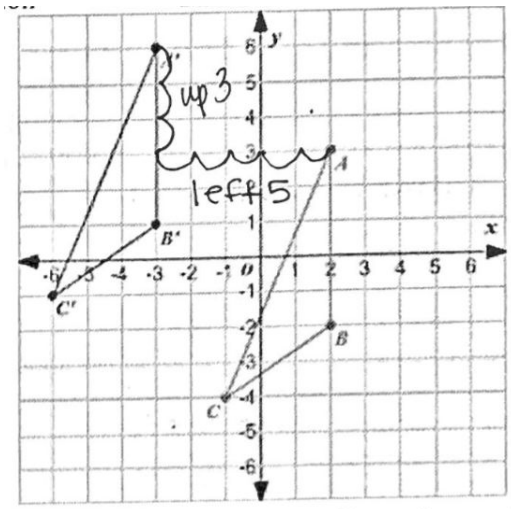
Transformations

A transformation is a process that manipulates a polygon or other two-dimensional object on a plane or coordinate system. There are a total of four transformations, but you will only learn about translations and reflections in 7th grade.

TRANSLATION NOTES:

- ***TRANSLATION is a transformation that SLIDES a figure horizontally (left or right), vertically (up or down), or both on a coordinate plane.***
- ***The original figure is the figure given.***
- ***The image is the figure after it has been translated. (It will have a 'prime' symbol on the letters. For example: A (original) → A' (image)***

When identifying the "Translation Rule", be sure to always start at the original *(which is the figure that does NOT have the prime symbols.)*



Translated left 5 and up 3.

When identifying the "Translation Rule", be sure to always start at the original *(which is the figure that does NOT have the prime symbols.)*

Example #1: Translate the following point horizontally 5 units and vertically 1 unit.

right 5 and up 1

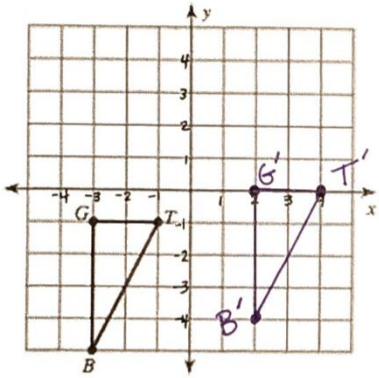


Image Coordinates:

B'(2,-4) G'(2,0) T'(4,0)

Translating a figure WITHOUT a coordinate plane:

- *When translating a figure, add or subtract the given value from its corresponding x- or y-value.*

Example #1: Identify the image coordinates of the rectangle PQSR with coordinates of P(−8, −3), Q(−2, −3), S (−2, −6), R(−8, −6) after it has been translated horizontally −3 and vertically 5.

x − 3

y + 5

P(−8, −3) Q(−2, −3) S(−2, −6) R(−8, −6)

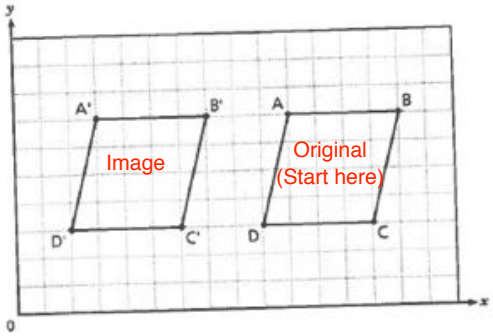
−3 +5 −3 +5 −3 +5 −3 +5

P'(−11, 2) Q'(−5, 2) S'(−5, −1) R'(−11, −1)

Week 3 (5/4 - 5/8):

Topic: Given a preimage in the coordinate plane, **identify** the coordinates of the image of a right triangle or rectangle that has been translated either vertically, horizontally, or a combination of a vertical and horizontal translation.

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



HINT: Start at ANY point on the original and count the "intersects" to get to the same letter on the image.

