CITYTUTOR DC

Eighth Grade Math Lesson Materials

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Identification of the material that is claimed to be infringing and that is to be removed or access to which is to be disabled, and information reasonably sufficient to permit us to locate the allegedly infringing material, e.g., the specific web page address on the Platform;

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G8 Unit 1:

Rigid Transformations and Congruence

G8 U1 Lesson 1
Describe the movement of shapes using the terms "clockwise," "counterclockwise," "translations," "rotations," and "reflections" of figures.

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G8 U1 Lesson 1 - Today will describe the movement of shapes using the terms “clockwise,” “counterclockwise,” “translations,” “rotations,” and “reflections” of figures.

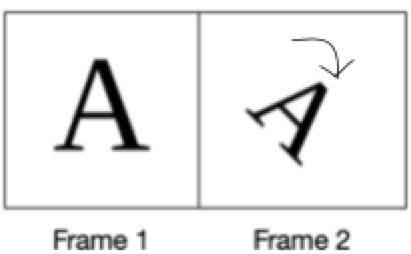
Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slide 2): Today we will and understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

As you may know, the hands of the analog clock turn to the right. That turn or circular motion is described as a “rotation.” Whenever a geometric figure rotates to the right, like the hands of a clock, the direction of that movement is described as “clockwise.”(*Draw an arrow to show a clockwise rotation. Write the words clockwise rotation.*)

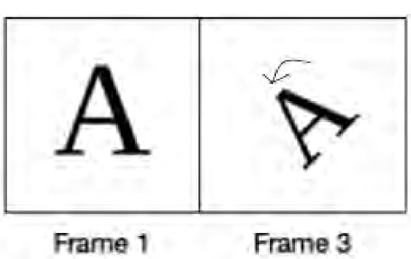
Let’s Talk (Slide 3): Now let’s talk about lines that intersect. Earlier we recalled the Vertical Angles Theorem from 7th grade. Let’s use what we know about line segments rotating 180 degrees and the properties of rigid transformations to figure why the Vertical Angles Theorem is true. Let’s start with a pair of intersecting lines *AB* and *CD* that intersect at point *E.* Let’s mark angle *AEC* on the intersecting lines and then use our tools to rotate line *AB* and line *CD* Possible Students Answers, Key Points:

- The second A is turning.
- It turns to the right.
- It’s rotating to the right.
- It’s turning clockwise.



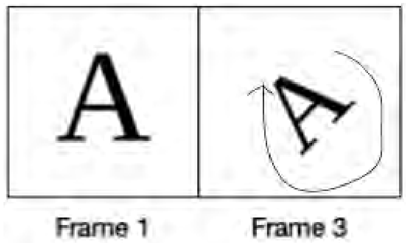
The letter in Frame 2 seems to be turning to the right, so we can describe this movement as a clockwise rotation of Frame 1. (Say and Do: *draw the arrow in the direction of the turn and write “clockwise rotation.”*)

Let’s Talk (Slide 4): How do we describe the same movement when turning to the left? When you counter something, it means you have an opposing or opposite opinion or action. So, “counterclockwise” means a figure is rotating in the opposite direction of the hands on a clock. Consider Frame 1 and Frame 3. How could you describe the movement from Frame 1 to Frame 3 using the words “rotation,” “clockwise,” and/or “counterclockwise.” Possible Students Answers, Key Points:



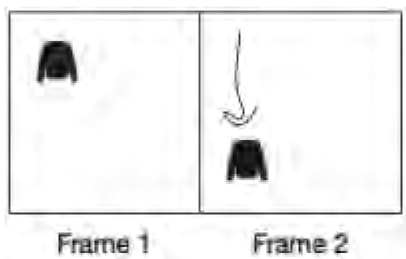
- The second A is turning.
- It turns to the left.
- It rotates to the left.
- It’s turning counterclockwise.
- Bonus: it’s turning a lot to the right.

I'll use arrows again to show the movement of the letter. In this case, Frame 3 is a counterclockwise rotation of Frame 1. (Say and Do: *draw the arrow in the direction of the turn and write "counterclockwise rotation."*)



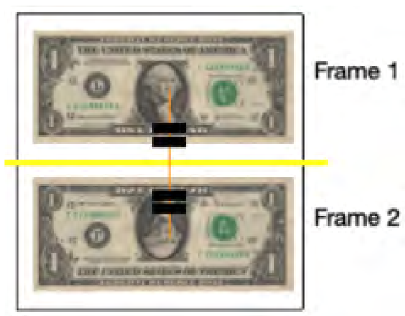
Rotations are fun because they can go in either direction. We could also say that Frame 3 is a clockwise rotation. (*Draw the arrow in the direction of a "clockwise rotation."*)

Let's Think (Slide 5): Now that we know what to call a turning figure - a "rotation" - and we can describe the direction of the turn using "clockwise" and "counterclockwise," let's explore the terms "translation" and "reflection." Take a look at Frame 1 and Frame 2. If I were going to describe the movement of the shirt from Frame 1 to Frame 2, I would say that the shirt slid down from Frame 1 to Frame 2. A geometric slide, in any direction, is also known as a "translation."



I used an arrow to show that the shirt slid down. So you can say that Frame 2 is a translation of Frame 1. (*Say: Draw an arrow to show a slide down and write the word "translation."*)

Let's Think (Slide 6): Finally, when a figure moves as if it is flipping over a straight line, it will appear as if the image created its reflection after looking in a mirror. That is why this type of move is described as a "reflection."



In this case, Frame 2 is a reflection of Frame 1. The mirror or line of reflection is a horizontal line. (Do and Say: *Use a different color or highlighter to highlight the line separating Frames 1 and 2. Write "reflection*.) When an image is reflected, the distance from the line of reflection to all corresponding parts are the same. For example, if we measured the distance from George Washington's nose in Frame 1 to the yellow line and the distance from his nose in Frame 2 to the yellow line, they should be equivalent. (*Draw a line to show the distance from the nose to the line of reflection on both sides is equal.)*

Let's Try it (Slides 7-8): Let's work on describing geometric transformations. We will work on this page together. Remember..

WARM WELCOME

Describe the movement of shapes using the terms “clockwise,” “translations,” “rotations,” and “reflections” of figures.

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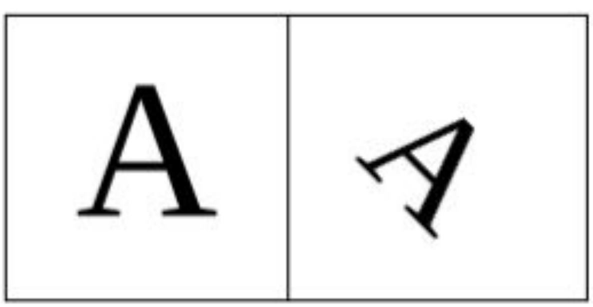
Let's Review:

The hands of an analog clock rotate clockwise.

Let's Talk:

How do you describe a geometric figure that turns to the right?

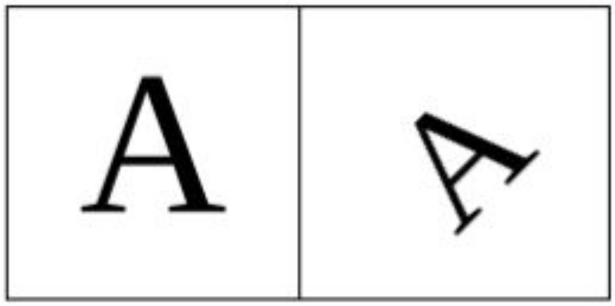
How would you describe the transformation from Frame 1 to Frame 2?



Frame 1 Frame 2

Let’s Talk: **How do you describe a geometric figure that turns to the left?**

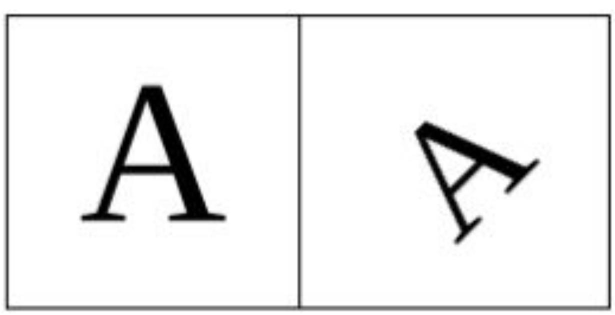
How would you describe the transformation from Frame 1 to Frame 3?



Frame 1 Frame 3

Let’s Talk: **How do you describe a geometric figure that turns to the left?**

How else can you describe the transformation from Frame 1 to Frame 3?



Frame 1 Frame 3

Let's Think:

How do you describe a geometric figure that slides?

Frame 1 Frame 2

Let's Think:

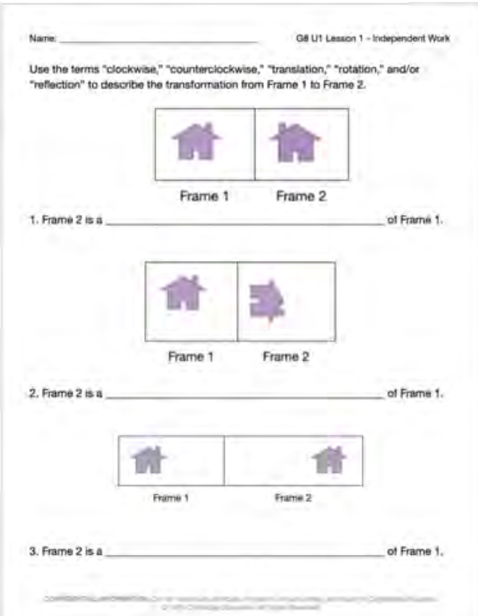
How do you describe a geometric figure that flips?

Frame 1

Frame 2

Let's Try It:

Let's practice describing the movement of shapes together.


Name: ______________________ G8 U1 Lesson 1 - Independent Work

Use the terms "clockwise," "counterclockwise," "translation," "rotation," and/or "reflection" to describe the transformation from Frame 1 to Frame 2.

Frame 1 Frame 2

1. Frame 2 is a ______________________ of Frame 1.

Frame 1 Frame 2

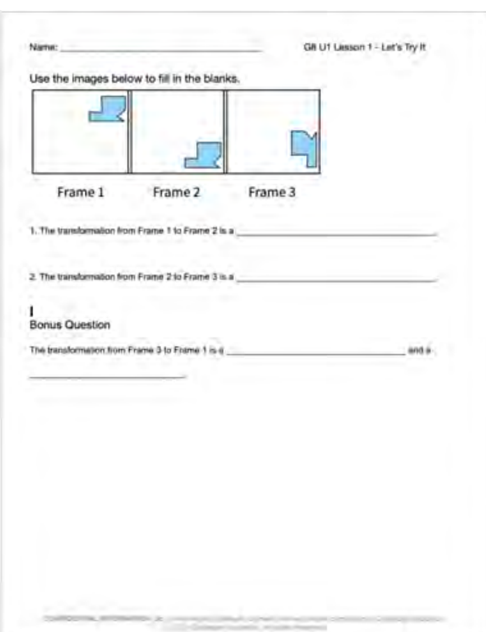
2. Frame 2 is a ______________________ of Frame 1.

Frame 1 Frame 2

3. Frame 2 is a ______________________ of Frame 1.

On your Own:

Now it's time to describe the movement of shapes on your own.


Name: ______________________ G8 U1 Lesson 1 - Let's Try It

Use the images below to fill in the blanks.

Frame 1 Frame 2 Frame 3

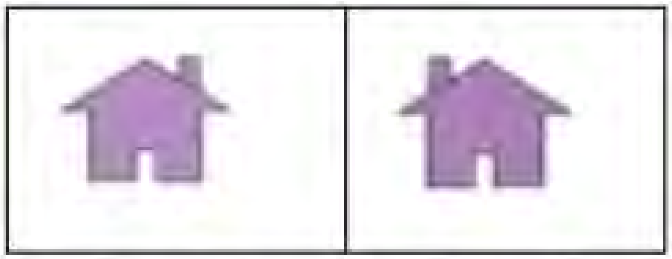
1. The transformation from Frame 1 to Frame 2 is a ______________________.

2. The transformation from Frame 2 to Frame 3 is a ______________________.

Bonus Question

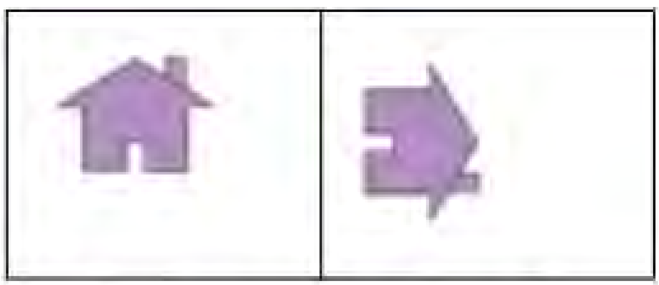
The transformation from Frame 3 to Frame 1 is a ______________________ and a ______________________.

Use the terms “clockwise,” “counterclockwise,” “translation,” “rotation,” and/or “reflection” to describe the transformation from Frame 1 to Frame 2.



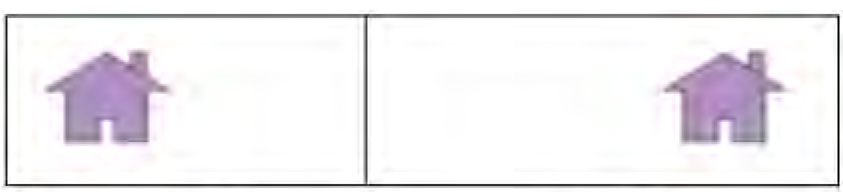
Frame 1 Frame 2

1. Frame 2 is a ____ of Frame 1.



Frame 1 Frame 2

2. Frame 2 is a ____ of Frame 1.

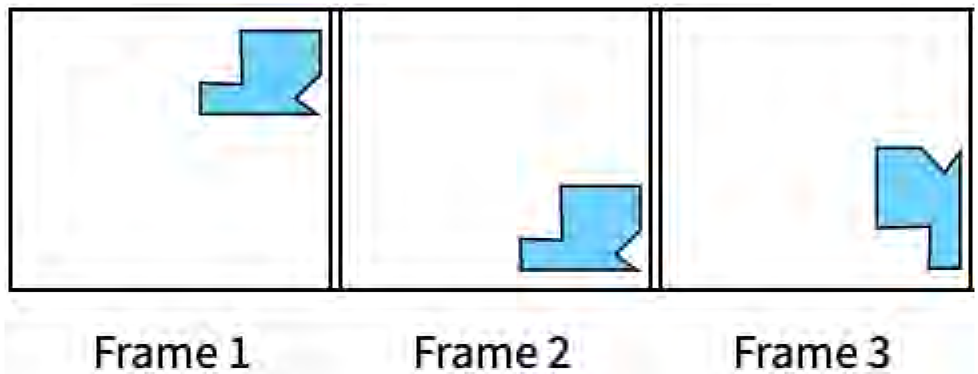


Frame 1 Frame 2

3. Frame 2 is a ____ of Frame 1.

Name: ____ G8 U1 Lesson 1 - Independent Work

Use the images below to fill in the blanks.



1. The transformation from Frame 1 to Frame 2 is a _______________________________________.

2. The transformation from Frame 2 to Frame 3 is a _______________________________________.

Bonus Question

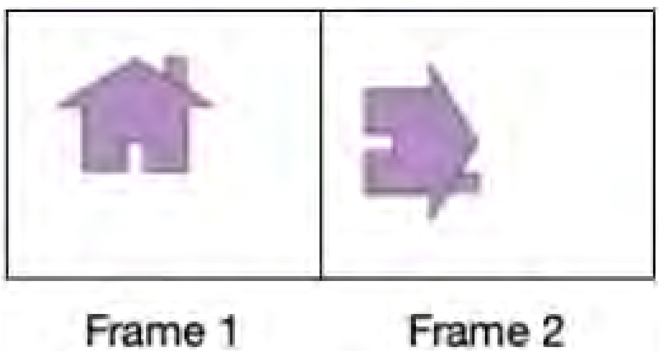
The transformations from Frame 3 to Frame 1 is a ___________________________________ and a

______________________________.

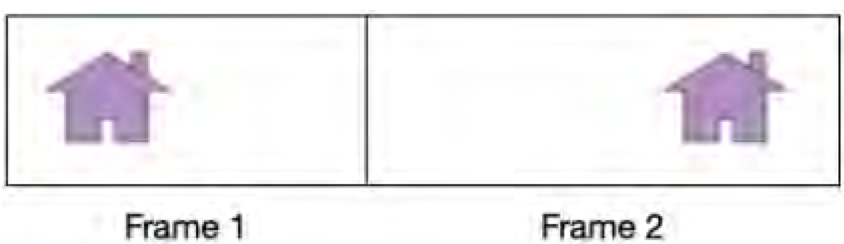
Name: Answer Key G8 U1 Lesson 1 - Let's Try It

Use the terms "clockwise," "counterclockwise," "translation," "rotation," and/or "reflection" to describe the transformation from Frame 1 to Frame 2.

1. Frame 2 is a reflection of Frame 1.



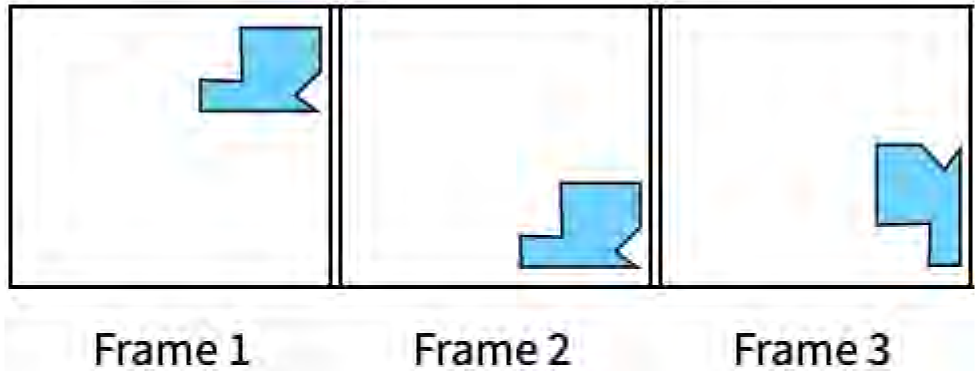
2. Frame 2 is a rotation clockwise of Frame 1.



3. Frame 2 is a translation right of Frame 1.

Name: Answer Key

Use the images below to fill in the blanks.



1. The transformation from Frame 1 to Frame 2 is a translation down.

2. The transformation from Frame 2 to Frame 3 is a rotation counterclockwise.

Bonus Question

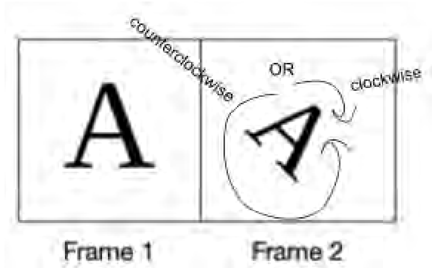
The transformations from Frame 3 to Frame 1 is a rotation clockwise and a translation up.

G8 U1 Lesson 2
Use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image.

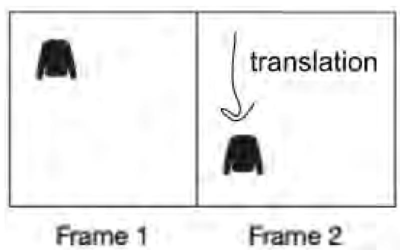
G8 U1 Lesson 2 - Use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image.

