes B (4, 20) to B' (1, 5) (x, y) → _____

c. The dilation that takes C (-27, -9) to C' (-9, -3) (x, y) → _____

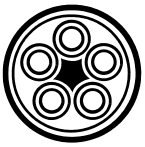
d. The dilation that takes D (2, 8) to D' (4, 16) (x, y) → _____

14. For each figure state the order and the angle of rotation.

a. 

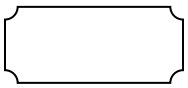
Order: _____

Angle : _____

b. 

Order: _____

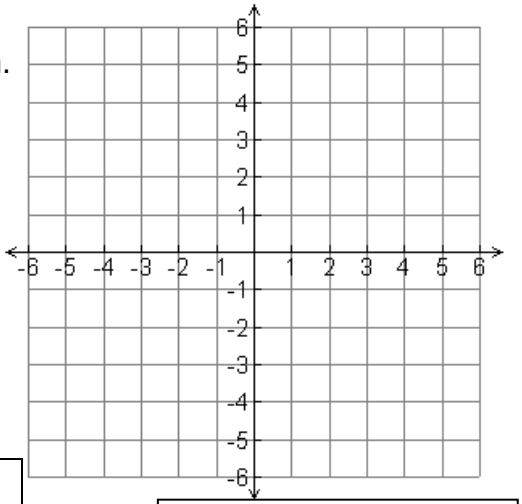
Angle : _____

c. 

Order: _____

Angle : _____

15. The vertices of a polygon are listed. Graph and label the polygon and its image after a given rotation. Name the coordinates of the image.



Rotate figure CDE about the origin 90° counterclockwise.

C (0, 1) → C' _____

D (-2, 6) → D' _____

E (-4, 1) → E' _____

Write the general rule: _____

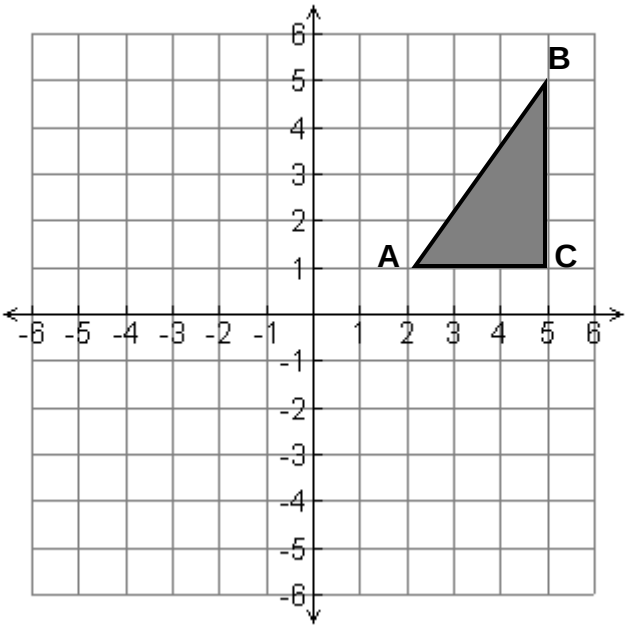
Homework is continued on the next page.

16. Using figure ABC, find each point for a reflection over the y-axis and then a rotation of 90ºcounterclock wise.

A _____ A' _____ A" _____

B _____ B' _____ B" _____

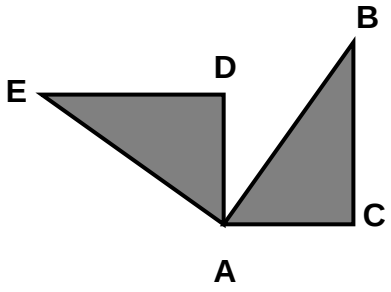
C _____ C' _____ C" _____



Draw triangle A'B'C' and A"B"C"

Use the transformation below for questions 17 and 18.