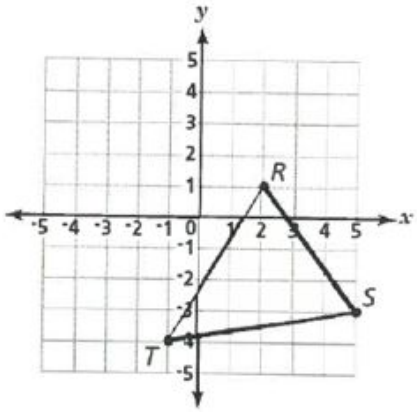
A —> A' C —> C'
B —> B' D —> D'

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

Left 7 units OR Horizontally -7 units

2. Study Δ RST on the grid below.

Be sure to only start at Point T.



When Δ RST is translated 4 units down, what is the coordinate of T'?

A. (–8, –1)

B. (–4, –1)

C. (–1, –8) Correct answer.

D. (0, 4)

3. Which expression describes the translation of a point from (–3, 4) to (4, –1)?

A. 7 units left and 5 units up

B. 7 units right and 5 units up

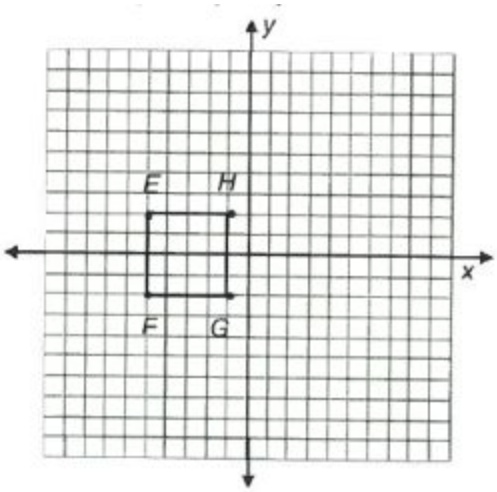
C. 7 units left and 5 units down

D. 7 units right and 5 units down
Correct answer.

HINT: What do you have to add to -3 to get 4? (That would be your left/right digit.)

HINT: What do you have to add to 4 to get -1? (That would be your up/down digit.)

4. 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'? Correct answer.

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)

5. If the triangle DOG with coordinates (2, 2), (2, 10), (8, 6) is translated six units left and three units down, what are the image coordinates?

HINT: Left represents a negative number. Also, moving left applies to the x-value.
Down represents a negative number. Also, moving down applies to the y-value.

(x, y)

D'(-4, -1), O'(-4, 7), G'(2, 3)

6. If the trapezoid LMNO with coordinates (–7, 5), (0, 5), (–2, 1), (–5, 1) is translated five units right, what are the image coordinates?

HINT: Right represents a positive number. Also, moving right applies to the x-value.
Since there's nothing moving on the y-axis, the y-values remain the SAME.

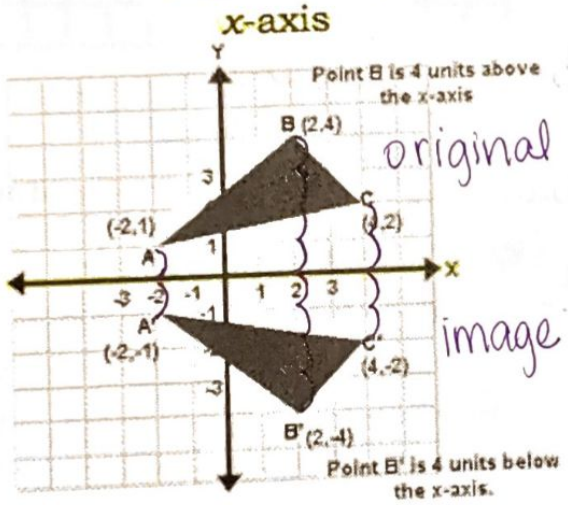
L'(-2, 5), M'(5, 5), N'(3, 1), P'(0, 1)

REFLECTION NOTES:

- ***<u>REFLECTION</u> is a transformation that <u>REFLECTS</u> a figure across a line, creating a mirror image.***
- ***The <u>original figure</u> is the figure given.***
- ***The <u>image</u> is the figure after it has been reflected. (It will have a 'prime' symbol on the letters. For example: A (original) → A' (image)***

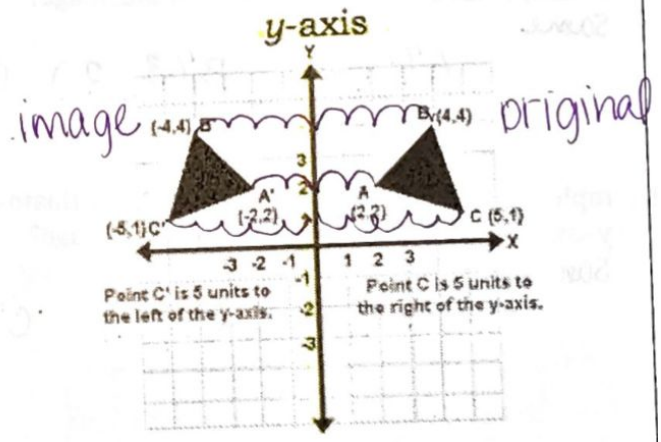
Reflecting across the x-axis.

When reflecting over the x-axis, the x-coordinate stays the same!



Reflecting across the y-axis

When reflecting over the y-axis, the y-coordinate stays the same!



Reflecting a figure WITHOUT a coordinate plane:

- *When reflecting a figure across the x-axis, the x-value remains the SAME and the y-value changes to its opposite.*
- *When reflecting a figure across the y-axis, the y-value remains the SAME and the x-value changes to its opposite.*

(x, y)

Example #4: If rectangle ABCD with the coordinates (−7, −2), (3, −2), (−7, −5) and (3, −5) is reflected over the x−axis, what are the coordinates of the image?

A B C D

Same

A'(−7, 2) B'(3, 2) C'(−7, 5) D'(3, 5)

Example #5: If rectangle ABCD with the coordinates (−7, −2), (3, −2), (−7, −5) and (3, −5) is reflected over the y−axis, what are the coordinates of the image?

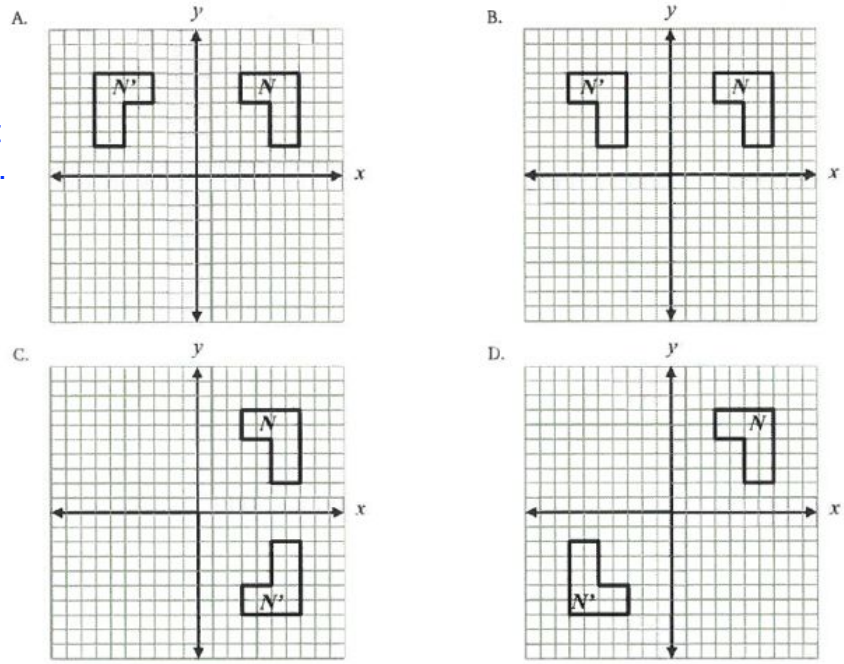
Same

A'(7, −2) B'(−3, −2) C'(7, −5) D'(−3, −5)

Topic: Given a preimage in the coordinate plane, **identify** the coordinates of the image of a right triangle or a rectangle that has been reflected over the x- or y-axis.