Warm Welcome (Slide 1): Tutor Choice

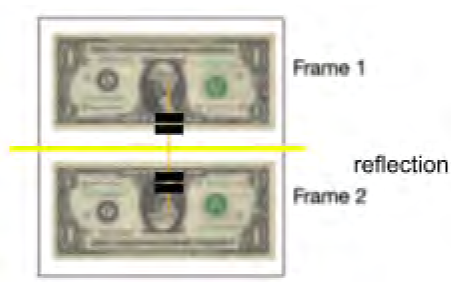
Frame the Learning/Connection to Prior Learning (Slides 2 - 5): Today we will use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image. First, let's recall the terms we use to describe rigid transformations.



Transformations that turn right, like the hands of an analog clock, or left, in the opposite direction of the hands of an analog clock, can be described as clockwise or counterclockwise rotations respectively.

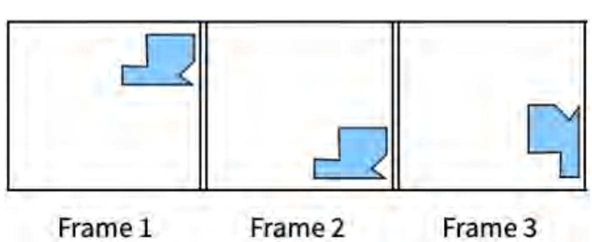


Transformations that move up and down or left and right can be described as translations.



Transformations that appear to flip over a straight line can be described as a reflection.

Let's Talk (Slide 6): Now, consider the term "image" and what it means in the real-world. When you take a picture with any camera, the result is also known as an image. Translations, rotations, and reflections are simply images created after an original figure undergoes some form of rigid motion.

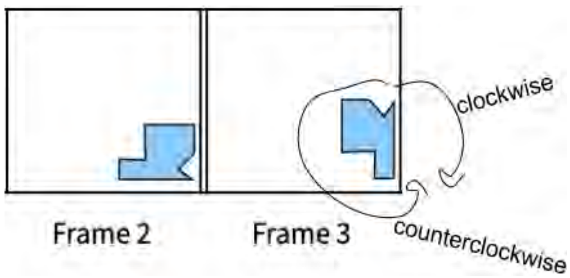


In the last lesson there was a bonus set of frames and the task asked you to describe the sequence from Frame 3 to Frame 1.

Typically the image is the final frame, but the challenge was to start with the image and map a set of transformations backwards. How would you describe how the original image transformed from Frame 3 to Frame 2? Possible Students Answers, Key Points:

- The original image in Frame 3 turned.
- The original image turned to the right.

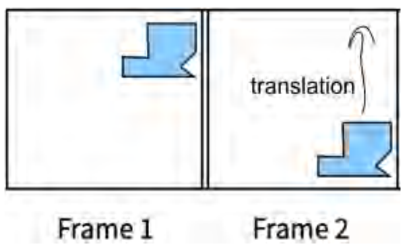
- The original image turned to the left.
- Frame 3 rotated counterclockwise or clockwise to create the image in Frame 2.



The transformation that took the original image from Frame 3 to Frame 2 was a turn to the right like the hands of an analog clock, a clockwise rotation, or a turn in the opposite direction of the hands on an analog clock, a counterclockwise rotation. (*Draw two arrows to show the possible rotations. Write the words clockwise and counterclockwise on the corresponding arrows.*)

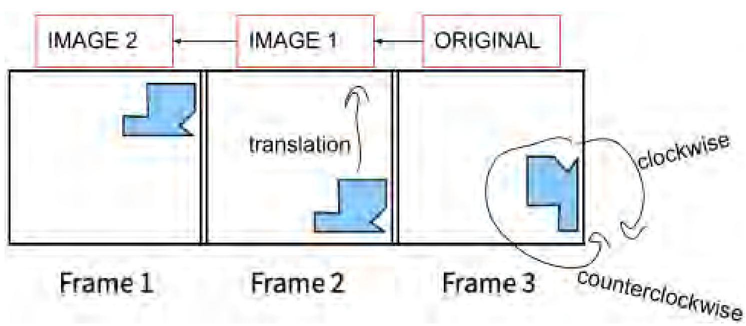
Let's Talk (Slide 7): How do we describe the movement that took the image in Frame 2 to the image in Frame 1? Possible Students Answers, Key Points:

- The image in Frame 2 moved up.
- The image in Frame 1 is a vertical translation of Frame 2.



The transformation that took Frame 2 to Frame 1 was a vertical move, a translation. *(Draw an arrow to show the movement. Write the word translation.)*

Let's Think (Slide 8): Using these terms to describe multiple transformations is known as identifying a sequence of transformations. Rather than identifying one transformation at a time, you may have a case where you are given more than one transformation and you are asked to identify the sequence of transitions. This means you need to name the transformations in the order that they occur to produce the final image.



The transformation from Frame 3 to its image in Frame 1 is a counterclockwise (or clockwise) rotation and a vertical translation, in that order. (*Draw arrows and label the appropriate terminology on each image. Write the word original above Frame 3, Image 1 above Frame 2, and Image 2 above Frame 3 with arrows to show the sequence of transformations.)*

Let's Try it (Slides 7-8): Let's work on using transformation terminology to describe a sequence of transformations. We will work on this page together. Remember to write the transformations in the order that they occur.

WARM WELCOME

Use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image.

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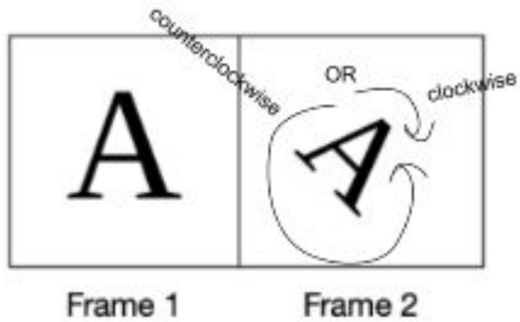
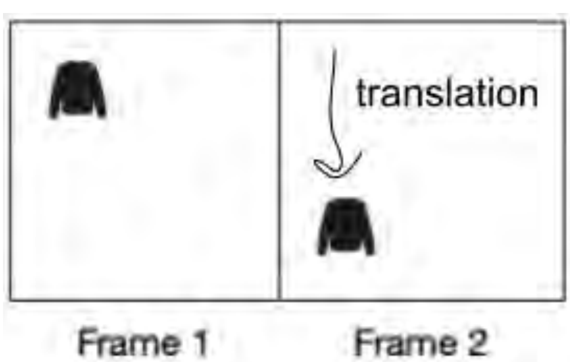
Let's Review:

Transformations that turn right and left can be described as clockwise or counterclockwise rotations like the hands of an analog clock.



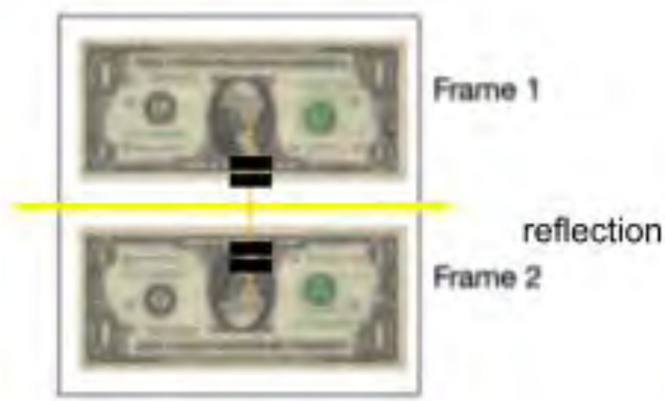
Let's Review:

Transformations that move up and down or left and right can be described as a translations.



Let's Review:

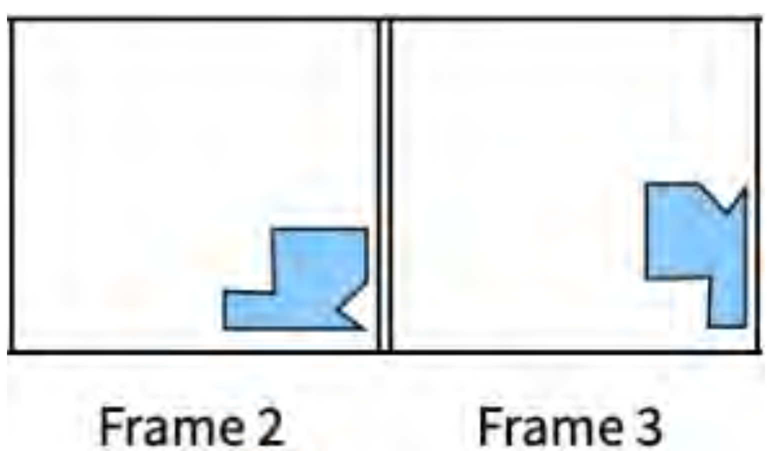
Transformations that appear to flip over a straight line can be described as a reflection.



Let's Talk:

How do you use transformation terminology to precisely describe transformations?

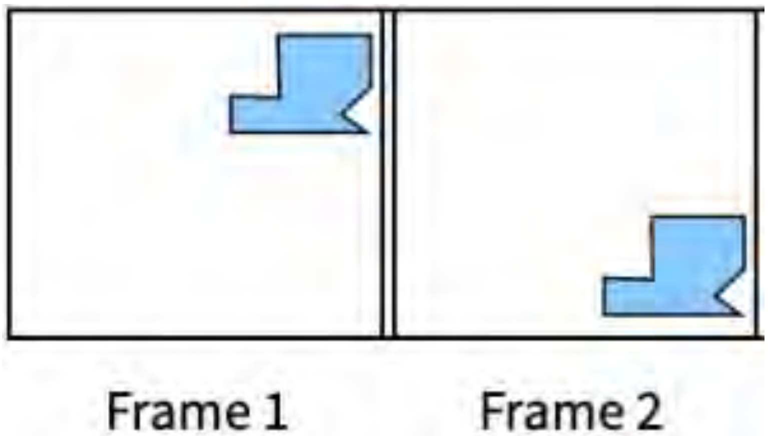
What series of transformations took Frame 3 to it's image in Frame 2?



Let's Talk:

How do you use transformation terminology to precisely describe transformations?

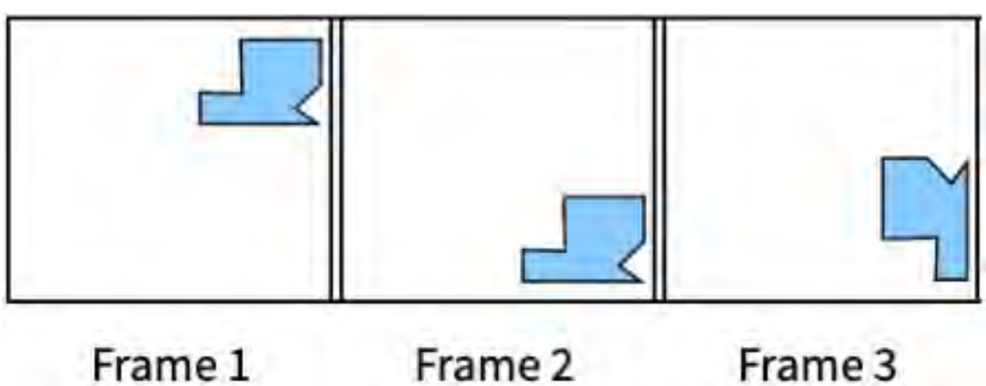
What series of transformations took Frame 2 to it's image in Frame 1?



Let's Think:

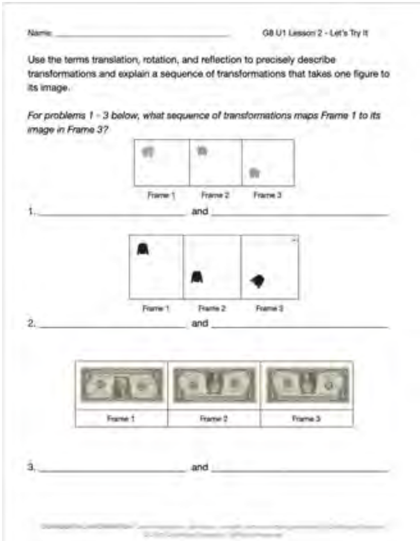
How do you use transformation terminology to precisely describe transformations?

What series of transformations from the original image in Frame 3 will create the image in Frame 1?



Let's Try It:

Let's practice using transformation terminology to identify a sequence of transformations.



Name: ______________________ G8 U1 Lesson 2 - Let's Try It

Use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image.

For problems 1 - 3 below, what sequence of transformations maps Frame 1 to its image in Frame 3?

Frame 1 Frame 2 Frame 3

1. ______________ and ______________

Frame 1 Frame 2 Frame 3

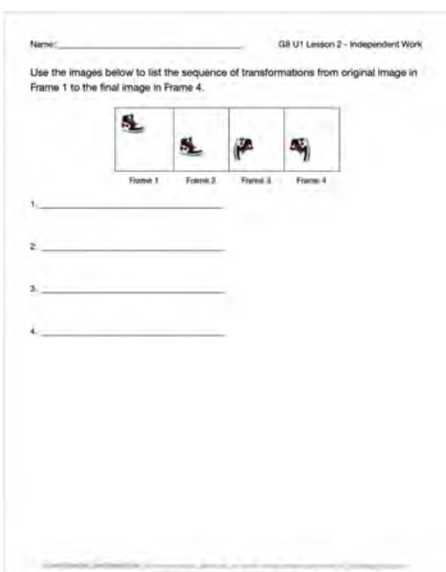
2. ______________ and ______________

Frame 1 Frame 2 Frame 3

3. ______________ and ______________

On your Own:

Now it's time to use transformation terminology to describe a sequence of transformations on your own.



Name: ______________________ G8 U1 Lesson 2 - Independent Work

Use the images below to list the sequence of transformations from original image in Frame 1 to the final image in Frame 4.

Frame 1 Frame 2 Frame 3 Frame 4

1. ______________

2. ______________

3. ______________

4. ______________

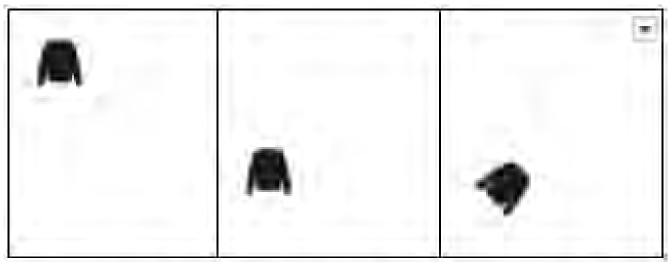
Name: ____ G8 U1 Lesson 2 - Let’s Try It

Use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image.

For problems 1 - 3 below, what sequence of transformations maps Frame 1 to its image in Frame 3?

Frame 1 Frame 2 Frame 3

1. ______________________________ and ____________________________________



Frame 1 Frame 2 Frame 3

2. ______________________________ and ____________________________________

		
Frame 1	Frame 2	Frame 3

3. ______________________________ and ____________________________________

Use the images below to list the sequence of transformations from the original image in Frame 1 to the final image in Frame 4.

Frame 1 Frame 2 Frame 3 Frame 4

1. ______________________________________

2. ______________________________________

3. ______________________________________

4. ______________________________________

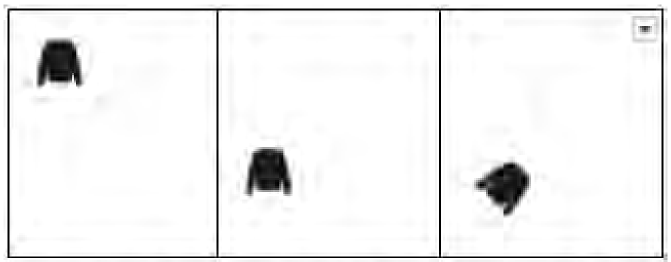
Name: ______________________________ G8 U1 Lesson 2 - Let’s Try It

Use the terms translation, rotation, and reflection to precisely describe transformations and explain a sequence of transformations that takes one figure to its image.

For problems 1 - 3 below, what sequence of transformations maps Frame 1 to its image in Frame 3?

Frame 1 Frame 2 Frame 3

1. reflection and translation down



Frame 1 Frame 2 Frame 3

2. translation down and rotation clockwise

Frame 1	Frame 2	Frame 3

3. reflection and reflection

Name: Answer Key G8 U1 Lesson 2 - Independent Work

Use the images below to list the sequence of transformations from original image in Frame 1 to the final image in Frame 4.

Frame 1 Frame 2 Frame 3 Frame 4

1. translation down

2. rotation clockwise

3. reflection

4.

G8 U1 Lesson 3
Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

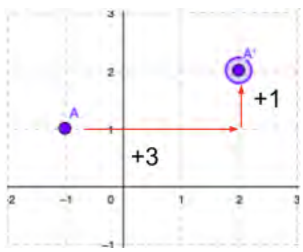
CITYTUTOR DC

G8 U1 Lesson 3 - Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 3): Today we will apply transformations to points on the coordinate plane and name the coordinates of points in the image of a transformation. Recall that a translation is a movement left/right or up/down. A reflection is a movement that flips.

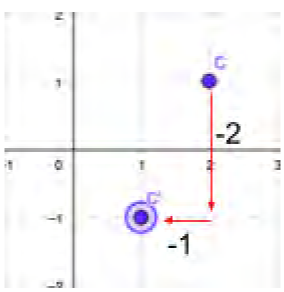
Let's Talk (Slide 4): The image of a point in a coordinate plane is named by the same letter and an apostrophe.



For example, point *A*(-1,1) was translated 3 units to the right and 1 unit up on the grid. The name of its image after the transformation is *A'*(2,2). *(Draw arrows to show the described translation and label the number of units the original image moved. Mark the image as A'.)*

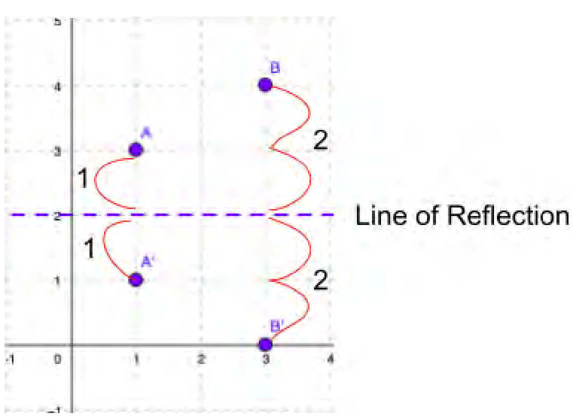
Let's Talk (Slide 5): Now, consider a similar translation. What are the new coordinates of the point *C*(2,1) after being translated 2 units down and 1 unit to the left? Possible Students Answers, Key Points:

- The new coordinates are (1,-1).
- x = 1 and y = -1
- The new name of the point is C'.



When you translate point *C*, you pass over the *x* axis into the 4th quadrant which tells us the resulting *y*-coordinate will be negative. Moving to the left impacts the *x-coordinate* only; it will remain positive because it's to the right of the *y*-axis. The image of *C* after a translation down 2 units and to the left 1 unit is *C'*(1,-1). *(Draw arrows to show the described translation. Mark the image as C'.)*

Let's Think (Slide 6): Reflections can be tricky because there are properties that must be true in order to make an image a reflection. Most important is that the distance from the line of reflection to all parts of the original figure must equal the distance from the line of reflection to all parts of the image. Let's consider how to reflect points *A* and *B* over the dashed line of reflection.



Since a reflection is a flip, we know that point *A* needs to flip over the line of the reflection. Since *A* is one unit above the line of reflection, its image, *A'*, will be one unit below the line of reflection. The same is true for point *B*. Since point *B* is two units above the line of reflection, its image, *B'*, will be two units below the line of reflection to ensure that the distances are the same from each point to the line of reflection. *(Mark the graph to show the distances from points A and B are the same to the line of reflection. Write the number of units and label the images A' and B'.)*

Let's Try it (Slides 7 - 8): Let's work on applying transformations and naming the coordinates of the image. We will work on this page together. Remember to ensure the distances remain the same and mark the point of the image with an apostrophe.