Triangle ABC is rotated 90º counterclockwise to create triangle AED

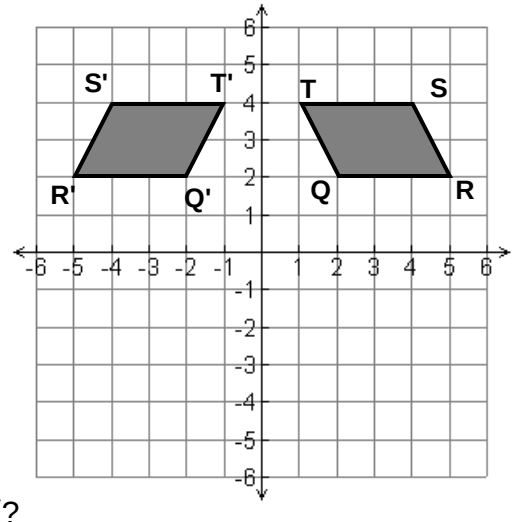


17. Which angle is congruent to $\angle B$? _____

18. Which side is congruent to $\overline{AC}$? _____

Use the coordinate plane to the right for questions 19-21.

Parallelogram QRST is reflected over the y-axis to create parallelogram Q'R'S'T'



19. Which angle is congruent to $\angle S$? _____

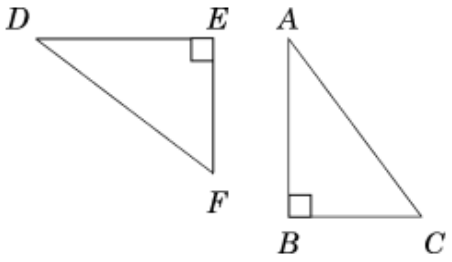
20. Which side is congruent to $\overline{QT}$? _____

21. $\overline{QR}$ is parallel to $\overline{TS}$. Which side is parallel to $\overline{Q'R'}$? _____

Homework is continued on the next page.

Multiple choice: The following are multiple choice questions. Circle the letter next to the answer.

22. If $\triangle DEF$ is congruent to $\triangle ABC$, which angles are corresponding angles?

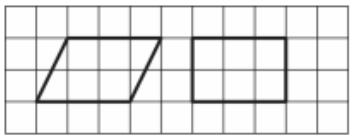


A. $\angle A$ and $\angle D$ B. $\angle B$ and $\angle F$

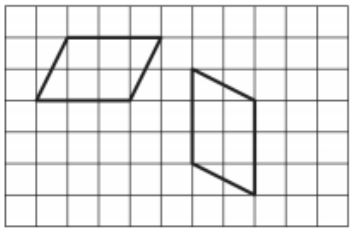
C. $\angle A$ and $\angle F$ D. $\angle A$ and $\angle E$

23. Which of the following pairs of quadrilaterals appears to be congruent?

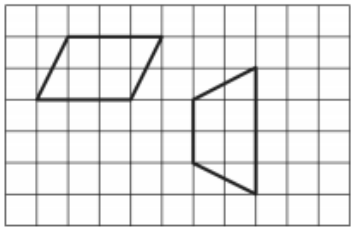
A.



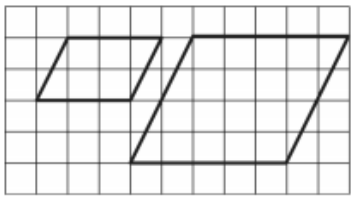
B.



C.



D.



24. Tom draws a triangle on a coordinate plane. Its vertices are $(-1, 0)$, $(0, 1)$, and $(1, 0)$. He then dilates the figure, making its new coordinates $(-3, 0)$, $(0, 3)$, and $(3, 0)$.

What scale factor did Tom use?

A. $\frac{1}{3}$ B. $\frac{1}{2}$ C. 2 D. 3

25. Which of the following transformations always preserves the dimensions of a figure?

I. translation

II. rotation

III. reflection

IV. dilation

A. I, II, and III B. I, II, and IV

C. I, III, and IV D. II, III, and IV

26. The coordinates of the endpoints of $\overline{ST}$ and its image $\overline{S'T'}$ are given below.

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

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

Which of the following single transformations maps $\overline{ST}$ to $\overline{S'T'}$?

A. translation 4 units to the left

B. rotation 180° clockwise about the origin

C. reflection over the x-axis

D. reflection over the y-axis

27. Gregory constructed two congruent polygons.

Which statement about Gregory's polygons is true?