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

Correct answer.



HINT: The y-axis runs up and down. The figure should look like it has been "flipped" over the y-axis.

8. If the triangle BAT with coordinates (–5, 1), (–5, 7), (0, 1) is reflected across the y–axis, what are the image coordinates?

HINT: The y-value remains the same; the x-value changes to its opposite.

B'(5, 1), A'(5, 7), T'(0, 1)

9. If the rectangle ABCD with coordinates (–8, –3), (–2, –3), (–2, –6), (–8, –6) is reflected across the x–axis, what are the image coordinates?

HINT: The x-value remains the same; the y-value changes to its opposite.

A'(-8, 3), B'(-2, 3), C'(-2, 6), D'(-8, 6)

10. What is the reflection across the x–axis of point A(4, 1)?

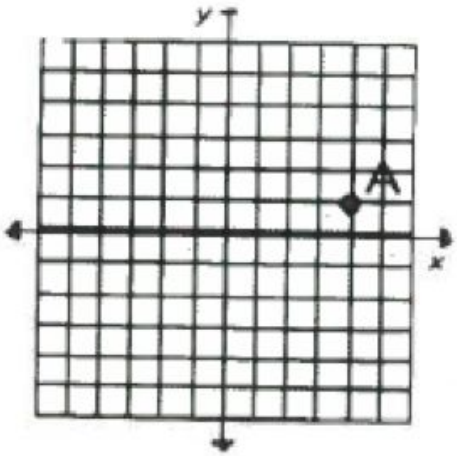
A. (0, –1)

B. (–4, 1)

C. (–4, –1)

D. (4, –1)

Correct answer.

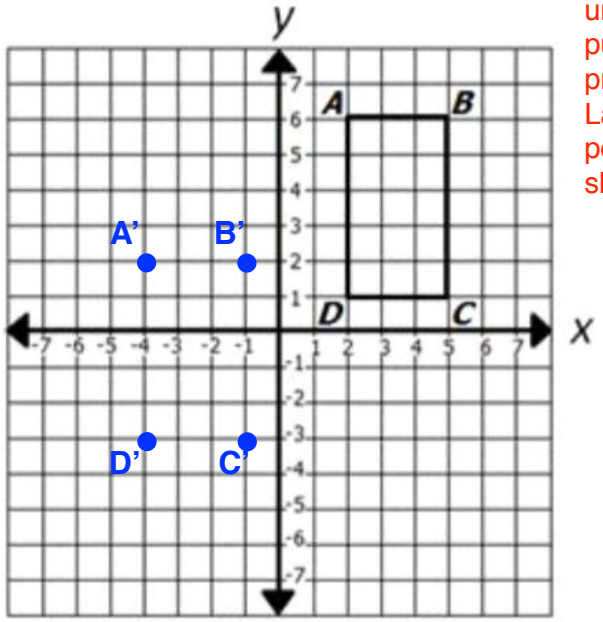


Week 4 (5/11 - 5/15):

Topic: Sketch the image of a right triangle or rectangle that has been translated vertically, horizontally, or a combination of both.