WARM WELCOME

Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

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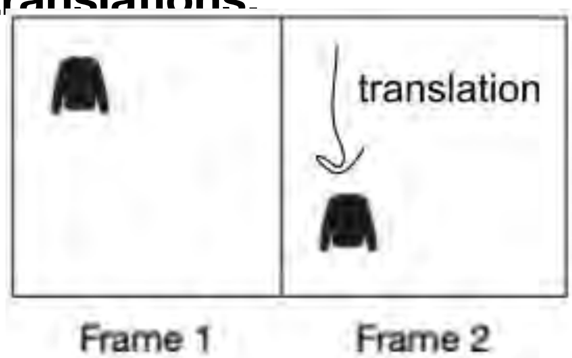
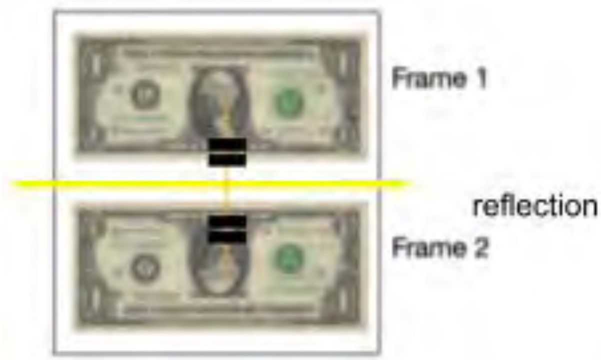
Let's Review:

Transformations that move up and down or left and right can be described as a translations.



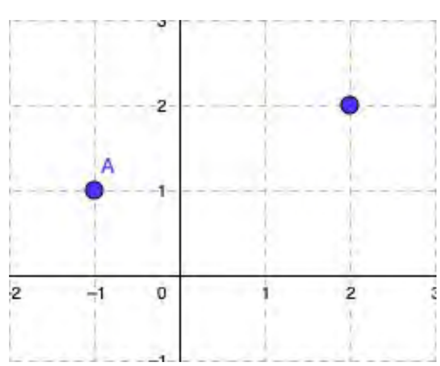
Transformations that appear to flip over a straight line can be described as a reflection.



Let's Talk:

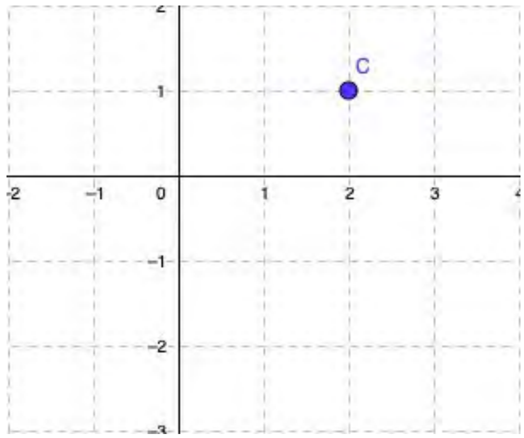
How do you apply a transformation and label its image?

What is the name of the image of point *A* after being translated 3 units to the right and 1 unit up?



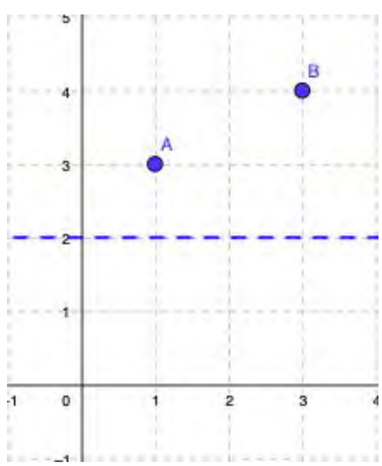
Let's Talk: How do you apply a transformation and label its image?

What are the new coordinates of point *C*(2,1) after being translate 2 units down and 1 unit to the left?



Let's Think: How do you apply a transformation and label its image?

Reflect and label points *A* and *B* over the dashed line of reflection.



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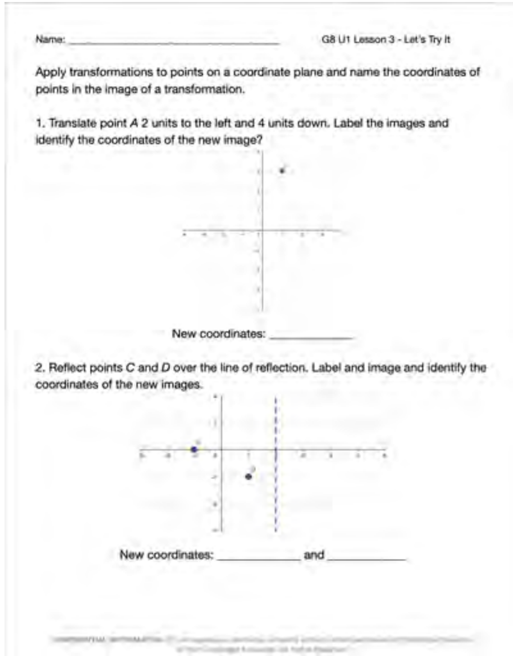
Let's Try It: Let's apply a transformation and label its image?



Name: ______________________________ G8 U1 Lesson 3 - Let's Try It

Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

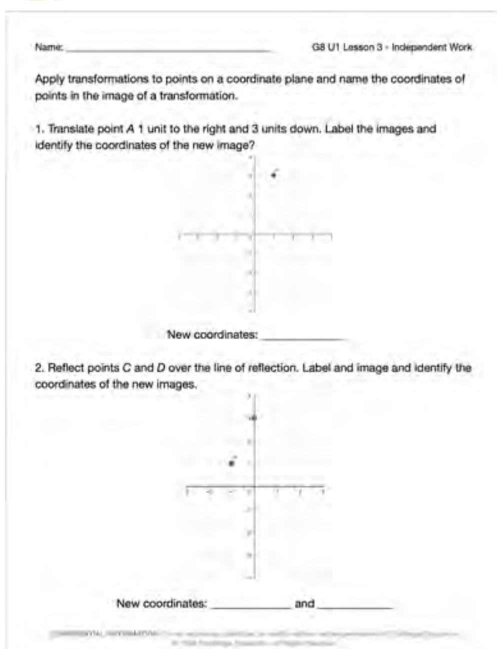
1. Translate point *A* 2 units to the left and 4 units down. Label the images and identify the coordinates of the new image?

New coordinates: ___________

2. Reflect points *C* and *D* over the line of reflection. Label and image and identify the coordinates of the new images.

New coordinates: ___________ and ___________

On your Own: Now it's time to apply a transformation and label its image?



Name: ______________________________ G8 U1 Lesson 3 - Independent Work

Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

1. Translate point *A* 1 unit to the right and 3 units down. Label the images and identify the coordinates of the new image?

New coordinates: ___________

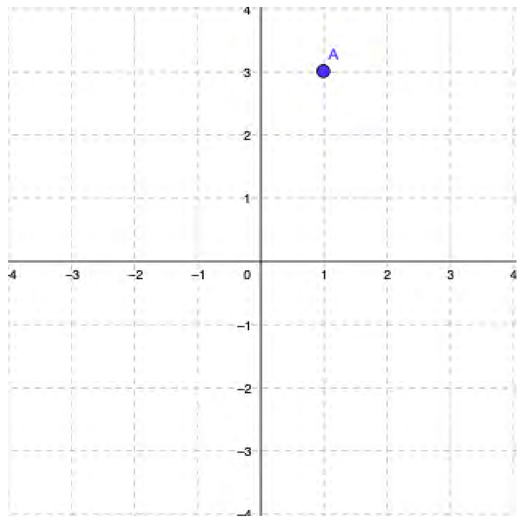
2. Reflect points *C* and *D* over the line of reflection. Label and image and identify the coordinates of the new images.

New coordinates: ___________ and ___________

Name: ______________________________________ G8 U1 Lesson 3 - Let's Try It

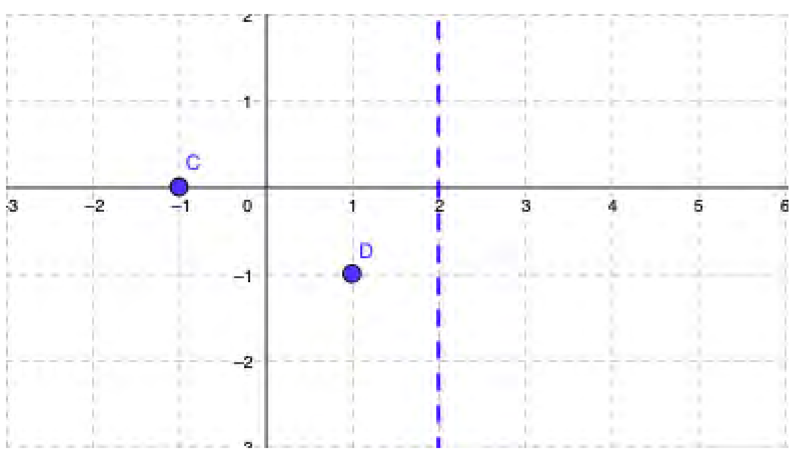
Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

1. Translate point *A* 2 units to the left and 4 units down. Label the images and identify the coordinates of the new image?



New coordinates: _____________

2. Reflect points *C* and *D* over the line of reflection. Label the images and identify the coordinates of the new points.

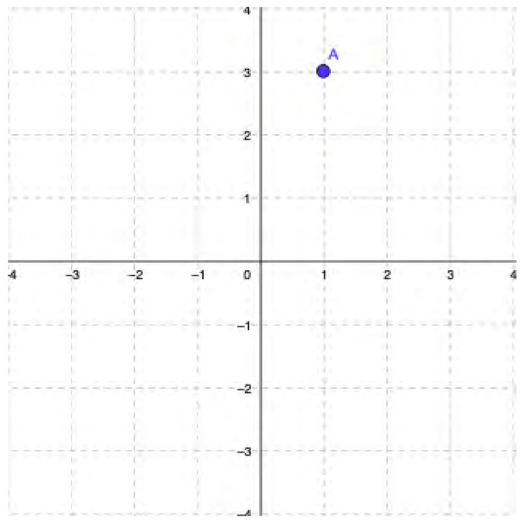


New coordinates: _____________ and ____________

Name: ______________________________________ G8 U1 Lesson 3 - Independent Work

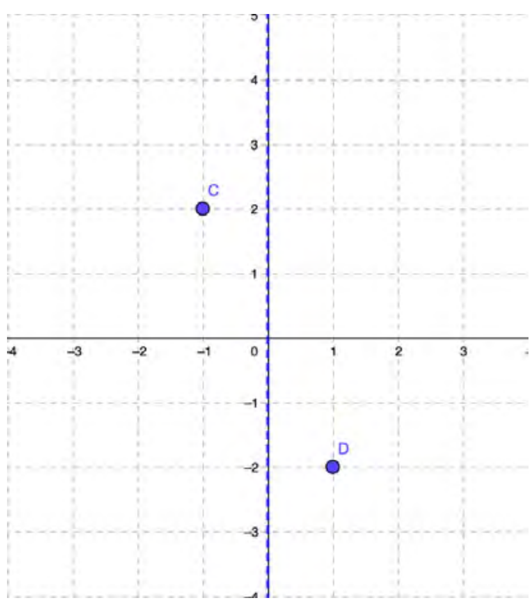
Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

1. Translate point *A* 1 unit to the right and 3 units down. Label the image and identify the coordinates of the new image?



New coordinates: _____________

2. Reflect points *C* and *D* over the dashed line of reflection. Label the images and identify the coordinates of the new points.

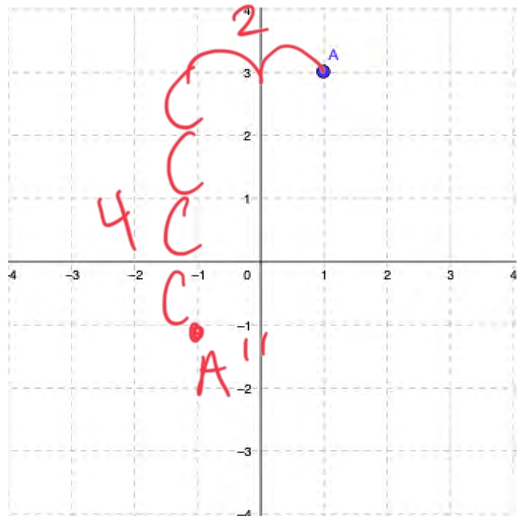


New coordinates: _____________ and ____________

Name: Answer Key

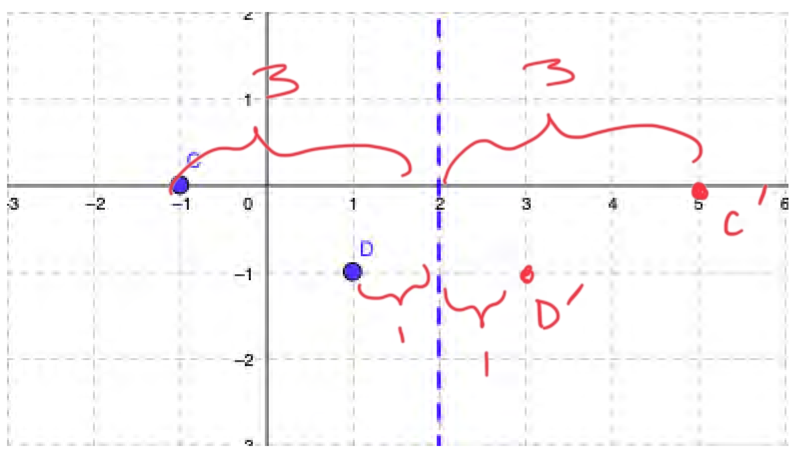
Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

1. Translate point *A* 2 units to the left and 4 units down. Label the images and identify the coordinates of the new image?



New coordinates: (-1, -1)

2. Reflect points *C* and *D* over the line of reflection. Label and image and identify the coordinates of the new images.

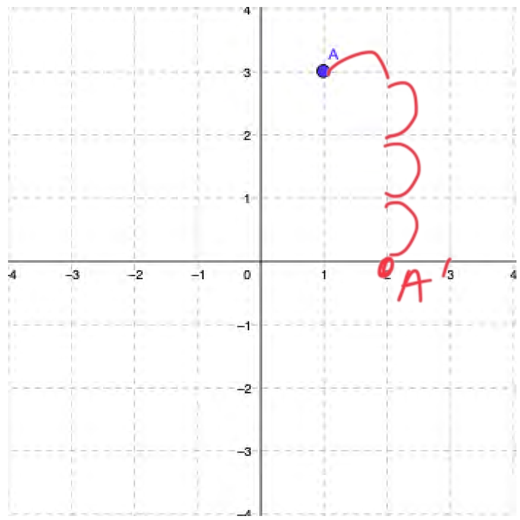


New coordinates: C'(5, 0) and D'(3, -1)

Name: Answer Key

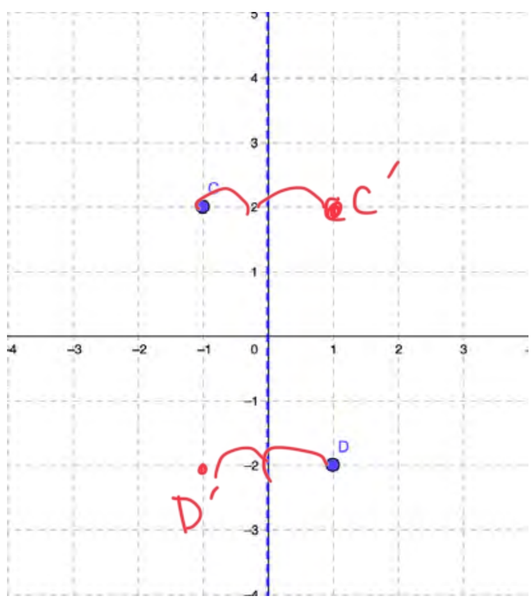
Apply transformations to points on a coordinate plane and name the coordinates of points in the image of a transformation.

1. Translate point *A* 1 unit to the right and 3 units down. Label the image and identify the coordinates of the new image?



New coordinates: A'(2,0)

2. Reflect points *C* and *D* over the dashed line of reflection. Label the images and identify the coordinates of the new points.



New coordinates: C'(1, 2) and D'(-1, -2)

G8 U1 Lesson 4
Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

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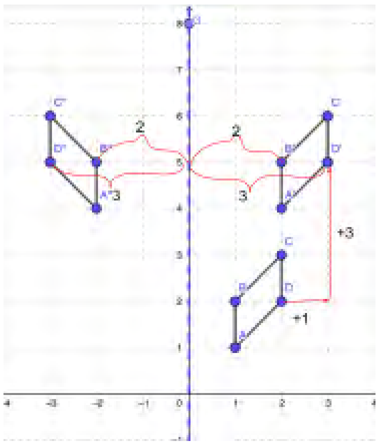
G8 U1 Lesson 4 - Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 3): Today we will apply a sequence of transformations to points on a coordinate to determine whether the order of sequences has an effect on the image. First, remember that a sequence of transformations occurs when you combine multiple transformations to produce a final image. You'll name the points of the final image with multiple apostrophes.

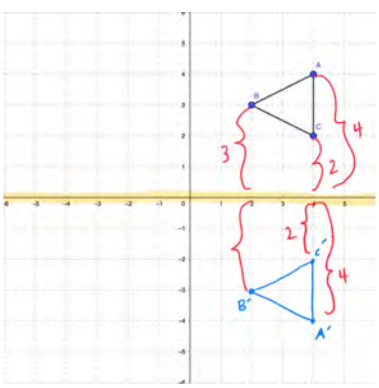


For example: In the last lesson, *ABCD* was translated one unit to the right and 3 units up creating the image *A'B'C'D'*. *(Draw arrows to demonstrate the vector by which the original image moved. Label at least one set of arrows with the number of units each point moved.)*

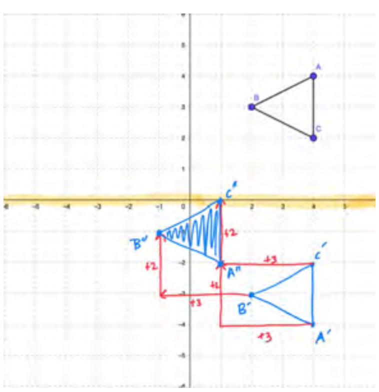
We then reflected the image over the *y*-axis. We ensured that the distance from each point to the line of reflection was the same and then we labeled each point (or vertex of the figure) *A''B''C''D''. (Mark the grid to show the distances are equal from at least two points to the line of reflection. Label the resulting vertices A'', B'', C'' and D''.)*

Let's Talk (Slide 4): Let's perform a sequence of transformations on triangle *ABC*. What do you think will happen to the new coordinates if we apply the following transformations: 1) Reflect *ABC* over the *x*-axis? 2) Translate the image 3 units left and 2 units up? Possible Students Answers, Key Points:

- The new coordinates will both be negative because the triangle will be in quadrant 4 after the reflection but some values may change after they are translated.
- The points (vertices) will be labeled A', B', and C'.