A. One polygon is twice as large as the other polygon.

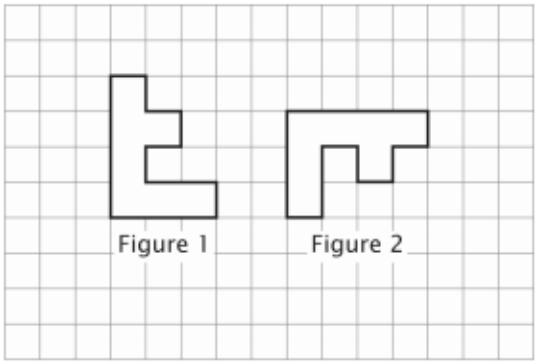
B. One polygon had half the number of lines of symmetry as the other polygon.

C. Each side length of one polygon is equal to the corresponding side length of the other polygon.

D. Each side length of one polygon is greater than the corresponding side length of the other polygon.

Homework is continued on the next page.

28. Study the figures on the grid below.



Which two transformations could be used to change Figure 1 to Figure 2?

A. a flip and a slide

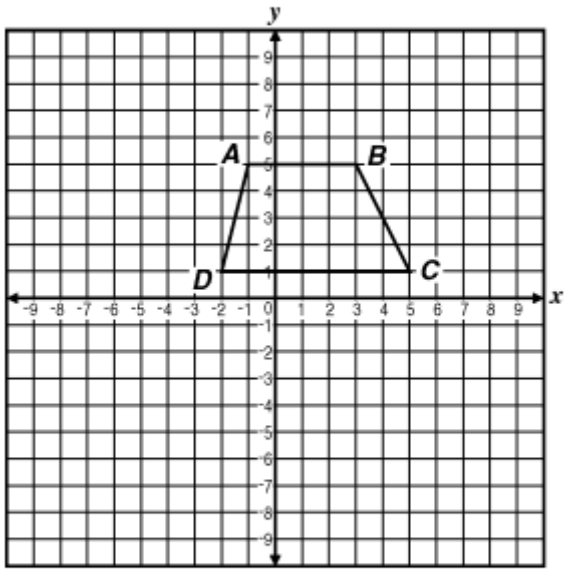
B. a slide and a flip

C. a counterclockwise 90° turn and a slide

D. a clockwise 90° turn and a slide

29. Trapezoid *ABCD* below is to be translated to trapezoid A'B'C'D' by the following motion rule.

$(x, y) \rightarrow (x + 3, y - 4)$

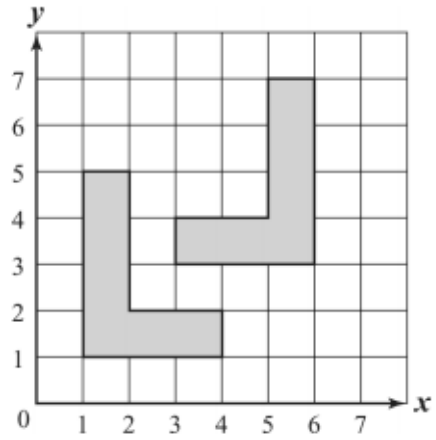


What will be the coordinates of vertex *C'*?

A. (1, –3) B. (2, 1)

C. (6, 1) D. (8, –3)

30. One of the shaded figures in the coordinate grid below is congruent to the other shaded figure.



Which of the following describes a method used for transforming one figure onto the other figure?

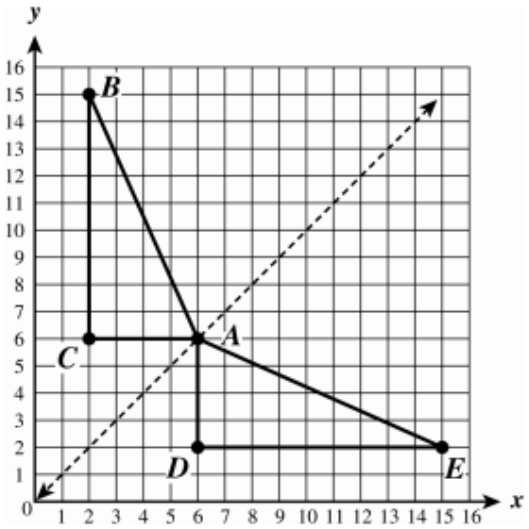
A. a rotation only

B. a translation only

C. a dilation and a rotation only

D. a reflection and a translation only

31. Right triangles *ABC* and *AED* are shownon the coordinate grid below.



Which single transformation, with respect to the line $y = x$, maps $\triangle ABC \rightarrow \triangle AED$?

A. dilation B. reflection

C. rotation D. translation