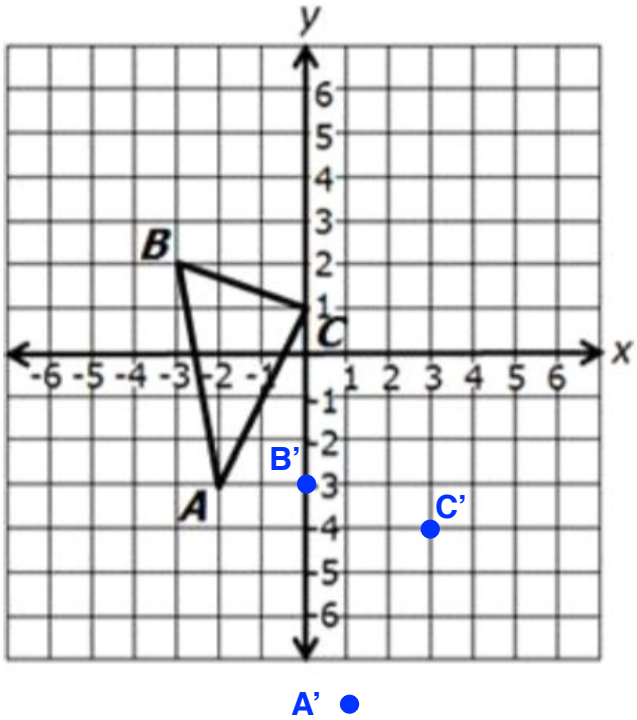
1. Translate rectangle ABCD 4 units down and 6 units to the left.

HINT: Start at any point and move 4 units down and 6 units left BEFORE putting the new point. Repeat this process for the remaining points. Lastly, be sure to connect the new points just like the original; so that it shows the same shape.



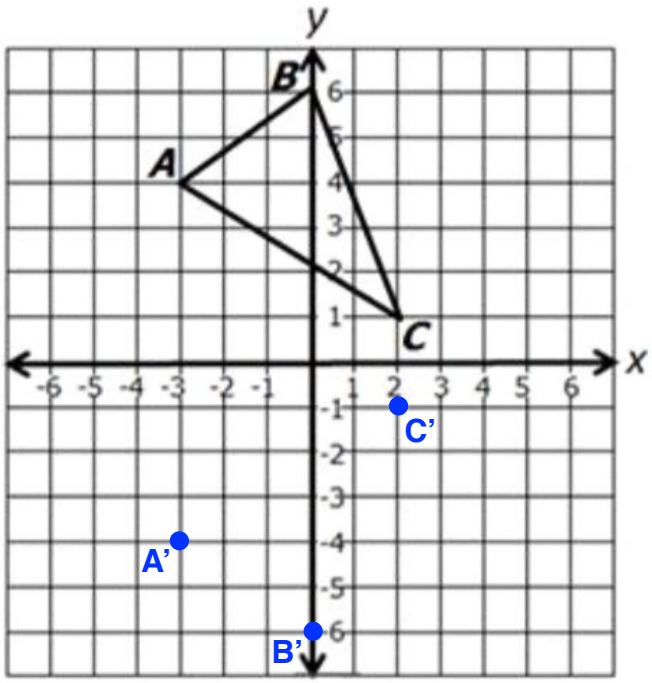
2. Translate triangle ABC horizontally 3 units and vertically -5 units.

HINT: Horizontally 3 units means move 3 units to the right. Vertically -5 units means move 5 units down.



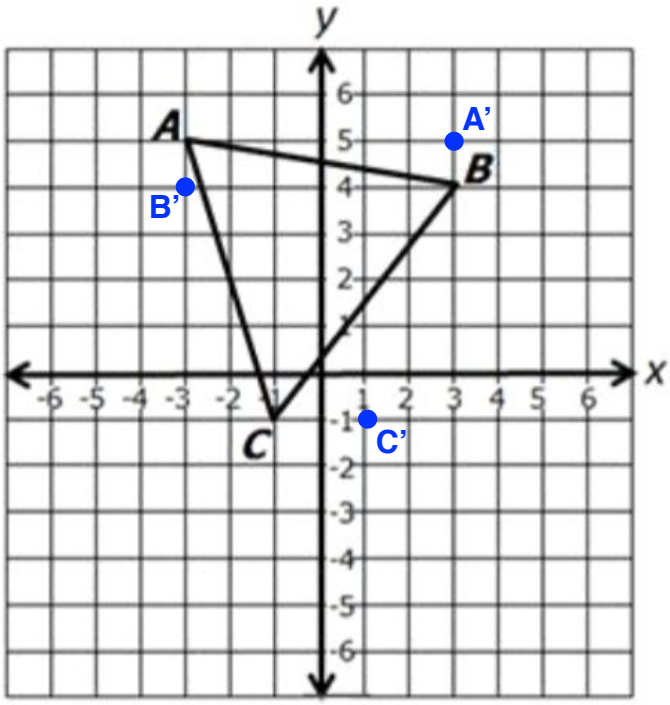
Topic: Sketch the image of a right triangle or rectangle that has been reflected over the x- or y-axis.