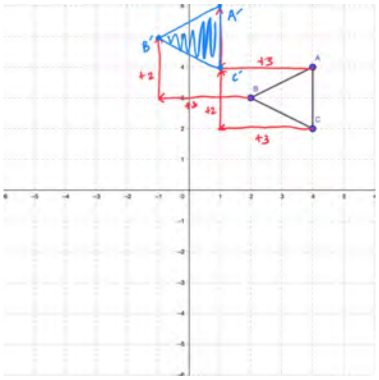


Let's apply the reflection over the *x*-axis to *ABC*. First, let's highlight or outline the line of reflection and notice how many units each vertex is away from the line of reflection. *(Highlight the line of reflection and apply the transformation to ABC. Label the vertices A'B'C'.)*

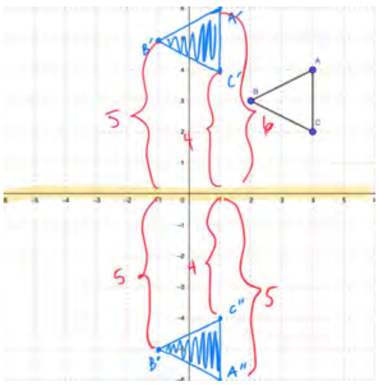


Next, let's apply the translation, 3 units to the left and 2 units up, to complete the sequence. (*Label the vertices of the image A"B"C".)*

Let's Think (Slide 5): Now, let's consider what happens if we take the same original figure, *ABC*, but switch the order of the transformations. This time we'll start by translating *ABC* 3 units left and 2 units up. After, we'll reflect the image over the *x*-axis.



Let's apply the first transformation to *ABC*, translating the triangle. *(Count with the students to translate each point and label the vertices A'B'C'. Mark the vectors using arrows or use counting arcs to demonstrate the movement.)*



Next, let's highlight or outline the line of reflection, noticing how many units each point is away from the *x*-axis to keep the distances equivalent on both sides. *(Highlight the line of reflection and draw the image. Label the vertices A''B''C''.)*

Now, let's compare *A''B''C''* in both cases after we switched the order of the transformations. What we've verified is that the order of the transformations in a sequence definitely matters since the final image, *A''B''C''*, is in a different final location.

Let's Try it (Slides 6 - 7): Let's work on applying a sequence of transformations twice, changing the order the second time, to see if it affects the final coordinates of the image. We will work on this page together. Remember to label your final vertices with the appropriate number of apostrophes. If you completed 1 transformation, there should be one apostrophe. If you performed two transformations, the final image should be labeled with two apostrophes. And so on.

WARM WELCOME

Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

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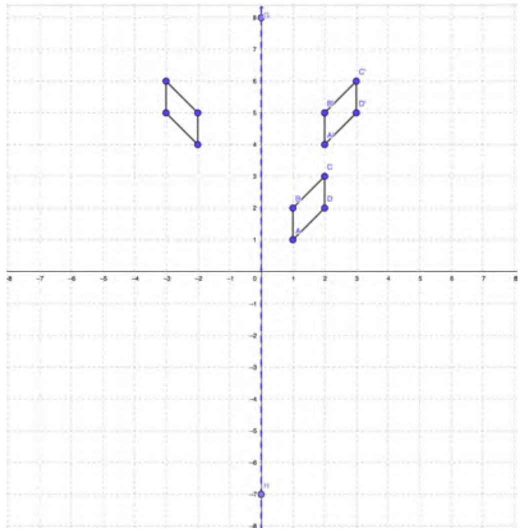
Let's Review:

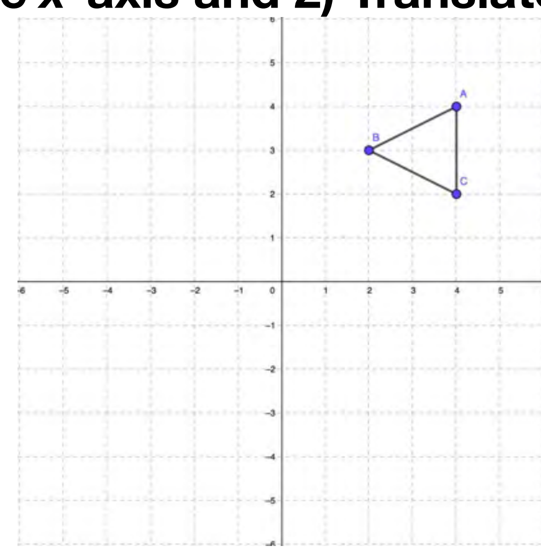
A sequence of transformations is when you combine multiple transformations to produce a final image.



Let's Talk:

Does the order matter in a sequence of transformations?

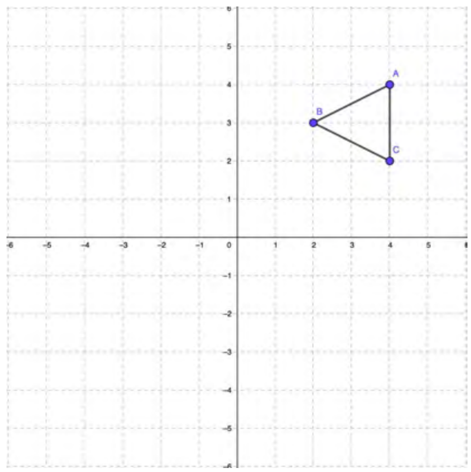
What will happen to the coordinates of the image when you 1) Reflect *ABC* over the *x*-axis and 2) Translate the image 3 units left and 2 units up?



Let's Think:

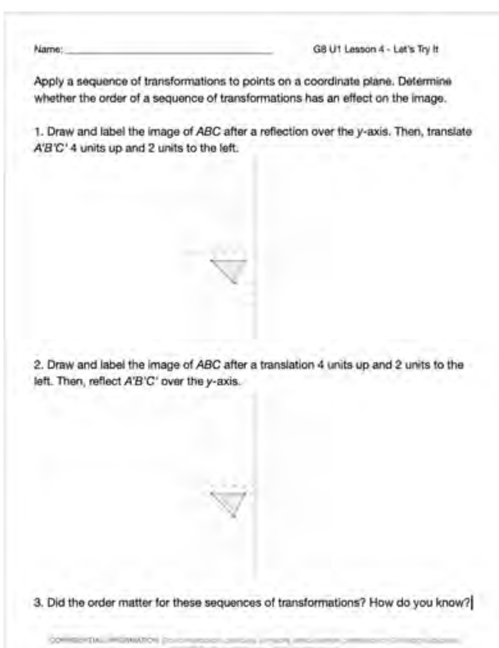
Does the order matter in a sequence of transformations?

Is there an impact on the coordinates of the image if we reverse the order of the transformations? 1) Translate the image 3 units left and 2 units up 2) Reflect *ABC* over the *x*-axis



Let's Try It:

Let's determine if the order matter in a sequence of transformations?



Name:________________________ G8 U1 Lesson 4 - Let's Try It

Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

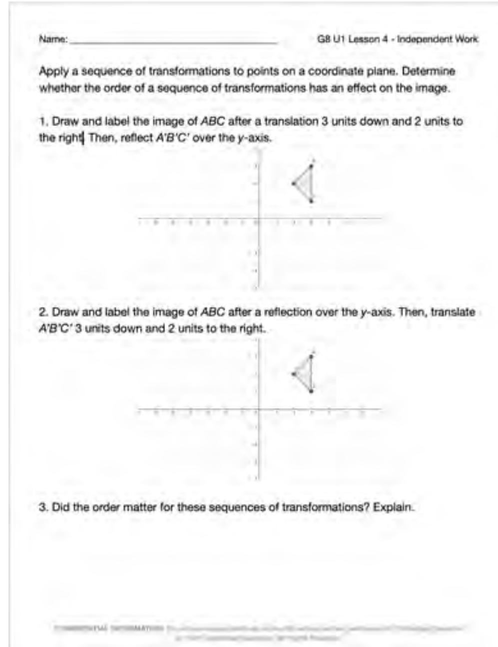
1. Draw and label the image of *ABC* after a reflection over the *y*-axis. Then, translate *A'B'C'* 4 units up and 2 units to the left.

2. Draw and label the image of *ABC* after a translation 4 units up and 2 units to the left. Then, reflect *A'B'C'* over the *y*-axis.

3. Did the order matter for these sequences of transformations? How do you know?

On your Own:

Now it's time to determine if the order matters in a sequence of transformations?



Name: ______________________________ G8 U1 Lesson 4 - Independent Work

Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

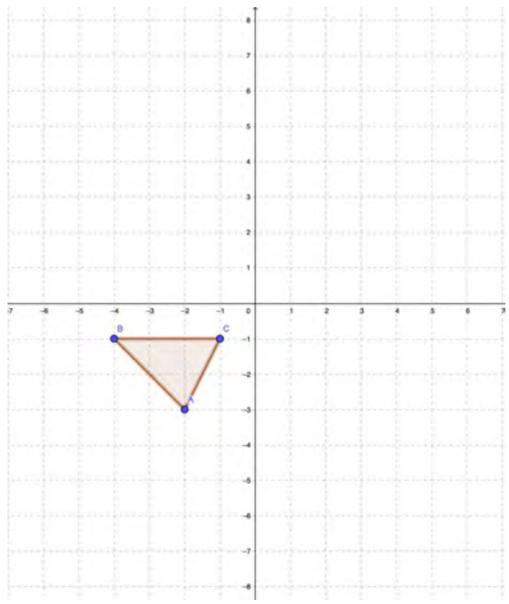
1. Draw and label the image of *ABC* after a translation 3 units down and 2 units to the right. Then, reflect *A'B'C'* over the *y*-axis.

2. Draw and label the image of *ABC* after a reflection over the *y*-axis. Then, translate *A'B'C'* 3 units down and 2 units to the right.

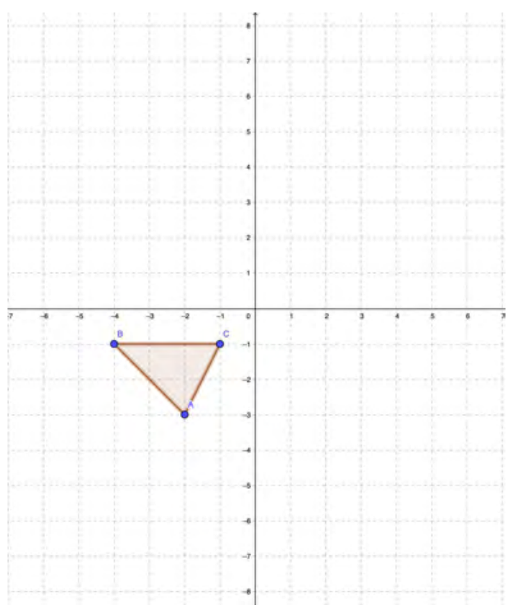
3. Did the order matter for these sequences of transformations? Explain.

Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

1. Draw and label the image of *ABC* after a reflection over the *y*-axis. Then, translate *A’B’C’* 4 units up and 2 units to the left.



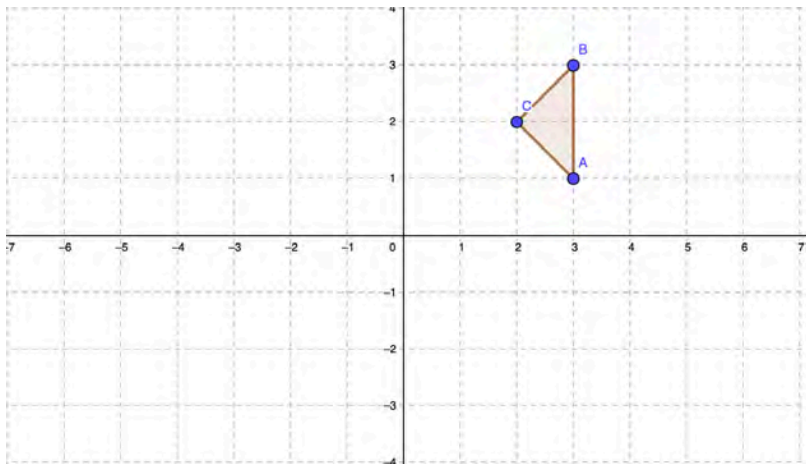
2. Draw and label the image of *ABC* after a translation 4 units up and 2 units to the left. Then, reflect *A’B’C’* over the *y*-axis.



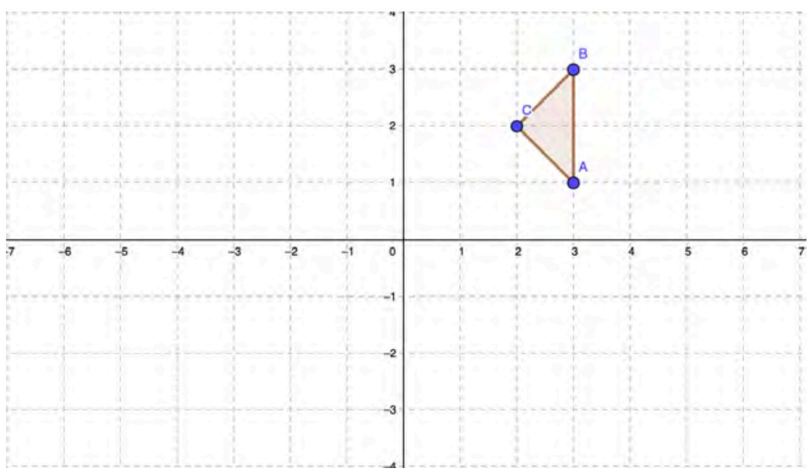
3. Did the order matter for these sequences of transformations? How do you know?

Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

1. Draw and label the image of *ABC* after a translation 3 units down and 2 units to the right. Then, reflect *A'B'C'* over the *y*-axis.



2. Draw and label the image of *ABC* after a reflection over the *y*-axis. Then, translate *A'B'C'* 3 units down and 2 units to the right.

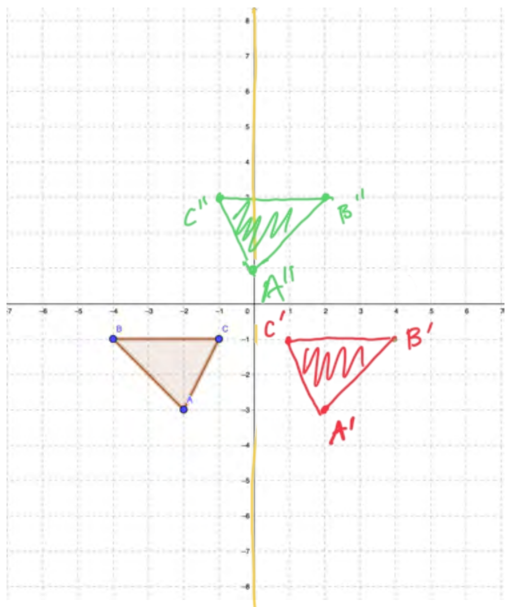


3. Did the order matter for these sequences of transformations? Explain.

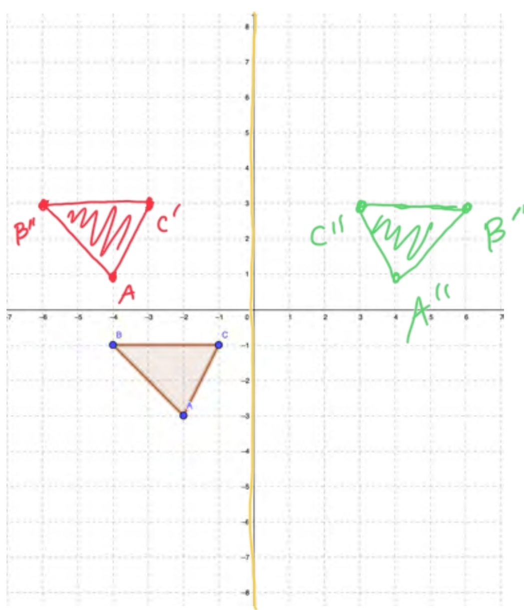
Name: Answer Key

Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

1. Draw and label the image of *ABC* after a reflection over the *y*-axis. Then, translate *A'B'C'* 4 units up and 2 units to the left.



2. Draw and label the image of *ABC* after a translation 4 units up and 2 units to the left. Then, reflect *A'B'C'* over the *y*-axis.



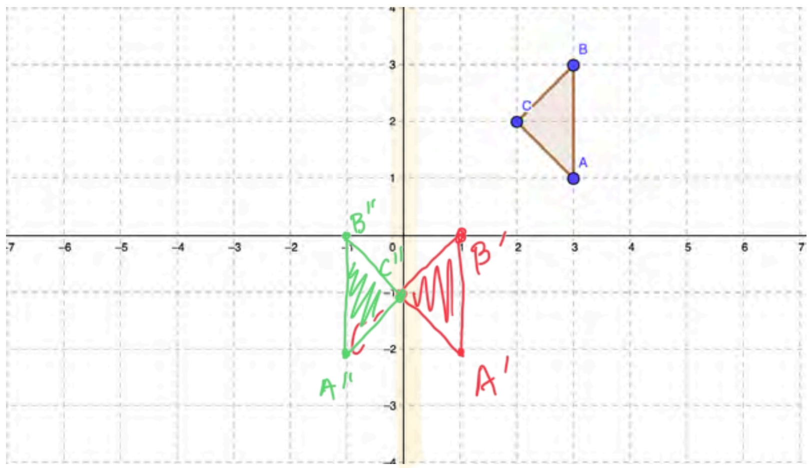
3. Did the order matter for these sequences of transformations? How do you know?

Yes, the order mattered. The final image of Δ ABC ended in different places even though it started in the same place.

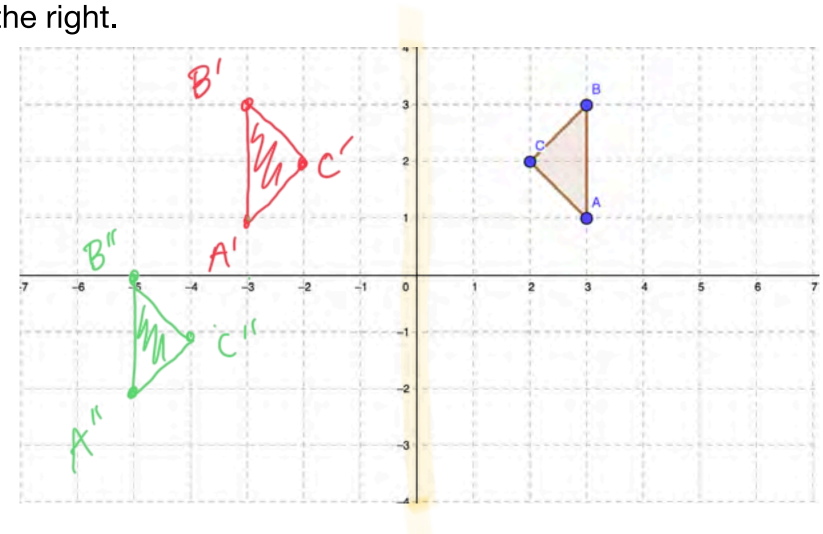
Name: Answer Key

Apply a sequence of transformations to points on a coordinate plane. Determine whether the order of a sequence of transformations has an effect on the image.

1. Draw and label the image of *ABC* after a translation 3 units down and 2 units to the right. Then, reflect *A’B’C’* over the *y*-axis.



2. Draw and label the image of *ABC* after a reflection over the *y*-axis. Then, translate *A’B’C’* 3 units down and 2 units to the right.



3. Did the order matter for these sequences of transformations? Explain.

G8 U1 Lesson 5
Compare measurements of sides and angles on a shape before and after rigid transformations.

G8 U1 Lesson 5 - Compare measurements of sides and angles on a shape before and after rigid transformations.

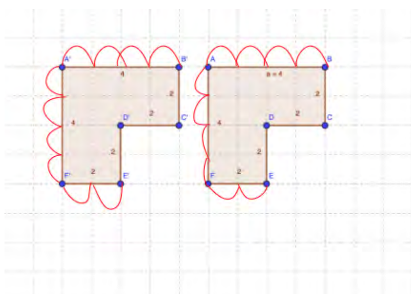
Materials: protractor

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 3): Today we will compare measurements of sides and angles on a shape before and after rigid transformations. First, recall that when you complete a rigid transformation, the side lengths of the original figure and its image have to be the same.