3. Reflect triangle ABC over the x-axis.



HINT: Start at any point and count the number of "intersections" to the x-axis. On the same line, count the same amount of intersections on the other side BEFORE putting the new point. Repeat until all points are done. Be sure to connect the points just like the original figure so that it looks like the same shape, just "flipped".

4. Reflect triangle ABC over the y-axis.



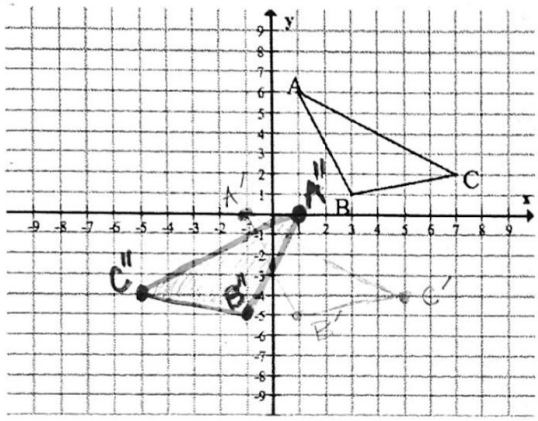
COMBINATION OF TRANSLATION & REFLECTION

NOTES:

Multiple transformations with a coordinate plane:

Order Matters: When you do multiple transformations, the order makes a difference! A reflection followed by a translation will not give you the same image as a translation followed by a reflection.

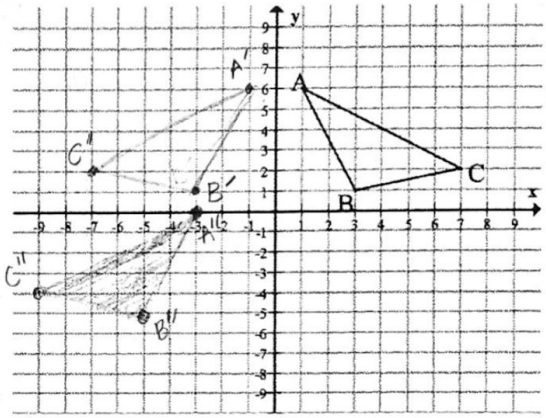
Translation then Reflection



Translate the triangle left 2 units and down 6 units. Next, reflect the figure across the y–axis.

A"(1 , 0) B"(-1 , -5) C"(-5 , -4)

Reflection then Translation



Reflect the figure across the y–axis. Next, translate the triangle left 2 units and down 6 units.

A"(-3 , 0) B"(-5 , -5) C"(-9 , -4)

Multiple transformations without a coordinate plane:

Identify the image coordinates of a rectangle with the coordinates, T(–5, 2), U(–1, 2), V(–2, 4) W(–4, 4), that has been reflected across the x–axis and translated right 6 units and down 6 units.

same x+6 y-6

T(-5, 2) U(-1, 2) V(-2, 4) W(-4, 4)