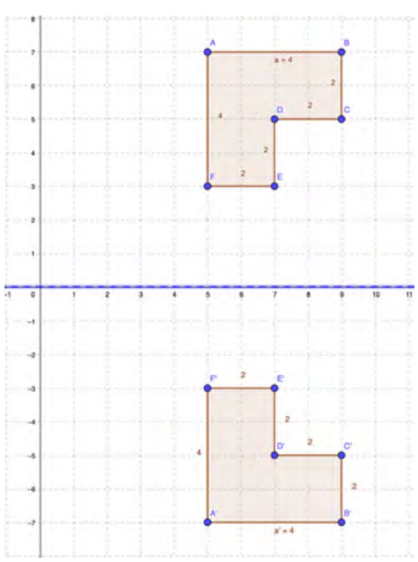
Let's Talk (Slide 4): First, let's confirm that the side lengths will be the same after a rigid transformation. Look at the polygon below. It was translated to the left 5 units. Without counting, what are the side lengths of segments *A'B'*, *E'F'*, and *F'A'*? Possible Students Answers, Key Points:

- Since the side lengths are the same in rigid transformation, the side lengths should be 4, 2, and 2 respectively.
- *A'B'* = 4 because it's the same as *AB.*
- *E'F'* = 2 because it's the same as *EF*.
- *F'A'* = 4 because it's the same as *FA*.



(Sketch counting humps to show that the three segments of the image are equal in length to the corresponding sides of or the original figure.) We've confirmed with a translation that the side lengths are the same in this rigid transformation. We can say that corresponding sides of a translated figure are the same.

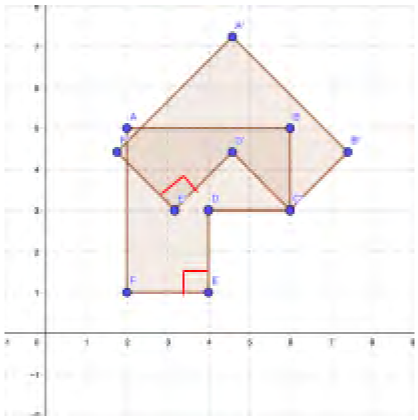
Let's Think (Slide 5): What about the side lengths of a figure that is reflected over a line? Let's use the same polygon but this time it was reflected over the *x*-axis.



Notice that like the translated figure, all of the corresponding sides are congruent.

Now that we verified, with two different rigid transformations, that the side lengths are the same once the original figure undergoes a transformation, let's consider what happens to the angles.

Let's Think (Slide 6): Let's consider what happens to the angles of a figure by rotating the same polygon 90 degrees clockwise about point *C*. Currently, all interior angles are 90 degrees which you can agree with without verifying because each angle forms a square with each unit of the grid.



We'll use a protractor to measure angle *E* in both polygons. *(Draw a right angle after you measure each angle.)* We can see that each angle appears to be the same but using the protractor helps us to verify that both angles measure 90 degrees.

Let's Try it (Slides 7 - 8): Let's work on comparing measurements of sides and angles on a shape before and after rigid transformations. We will work on this page together. Remember corresponding sides and angles of figures that undergo all three rigid transformations will be equal.

WARM WELCOME

Compare measurements of sides and angles on a shape before and after rigid transformations.

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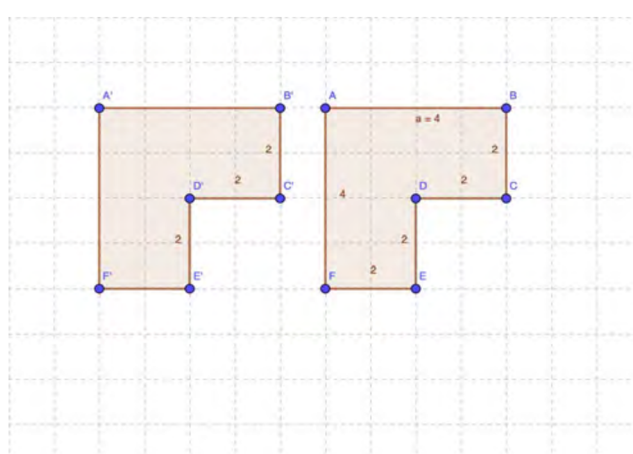
Let's Review:

When you complete a rigid transformation, the side lengths of the original figure and its image will be the same.

Let's Talk:

Can we determine if a rigid transformation occurred based on the measurements of the sides and angles of shapes?

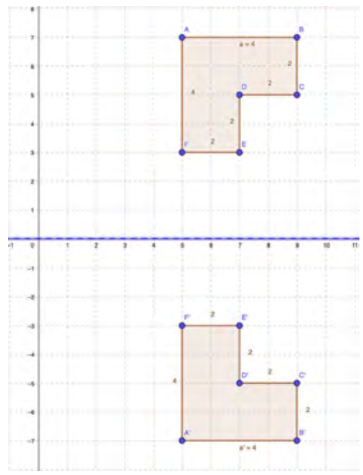
Given that polygon *A'B'C'D'E'F'* is the image of polygon *ABCDEF* after a translation 3 units to the left, what are the lengths of segments *A'B'*, *E'F'*, and *F'A'*.



Let's Think:

Can we determine if a rigid transformation occurred based on the measurements of the sides and angles of shapes?

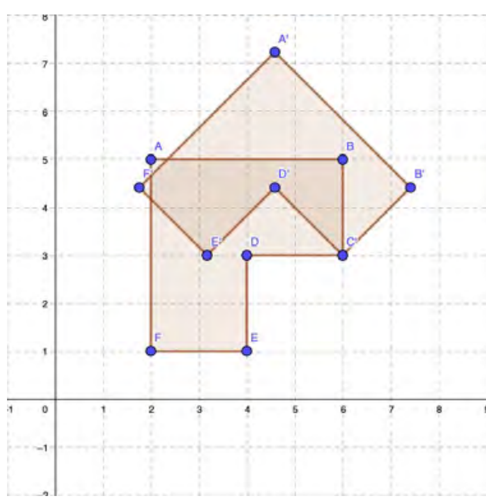
What do the images below tell us about the side lengths of a figure when it undergoes a reflection as the rigid transformation?



Let's Think:

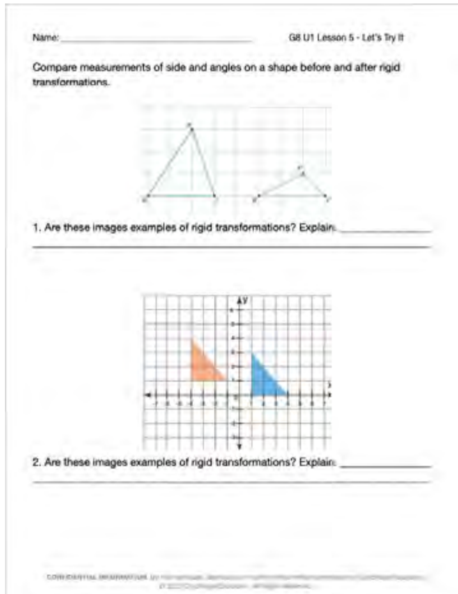
Can we determine if a rigid transformation occurred based on the measurements of the sides and angles of shapes?

What about the corresponding angles of figures before and after a rigid transformation? Are they also the same?



Let's Try It:

Let's determine if a rigid transformation occurred based on the measurements of the sides and angles of shapes.


Name: ______________________ G8 U1 Lesson 5 - Let's Try It

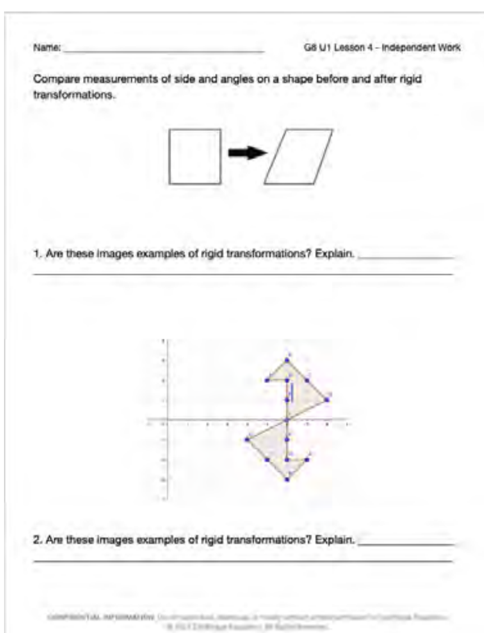
Compare measurements of side and angles on a shape before and after rigid transformations.

1. Are these images examples of rigid transformations? Explain: ____________

2. Are these images examples of rigid transformations? Explain: ____________

On your Own:

Now it's time to determine if a rigid transformation occurred based on the measurements of the sides and angles of shapes.

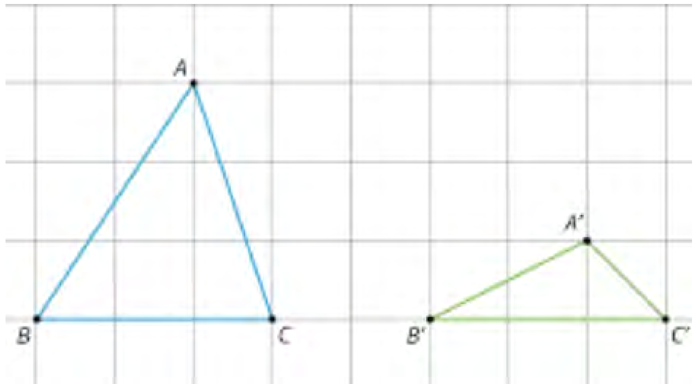

Name: ______________________ G8 U1 Lesson 4 - Independent Work

Compare measurements of side and angles on a shape before and after rigid transformations.

1. Are these images examples of rigid transformations? Explain. ____________

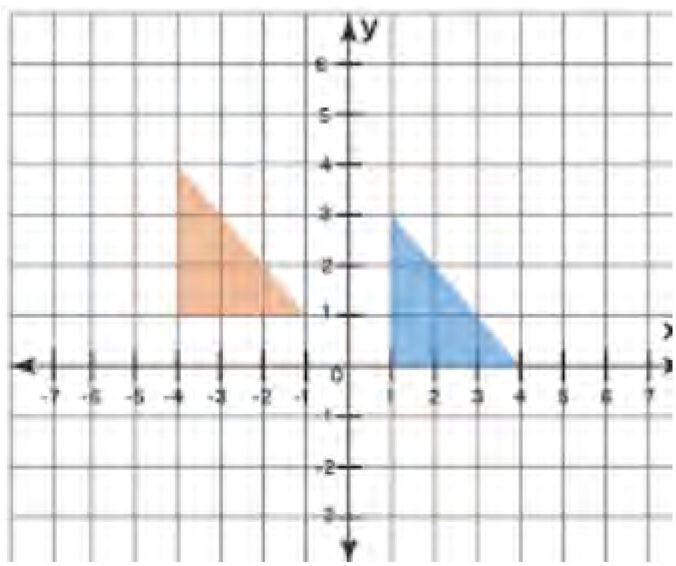
2. Are these images examples of rigid transformations? Explain. ____________

Compare measurements of sides and angles on a shape before and after rigid transformations.



1. Are these images examples of rigid transformations? Explain. ___________________________

____

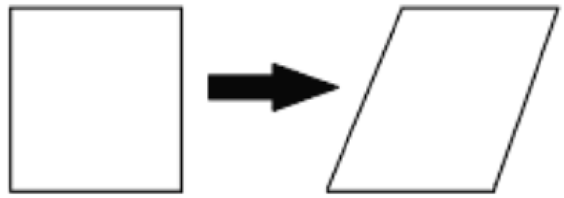


2. Are these images examples of rigid transformations? Explain. ___________________________

____

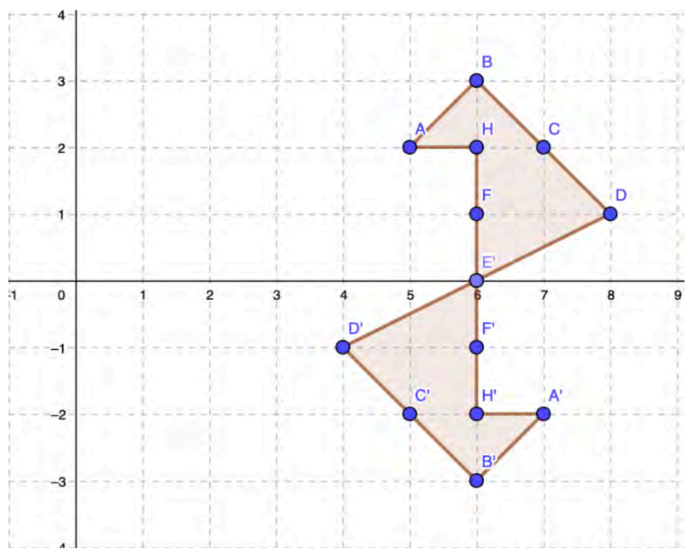
Name: ______________________________________ G8 U1 Lesson 5 - Independent Work

Compare measurements of sides and angles on a shape before and after rigid transformations.



1. Are these images examples of rigid transformations? Explain. ____________________________

____



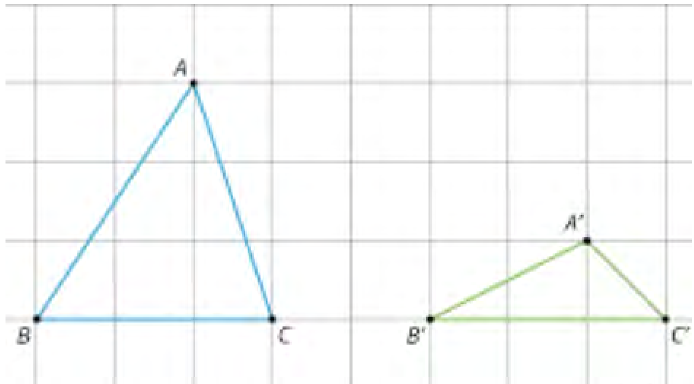
2. Are these images examples of rigid transformations? Explain. ____________________________

____

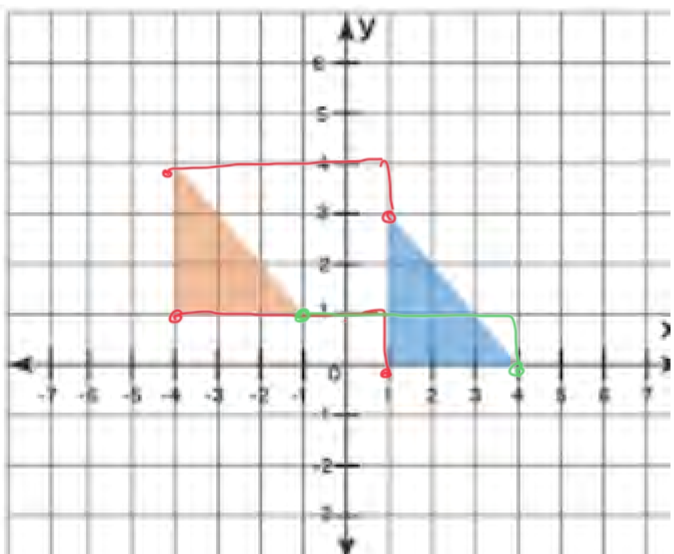
Name: Answer Key

G8 U1 Lesson 5 - Let's Try It

Compare measurements of side and angles on a shape before and after rigid transformations.



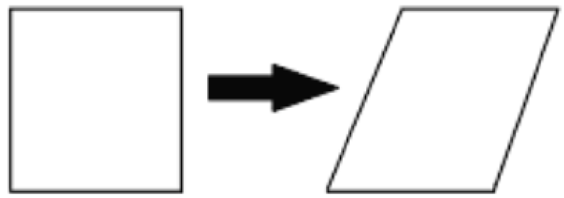
1. Are these images examples of rigid transformations? Explain. No. I cannot use a translation, reflection, or rotation to make Δ A'B'C' lay on top of Δ ABC so their measurements are not all the same.



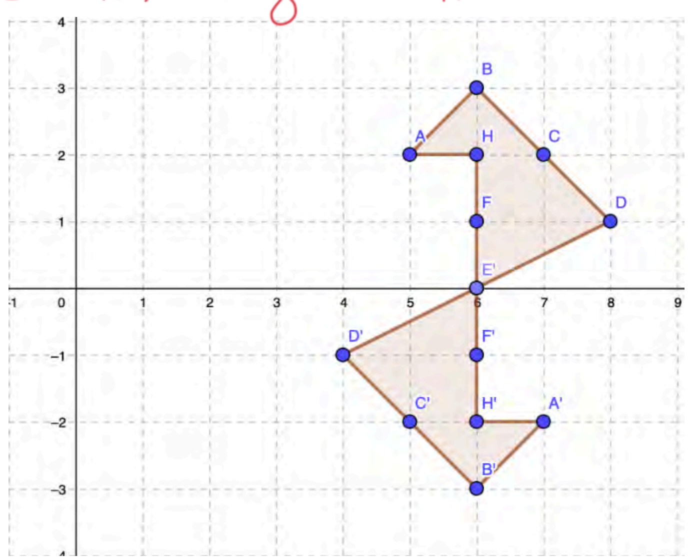
2. Are these images examples of rigid transformations? Explain. Yes. These triangles will overlap completely using a translation of 5 units right an 1 unit down [or the opposite] which means their side lengths and angles are all the same.

Name: Answer Key

Compare measurements of sides and angles on a shape before and after rigid transformations.



1. Are these images examples of rigid transformations? Explain. No. The interior ∡s of the left shape appear to be 90° while those on the right are greater or less than 90°. Since the angles are not congruent these shapes are not rigid transformations.



2. Are these images examples of rigid transformations? Explain. Yes. I can rotate polygon ABCDEFH 180° Counterclockwise and all sides and angles will match.

G8 U1 Lesson 6
Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.

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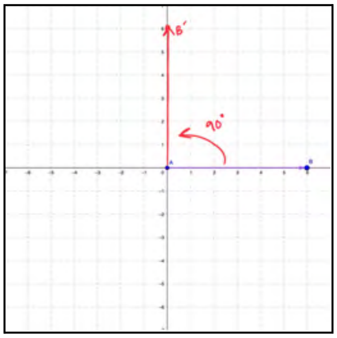
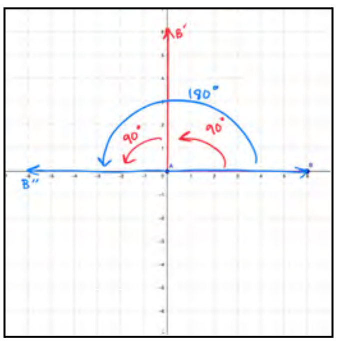
G8 U1 Lesson 6 - Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slide 2): Today we will rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment in order to generalize the outcomes of rotating a segment 180 degrees around different points. First, let's recall what it means for something to be 180 degrees. The simplest way to think of 180 degrees might be to consider a quadrant chart.



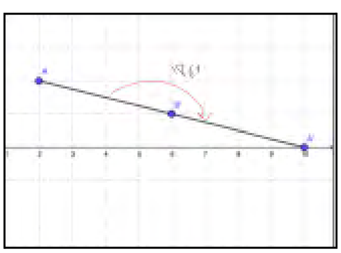
Consider the arrow pointing toward *B*. If we rotate the arrow 90 degrees counterclockwise, the image creates a 90 degree angle with the original arrow. *(Draw an arrow in the direction counterclockwise and write 90 degrees.)*



Since 90 + 90 is 180, we can rotate the arrow another 90 degrees for a full angle rotation of 180 degrees. *(Show an arc for an additional 90 degree rotation.)* The final image of the arrow makes a straight line with the original arrow. (*Draw an arrow to show 180 degrees then highlight/outline the straight line that the final arrow created with the original arrow.)*

Let's Talk (Slide 3): Now, consider the segment *AB*. Where would the image be if we rotated the segment 180 degrees around point *B*? Possible Students Answers, Key Points:

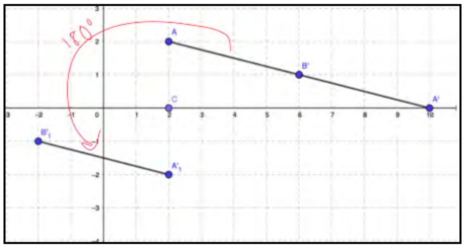
- The image would create a longer straight line.
- The image will be in line with segment *AB*.
- The image will create a longer line where *B* is the midpoint of *A* and *A*'



(*Draw an arrow to show the angle of rotation and mark it as 180 degrees.)* Notice that since *B* is on the original line segment and is the point of rotation, rotating 180 degrees in this case gives us a straight line with *B* as the midpoint.