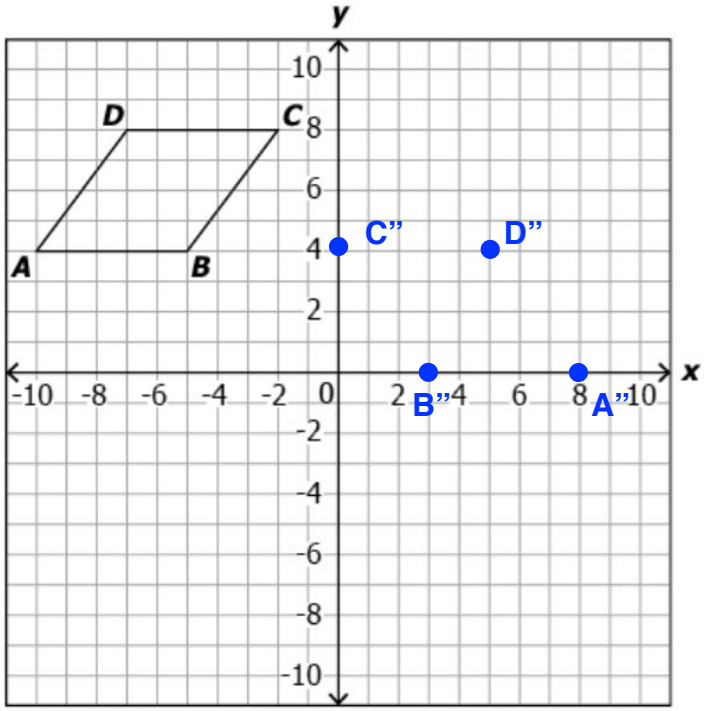
T'(-5, -2) U'(-1, -2) V'(-2, -4) W'(-4, -4)
+6 -6 +6 -6 +6 -6 +6 -6

T''(1, -8) U''(5, -8) V''(4, -10) W''(2, -10)

Topics:

- Given a preimage in the coordinate plane, **identify** the coordinates of the image of a right triangle or rectangle that has been translated and reflected over the x- or y-axis or reflected over the x- or y-axis and then translated.
- **Sketch** the image of a right triangle or rectangle that has been translated and reflected over the x- or y-axis or reflected over the x- or y-axis and then translated.

5. The quadrilateral ABCD is translated 2 units right and 4 units down and then reflected across the y-axis to obtain another quadrilateral A'B'C'D'. **Sketch quadrilateral A'B'C'D'.**



HINT: Translate each point 2 units right and 4 units down. Be sure to record the letters as you go. Next, reflect the new points over the y-axis.

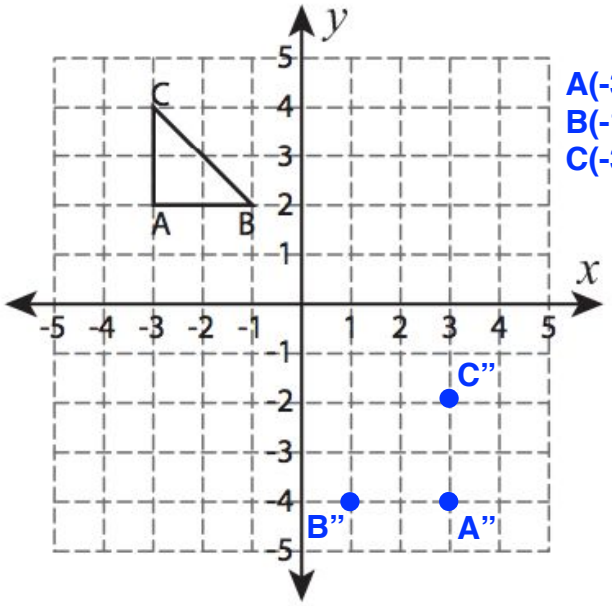
	Translation	Reflection
A(-10, 4)	—> A'(-8,0)	—> A"(8, 0)
B(-5, 4)	—> B'(-3, 0)	—> B"(3, 0)
C(-2, 8)	—> C'(0, 4)	—> C"(0, 4)
D(-7, 8)	—> D'(-5, 4)	—> D"(5, 4)

6. Using the answer to question #1, select the correct statements.

The length of A'B' is 5 units.	The length of A'B' is 6 units.
The length of B'C' is 4 units.	The length of B'C' is 5 units.
The length of A'D' is 5 units.	The length of A'D' is 6 units.