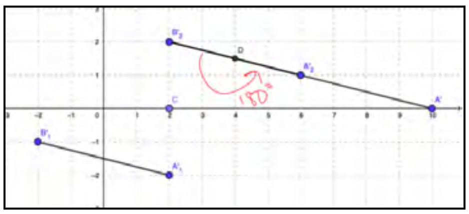
Let's Talk (Slide 4): Now let's rotate the same segment around a point *C* that is not on the original segment. What do you think will happen? Possible Students Answers, Key Points:

- The image will not create a longer line segment with the point as the midpoint.
- The image will be in a different place but the same distance from the point of rotation.



(Draw an arrow to show the angle of rotation and mark it as 180 degrees.) Notice that since *C* is not on the original line segment but is the point of rotation, rotating 180 degrees in this case creates a new image of *AB* that is equidistant from the point of rotation as the original segment but not on the same line.

Let's Think (Slide 5): Now that we have some idea of what happens when we rotate a segment 180 degrees around a point on the segment and a point not on the segment, let's think about what might happen if I rotate segment *AB* around its own midpoint *D*.



Remember that a 180 degree angle is a straight line angle. In this case, because the point of rotation is the midpoint of the segment being rotated, the segment turned and overlapped itself. *(Draw an arrow to show the angle of rotation and mark it as 180 degrees. Label the new point of the image as shown so they understand that the B now overlaps A and vice versa after undergoing this transformation.)*

Let's Try it (Slides 7-8): Let's work on rotating segments 180 degrees around a segment's midpoint, a point on the segment, and a point off of the segment. We will work on this page together. Remember that 1) rotating a segment 180 degrees around its midpoint creates an image that overlaps the original segment, 2) rotating a segment 180 degrees around a point on the segment creates an image that extends the length of the original segment, and 3) rotating a segment 180 degrees around a point that is not on the segment creates an image that is does not connect to the original segment but all points on both segments are equidistant to the center of rotation.

WARM WELCOME

Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.

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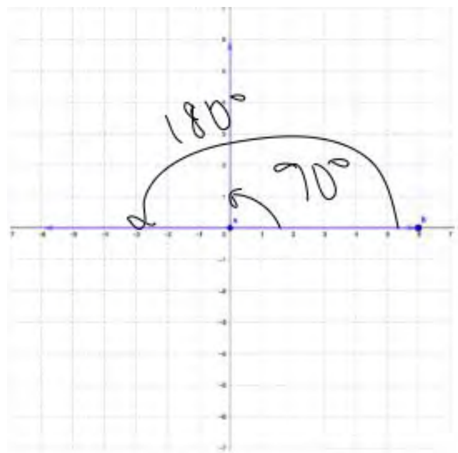
Let's Review:

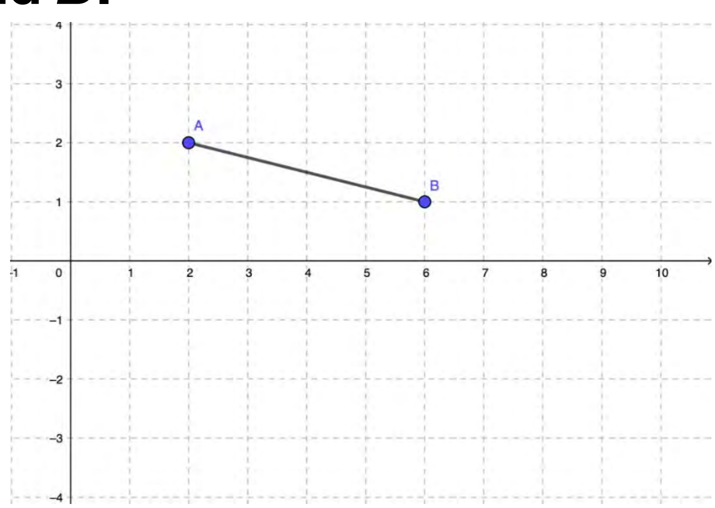
A straight line is 180 degrees.



Let's Talk:

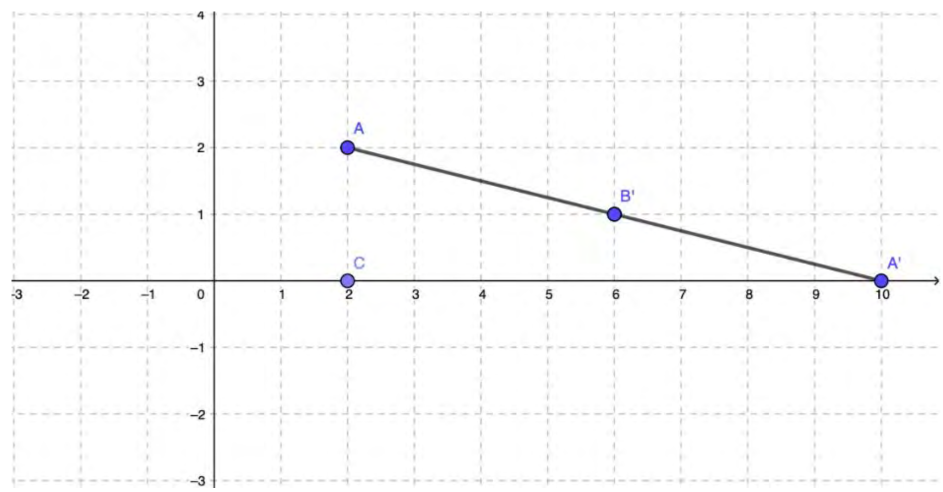
What is true about line segments rotated 180 degrees around a point?

Describe where the image of *AB* will be when it is rotated 180 degrees around *B*.



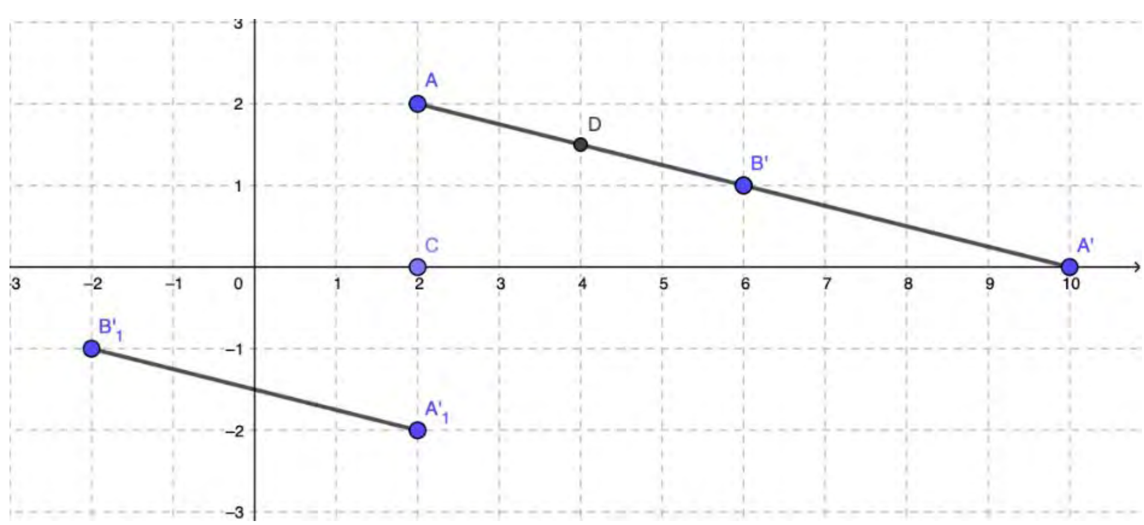
Let's Talk: **What is true about line segments rotated 180 degrees around a point?**

Now, where will the image of *AB* be when it is rotated 180 degrees around *C*?



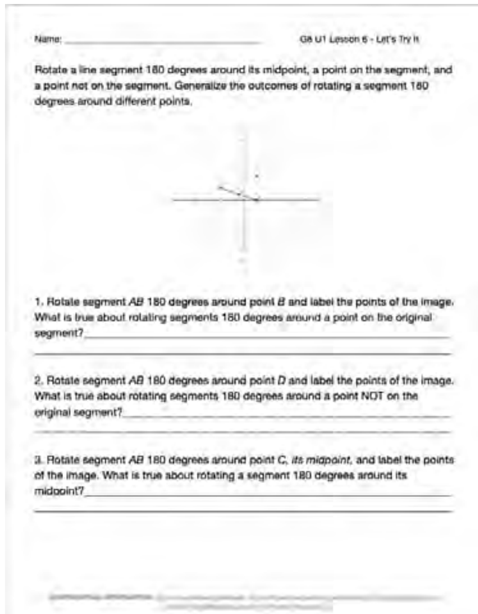
Let's Think: **What is true about line segments rotated 180 degrees around a point?**

Where will the image of *AB* be when it is rotated 180 degrees around *D*, its midpoint?



Let's Try It:

Let's practice rotating segments 180 degrees about different points.



Name: ____________________ G8 U1 Lesson 6 - Let's Try It

Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.

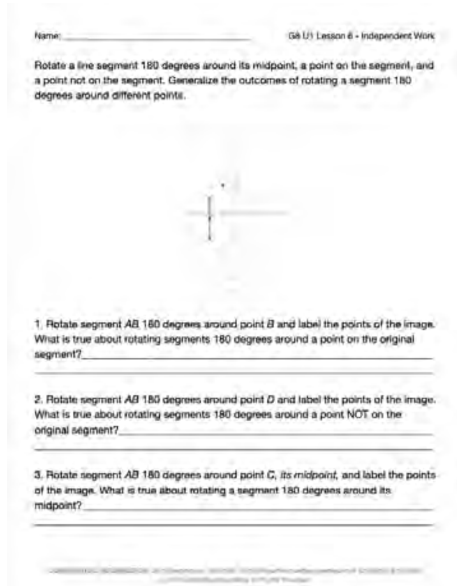
1. Rotate segment *AB* 180 degrees around point *B* and label the points of the image. What is true about rotating segments 180 degrees around a point on the original segment?____________________

2. Rotate segment *AB* 180 degrees around point *D* and label the points of the image. What is true about rotating segments 180 degrees around a point NOT on the original segment?____________________

3. Rotate segment *AB* 180 degrees around point *C*, *its midpoint*, and label the points of the image. What is true about rotating a segment 180 degrees around its midpoint?____________________

On your Own:

Now it's time to rotate segments 180 degrees about different points.



Name: ____________________ G8 U1 Lesson 6 - Independent Work

Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.

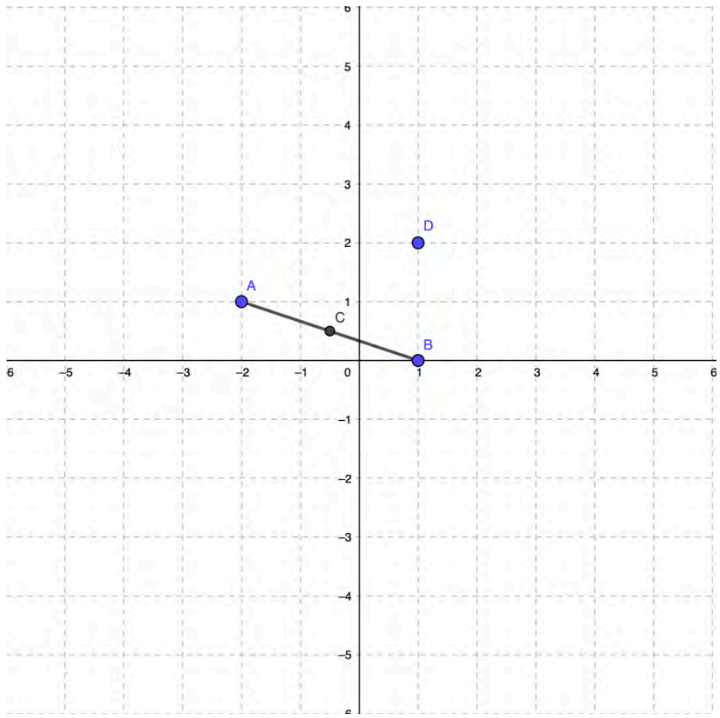
1. Rotate segment *AB* 180 degrees around point *B* and label the points of the image. What is true about rotating segments 180 degrees around a point on the original segment?____________________

2. Rotate segment *AB* 180 degrees around point *D* and label the points of the image. What is true about rotating segments 180 degrees around a point NOT on the original segment?____________________

3. Rotate segment *AB* 180 degrees around point *C*, *its midpoint*, and label the points of the image. What is true about rotating a segment 180 degrees around its midpoint?____________________

Name: ____ G8 U1 Lesson 6 - Let's Try It

Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.



1. Rotate segment *AB* 180 degrees around point *B* and label the points of the image. What is true about rotating segments 180 degrees around a point on the original segment? ____________________

____

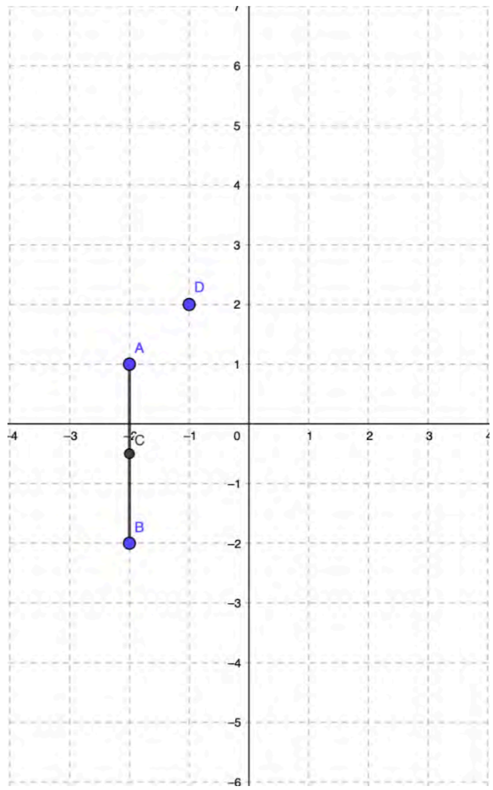
2. Rotate segment *AB* 180 degrees around point *D* and label the points of the image. What is true about rotating segments 180 degrees around a point NOT on the original segment? _______________

____

3. Rotate segment *AB* 180 degrees around point *C, its midpoint,* and label the points of the image. What is true about rotating a segment 180 degrees around its midpoint? __________________________

____

Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.



1. Rotate segment *AB* 180 degrees around point *B* and label the points of the image. What is true about rotating segments 180 degrees around a point on the original segment?__________________

____

2. Rotate segment *AB* 180 degrees around point *D* and label the points of the image. What is true about rotating segments 180 degrees around a point NOT on the original segment?_______________

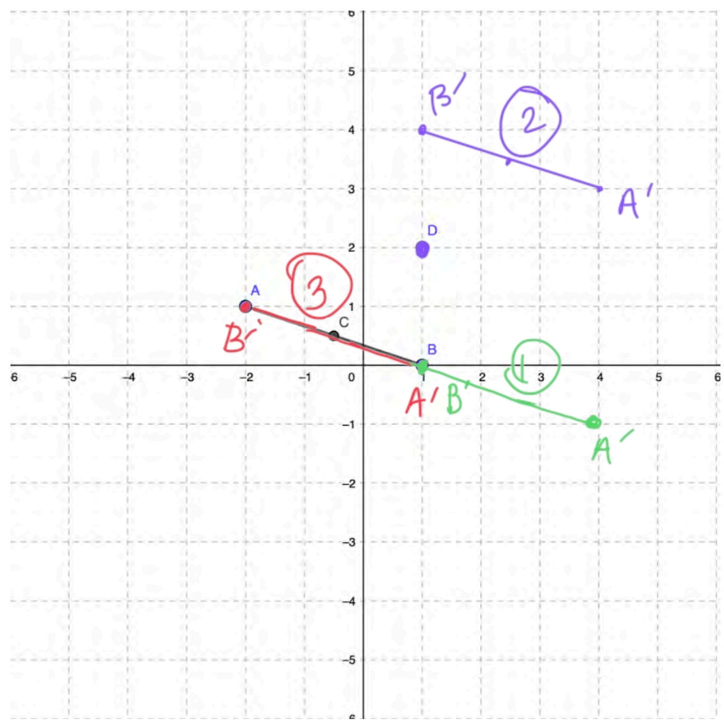
____

3. Rotate segment *AB* 180 degrees around point *C, its midpoint,* and label the points of the image. What is true about rotating a segment 180 degrees around its midpoint?_________________________

____

Name: Answer Key

Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.



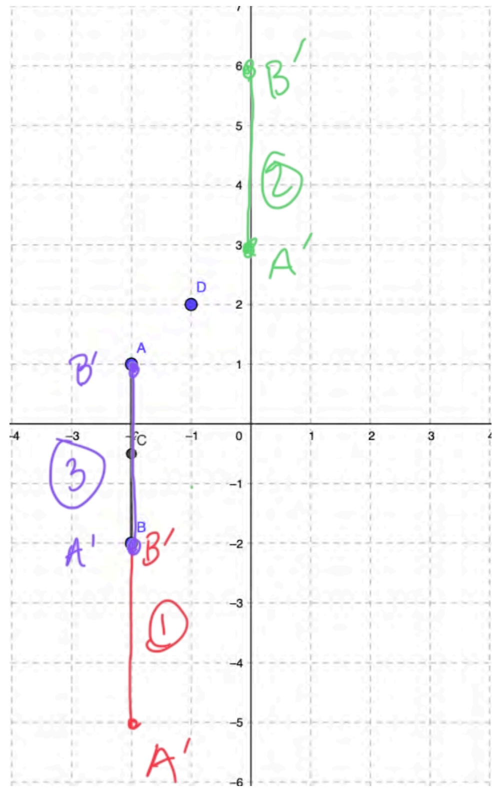
1. Rotate segment *AB* 180 degrees around point *B* and label the points of the image. What is true about rotating segments 180 degrees around a point on the original segment? The segment extends the length of the original line

2. Rotate segment *AB* 180 degrees around point *D* and label the points of the image. What is true about rotating segments 180 degrees around a point NOT on the original segment? The new segment will not be on the original segment.

3. Rotate segment *AB* 180 degrees around point *C, its midpoint,* and label the points of the image. What is true about rotating a segment 180 degrees around its midpoint? The segment will lie directly on top of itself.

Name: Answer Key

Rotate a line segment 180 degrees around its midpoint, a point on the segment, and a point not on the segment. Generalize the outcomes of rotating a segment 180 degrees around different points.



1. Rotate segment *AB* 180 degrees around point *B* and label the points of the image. What is true about rotating segments 180 degrees around a point on the original segment? The segment extends the length of the line.

2. Rotate segment *AB* 180 degrees around point *D* and label the points of the image. What is true about rotating segments 180 degrees around a point NOT on the original segment? The segment will not be on the original image

3. Rotate segment *AB* 180 degrees around point *C, its midpoint,* and label the points of the image. What is true about rotating a segment 180 degrees around its midpoint? The segment overlaps itself completely.