OMIT

7. Triangle ABC is reflected across the y-axis and then translated down 6 units to obtain triangle A'B'C'. **Sketch quadrilateral A'B'C'.**



	Reflection	Translation
A(-3, 2)	—> A'(3,2)	—> A"(3, -4)
B(-1, 2)	—> B'(1, 2)	—> B"(1, -4)
C(-3, 4)	—> C'(3, 4)	—> C"(3, -2)

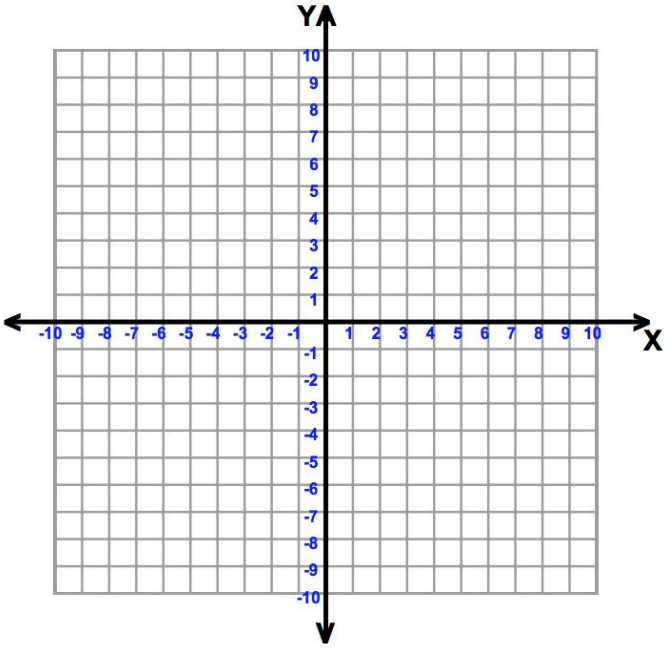
Challenges:

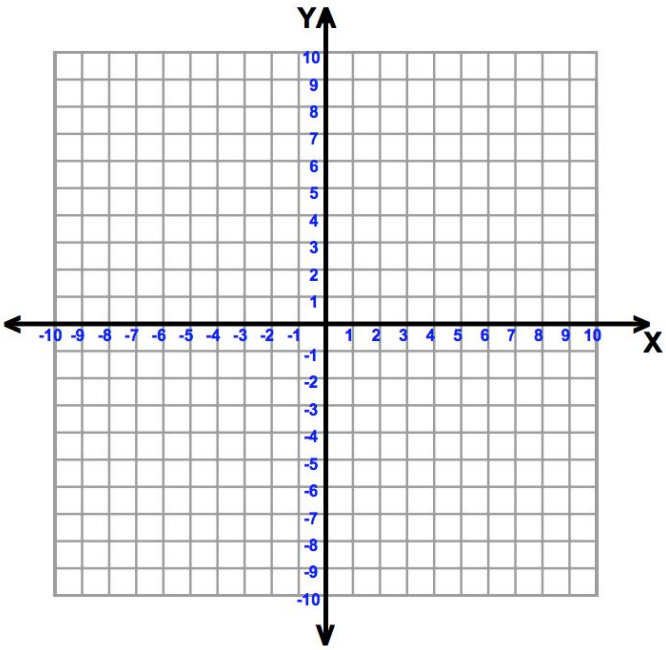
Complete <u>BOTH</u> challenges!!

- *Create your own figure by sketching it on the provided coordinate plane. (It can be complex (like a flower) or simple (triangle or quadrilateral). Be sure to label with letters.*
- *Design your own transformation rule. Be sure to write the rule down.*
- *Sketch your image.*

Challenge #1: Translation OR Reflection

Rule: _____



Challenge #2: Multiple Transformations (Translation AND Reflection)

Rule: _____