G8 U1 Lesson 7
Describe the effects of a rigid transformation on a pair of parallel lines.

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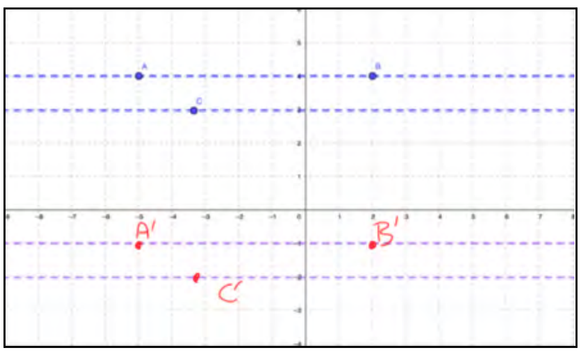
G8 U1 Lesson 7 - Describe the effects of a rigid transformation on a pair of parallel lines and understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

Warm Welcome (Slide 1): Tutor Choice

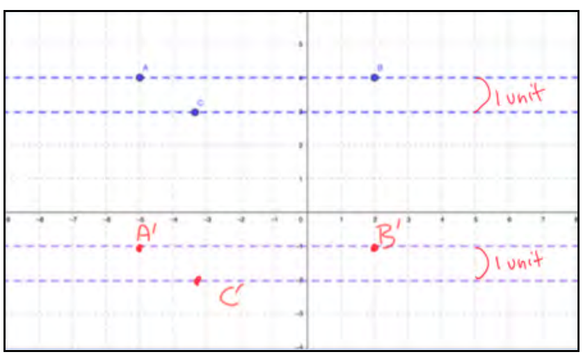
Frame the Learning/Connection to Prior Learning (Slides 2): Today we will describe the effects of a rigid transformation on a pair of parallel lines. In High School Geometry, you'll be asked to prove theorems and formulas are true. Understanding the properties of parallel lines after they undergo a rigid transformation will be helpful.

Let's Talk (Slide 3): Now, let's see what happens when we perform rigid transformations on parallel lines. Lines *AB and C* are parallel. They were translated down 4 units. What do you notice about the parallel lines and their image? Possible Students Answers, Key Points:

- The new parallel lines are 4 units below.
- The distance between the parallel lines is the same in both sets of lines.
- The new lines are still parallel.

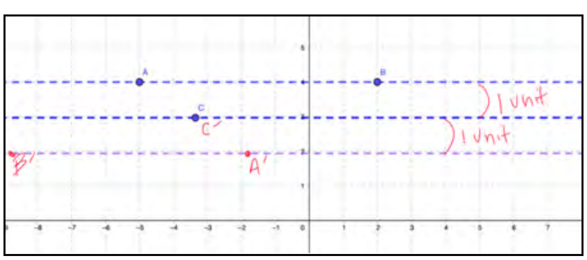


The image of the parallel lines is still parallel after the translation. *(Label the new lines A'B' and C'.)*



The distance between both sets of parallel lines is the same because the translation did not change the angles or lengths, it simply moved everything together, maintaining their original properties. *(Draw a unit arc to show each set of parallel lines has one unit of space between the lines.)*

Let's Think (Slide 4): What may happen if we rotate the original parallel lines 180 degrees about point C.



Like translations, the properties remained the same and the new set of lines are also parallel. *(Label the image pair of lines C' and A'B' and draw unit arcs to label the distances between both sets of parallel lines.)*

Let's Try it (Slides 5 - 6): Let's work on describing the effects of a rigid transformation on a pair of parallel lines. We will work on this page together. Remember, when parallel lines undergo a rigid transformation, they remain parallel and the distance between the lines is the same in all sets of lines from the original pair to the image pair.

WARM WELCOME

Describe the effects of a rigid transformation on a pair of parallel lines and understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

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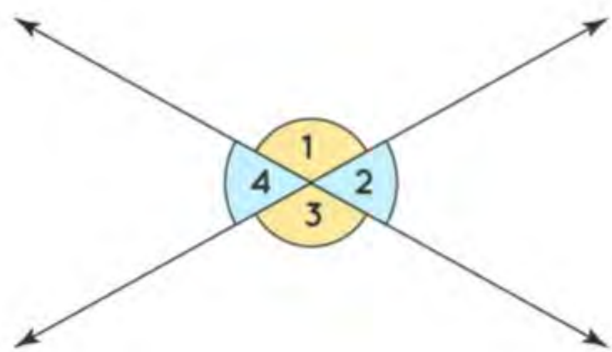
Let's Review:

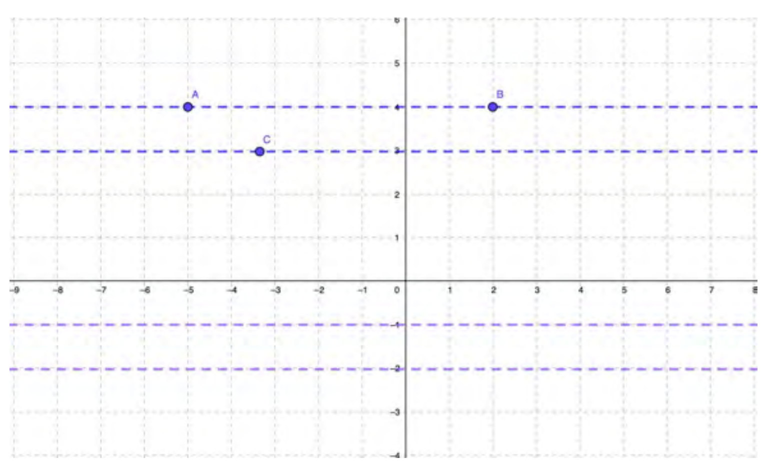
The vertical angles theorem says that angles, across from each other, that are created by a pair of intersecting lines are congruent.



Let's Talk:

What effects do rigid transformations have on parallel lines?

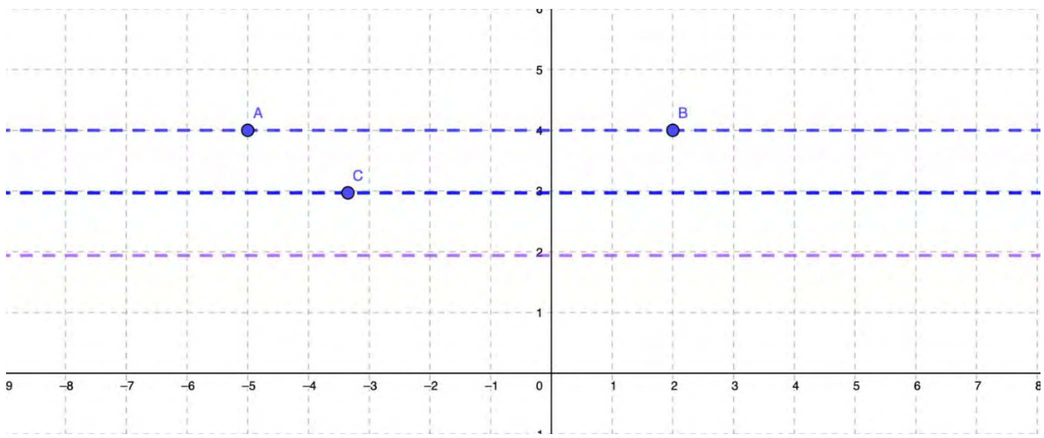
What do you notice about parallel lines *AB* and *C* and their image highlighted in purple?



Let's Think:

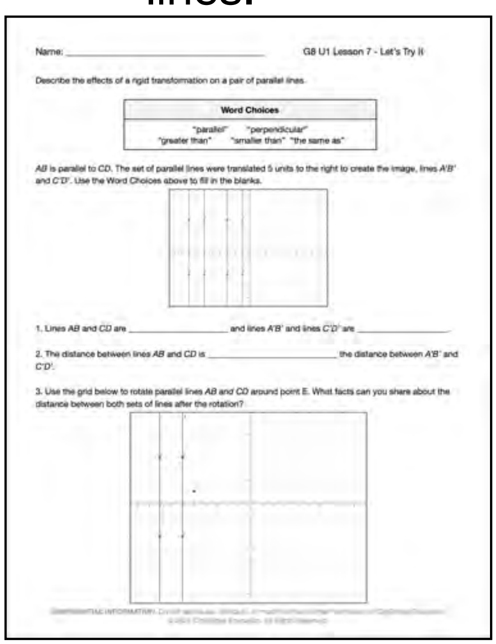
What effects do rigid transformations have on parallel lines?

What do you notice about parallel lines *AB* and *C* after they were rotated 180 degrees around point *C*?



Let's Try It:

Let's practice describing the effects of a rigid transformation on a pair of parallel lines.



Name: ______________________ G8 U1 Lesson 7 - Let's Try It

Describe the effects of a rigid transformation on a pair of parallel lines.

Word Choices
"parallel" "perpendicular" "greater than" "smaller than" "the same as"

AB is parallel to *CD*. The set of parallel lines were translated 5 units to the right to create the image, lines *A'B'* and *C'D'*. Use the Word Choices above to fill in the blanks.

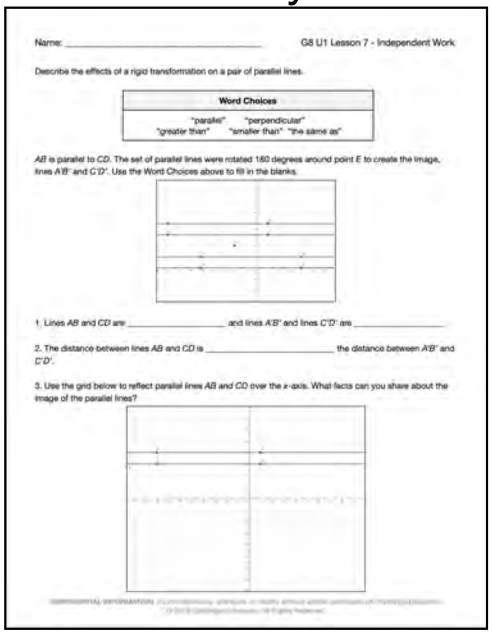
1. Lines *AB* and *CD* are ______________ and lines *A'B'* and lines *C'D'* are ______________.

2. The distance between lines *AB* and *CD* is ______________ the distance between *A'B'* and *C'D'*.

3. Use the grid below to rotate parallel lines *AB* and *CD* around point E. What facts can you share about the distance between both sets of lines after the rotation?

On your Own:

Now it's time to describe the effects of a rigid transformation on a pair of parallel lines on your own.


Name: ______________________ G8 U1 Lesson 7 - Independent Work

Describe the effects of a rigid transformation on a pair of parallel lines.

Word Choices
"parallel" "perpendicular" "greater than" "smaller than" "the same as"

AB is parallel to *CD*. The set of parallel lines were rotated 180 degrees around point *E* to create the image, lines *A'B'* and *C'D'*. Use the Word Choices above to fill in the blanks.

1. Lines *AB* and *CD* are ______________ and lines *A'B'* and lines *C'D'* are ______________

2. The distance between lines *AB* and *CD* is ______________ the distance between *A'B'* and *C'D'*.

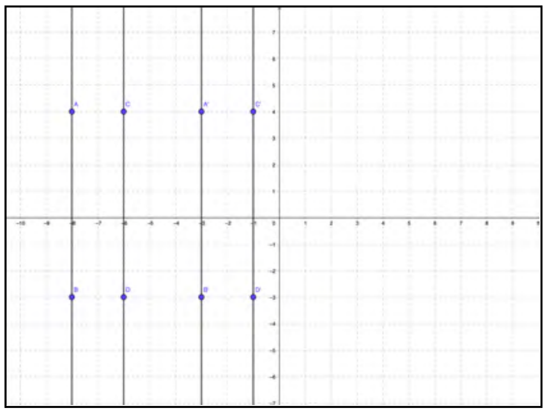
3. Use the grid below to reflect parallel lines *AB and CD* over the *x*-axis. What facts can you share about the image of the parallel lines?

Name: ______________________________________ G8 U1 Lesson 7 - Let's Try It

Describe the effects of a rigid transformation on a pair of parallel lines.

Word Choices
"parallel" "perpendicular" "greater than" "smaller than" "the same as"

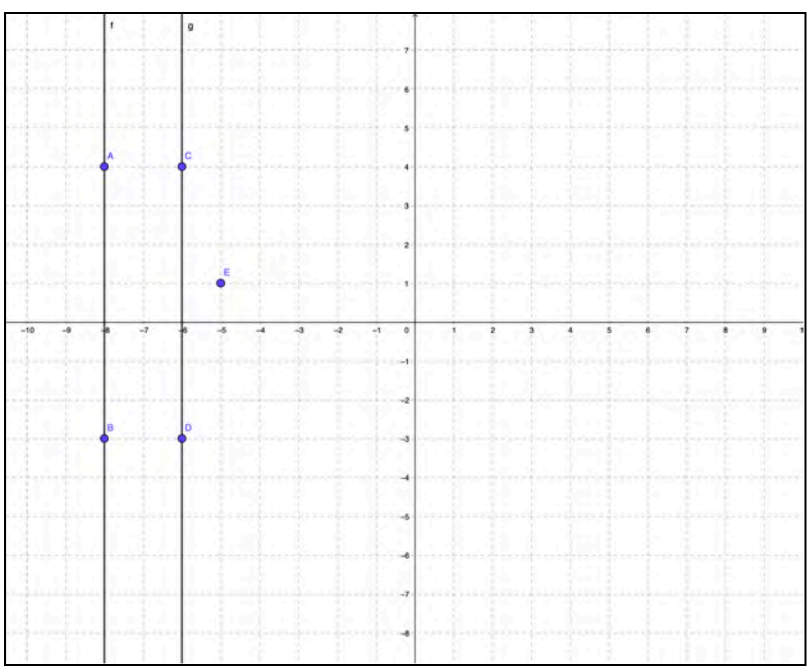
AB is parallel to *CD*. The set of parallel lines were translated 5 units to the right to create the image, lines *A'B'* and *C'D'*. Use the Word Choices above to fill in the blanks.



1. Lines *AB* and *CD* are ____________________ and lines *A'B'* and lines *C'D'* are __________________.

2. The distance between lines *AB* and *CD* is __________________________ the distance between *A'B'* and *C'D'*.

3. Use the grid below to rotate parallel lines *AB and CD* around point E. What facts can you share about the distance between both sets of lines after the rotation?

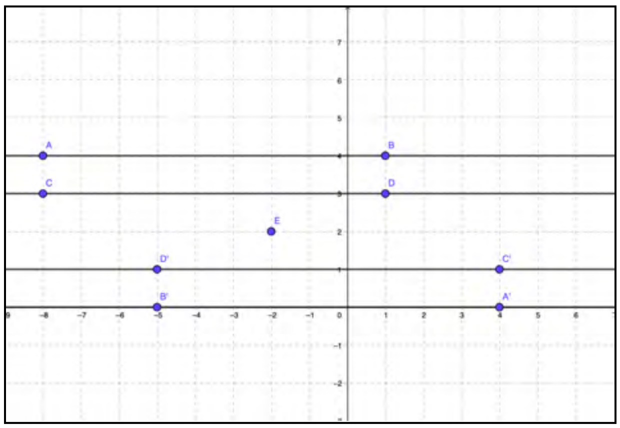


Name: ____ G8 U1 Lesson 7 - Independent Work

Describe the effects of a rigid transformation on a pair of parallel lines.

Word Choices
“parallel” “perpendicular” “greater than” “smaller than” “the same as”

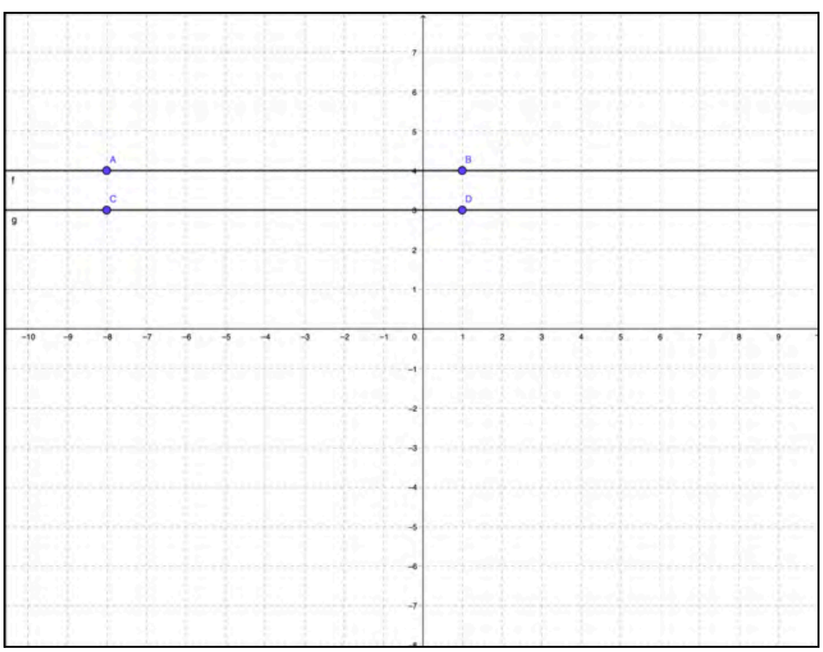
AB is parallel to *CD*. The set of parallel lines were rotated 180 degrees around point *E* to create the image, lines *A’B’* and *C’D’*. Use the Word Choices above to fill in the blanks.



1. Lines *AB* and *CD* are ______________________ and lines *A’B’* and lines *C’D’* are ____________________.

2. The distance between lines *AB* and *CD* is _____________________________ the distance between *A’B’* and *C’D’*.

3. Use the grid below to reflect parallel lines *AB and CD* over the *x*-axis. What facts can you share about the image of the parallel lines?

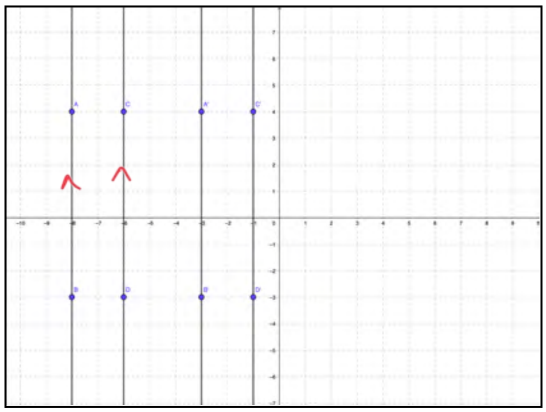


Name: Answer Key

Describe the effects of a rigid transformation on a pair of parallel lines.

Word Choices
“parallel” “perpendicular” “greater than” “smaller than” “the same as”

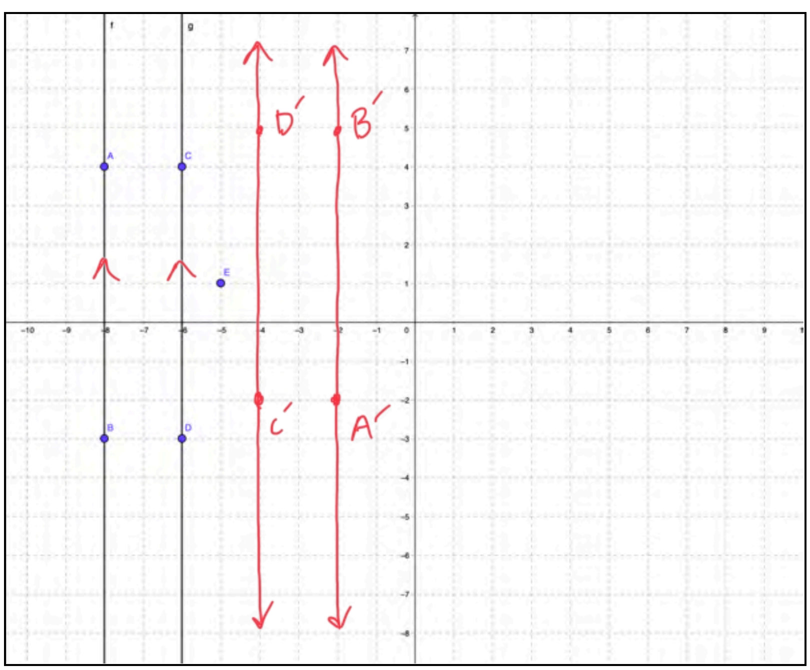
AB is parallel to *CD*. The set of parallel lines were translated 5 units to the right to create the image, lines *A’B’* and *C’D’*. Use the Word Choices above to fill in the blanks.



1. Lines *AB* and *CD* are parallel and lines *A’B’* and lines *C’D’* are parallel.

2. The distance between lines *AB* and *CD* is the same as the distance between *A’B’* and *C’D’*.

3. Use the grid below to rotate parallel lines *AB and CD* around point E. What facts can you share about the distance between both sets of lines after the rotation?



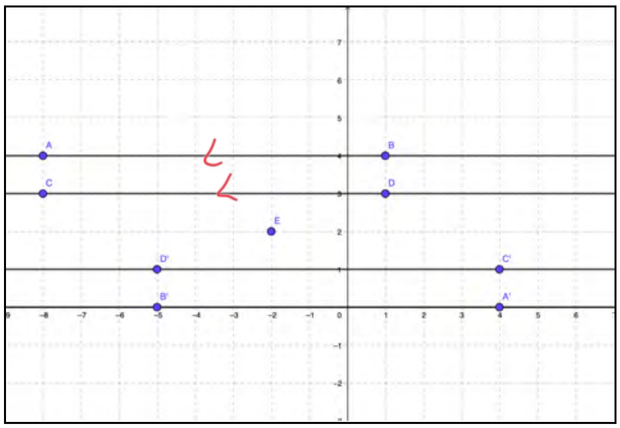
The distance between both sets of lines will be the same because rotations maintain all properties of the original figure.

Name: Answer Key

Describe the effects of a rigid transformation on a pair of parallel lines.

Word Choices
"parallel" "perpendicular" "greater than" "smaller than" "the same as"

AB is parallel to *CD*. The set of parallel lines were rotated 180 degrees around point *E* to create the image, lines *A'B'* and *C'D'*. Use the Word Choices above to fill in the blanks.

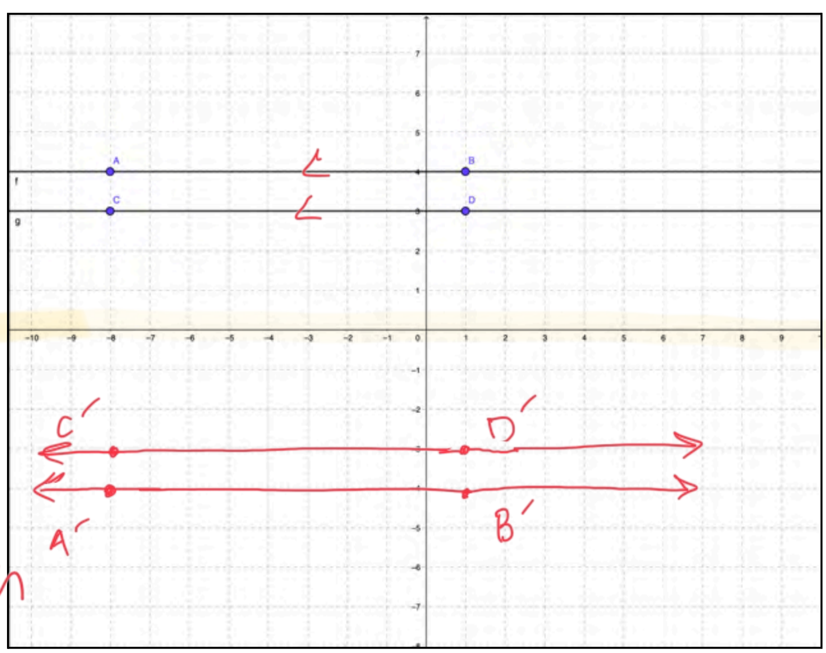


1. Lines *AB* and *CD* are parallel and lines *A'B'* and lines *C'D'* are parallel.

2. The distance between lines *AB* and *CD* is the same as the distance between *A'B'* and *C'D'*.

3. Use the grid below to reflect parallel lines *AB and CD* over the *x*-axis. What facts can you share about the image of the parallel lines?

The image of ∥ lines $\overline{AB}$ and $\overline{CD}$ is also ∥. The distance between the lines is the same in both sets.



G8 U1 Lesson 8
Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

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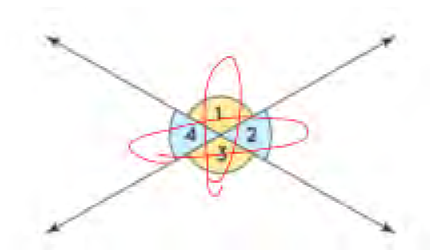
G8 U1 Lesson 8 - Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

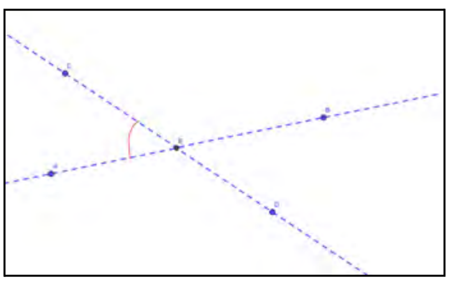
Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 3): Today we will understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it. First, let's recall the vertical angles theorem that you learned in 7th grade. The vertical angles theorem is almost misleading because the angles being compared may appear horizontal to each other or diagonal to each. So what is meant in this case by vertical?



The vertical angles theorem states that angle measures that appear to be across from each other at the point of two intersecting lines, regardless of their actual orientation, are the same. In this case, angle 2 and angle 4 are vertical angles because they were created by the intersection of two lines and are across or opposite from each other on a straight line. The same can be said for angles 1 and 3. This also means that angle 4 has the same measure as angle 2 and angle 3 has the same measure as angle 1. *(Circle the vertical angles.)* But, why is that true?

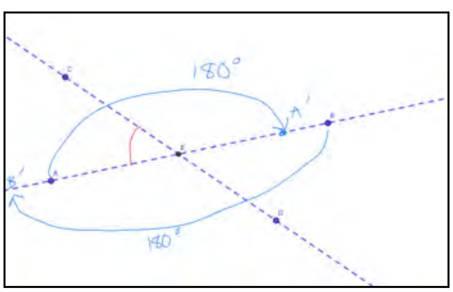
Let's Talk (Slide 4): Let's use what we know about line segments rotating 180 degrees and the properties of rigid transformations to figure out why the Vertical Angles Theorem is true. Let's start with a pair of intersecting lines *AB* and *CD* that intersect at point *E.*



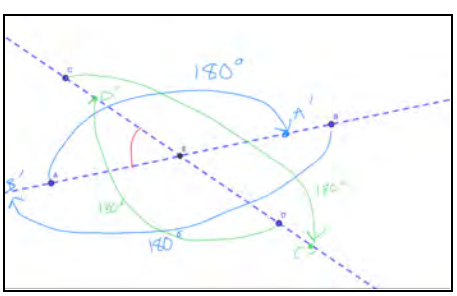
Let's mark angle *AEC* on the intersecting lines and then use our tools to rotate lines *AB* and *CD* 180 degrees about point *E*. What do you think will happen? Possible Students Answers, Key Points:

- Point *E* and point *E'* will be in the same place.
- New angles will form.

(Mark angle AEC.)

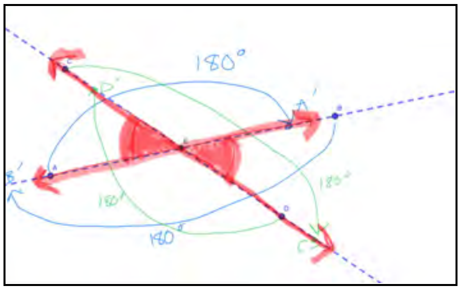


Recall that a straight line that is rotated 180 degrees about a point on the line will create an image that is on top of itself or the same line. *(Draw arcs to show the rotation of line AB and the points A and B on the line.)*



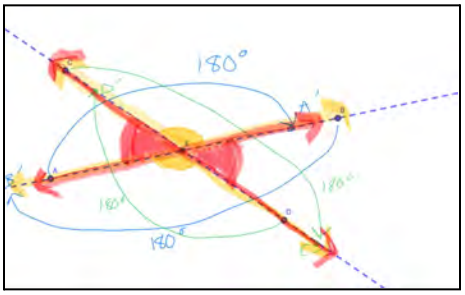
(Draw arcs to show the rotation of line CD and the points C and D on the line.) After the rotation of both lines, the images lay on top of the original lines. What does this tell us about the angle measures of angle *AEC* and angle *A'E'C'*? Possible Students Answers, Key Points:

- The angles are the same.



The measures of angle *AEC* and angle *A’E’C’* are equal because of the properties of rigid transformations which maintains the measure of angles. *(Mark the angles in question and shade in the arcs.)* This proves why the Vertical Angle Theorem is true. Angle *AEC* and angle *A’E’C’* are vertical angles, then. Given this, what is true about angle *CEB* and its image, created after the rotation of the lines? Possible Students Answers, Key Points:

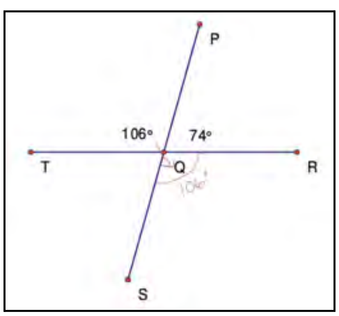
- The angles are the same because they are vertical angles.



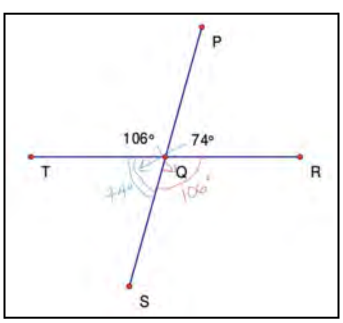
Angles *CEB* and *C’E’B’* are vertical angles and thus they are equal or congruent. *(Mark the angles in a different color and shade in the arcs.)*

Let’s Think (Slide 5): Now that we know what why the Vertical Angle Theorem is true and we know that angles formed by a pair of intersecting lines are congruent to the angle across the point of intersection, not adjacent or next to the angle, let’s solve a problem that used the Vertical Angle Theorem to find a missing angle.

When we are presented with a pair of intersecting lines and only two of the 4 angles created by the lines, we can assume the other angles using the Vertical Angle Theorem. Let’s start by finding the measure of angle *RQS*.



Angle *RQS* is congruent to angle *TQP* because they are vertical angles so angle *RQS* measures 106 degrees. *(Draw the missing angle and and arrow to show the angle it is vertical to. Then label the measure of the missing angle.*



Similarly, angle *PQR* is vertical to angle *SQT* so the angle measures must be the same. Angle *SQT* must have a measure of 74 degrees. I know - this is so simple it almost makes me wonder if it can be this easy. But it is. *(Draw the missing angle and an arrow to show the angle it is vertical to. Then label the measure of the missing angle.)*

Let’s Try it (Slides 6-7): Let’s work on applying what we understand about vertical angles. We will work on this page together. Remember that vertical angles are congruent to each other.

WARM WELCOME

Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

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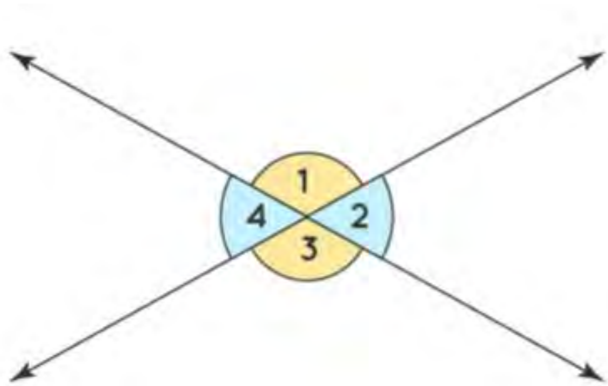
Let's Review:

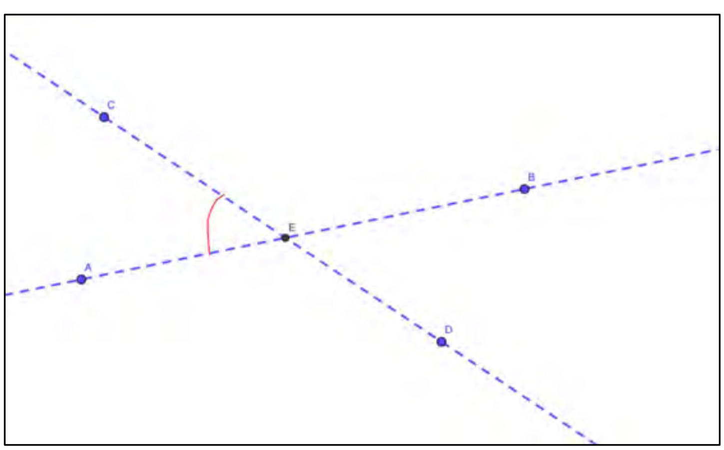
The vertical angles theorem says that angles across from each other that are created by a pair of intersecting lines are congruent.



Let's Talk:

Why are vertical angles congruent?

What happens to the angles formed by intersecting lines when we rotate the lines 180 degrees about their point of intersection?



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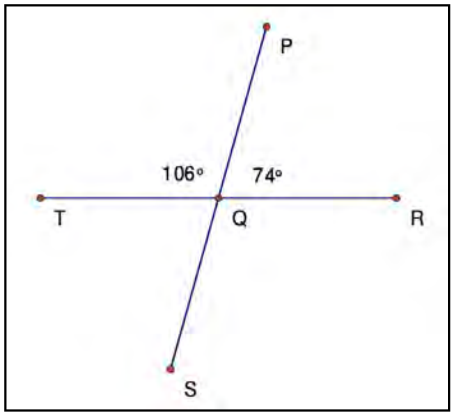
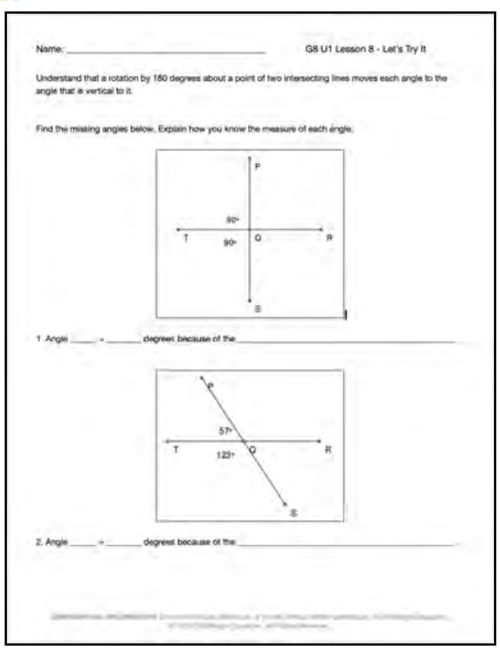
Let's Think: How do we apply the Vertical Angle Theorem?

What are the measures of angles *RQS* and *SQT?*



Let's Try It: Let's practice applying the Vertical Angle Theorem.


Name: ______________________ G8 U1 Lesson 8 - Let's Try It

Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

Find the missing angles below. Explain how you know the measure of each angle.

P, 90°, T, 90°, Q, R, S

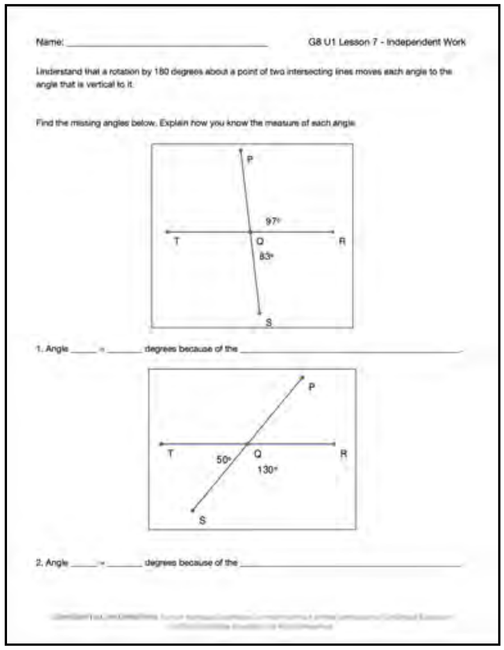
1. Angle _____ = _______ degrees because of the ______________________

P, 57°, T, 123°, Q, R, S

2. Angle _____ = _______ degrees because of the ______________________

On your Own:

Now it’s time to apply the Vertical Angle Theorem on your own.



Name: ______________________ G8 U1 Lesson 7 - Independent Work

Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

Find the missing angles below. Explain how you know the measure of each angle.

P
97°
T
Q
R
83°
S

1. Angle _____ = ______ degrees because of the ______________________

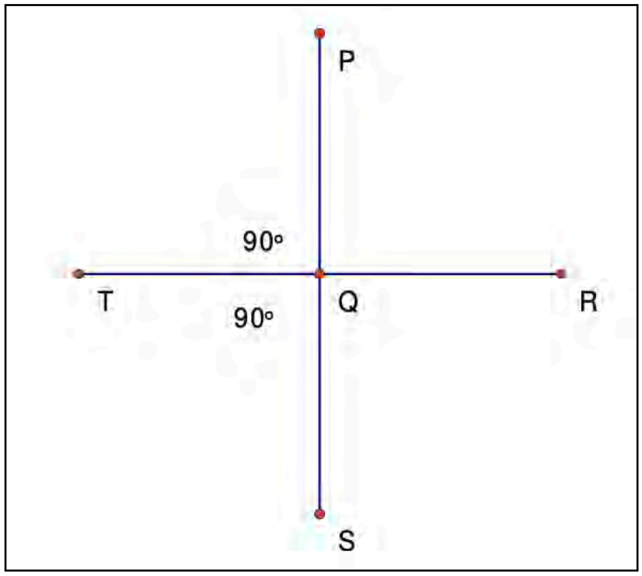
P
T
50°
Q
R
130°
S

2. Angle _____ = ______ degrees because of the ______________________

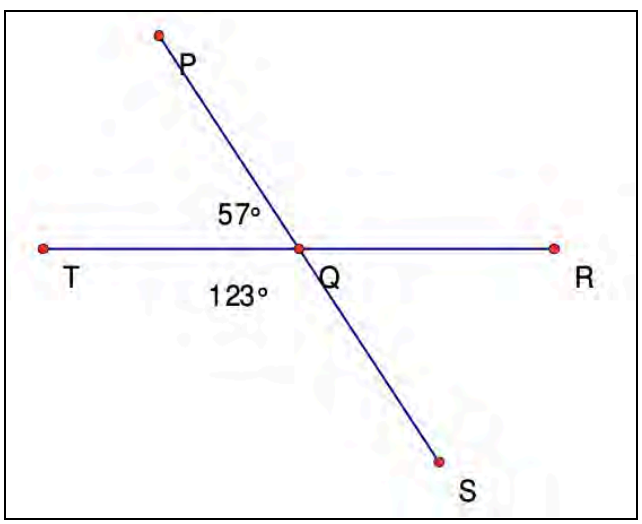
Name: ____ G8 U1 Lesson 8 - Let's Try It

Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

Find the missing angles below. Explain how you know the measure of each angle.



1. Angle ______ = ________ degrees because of the ____.

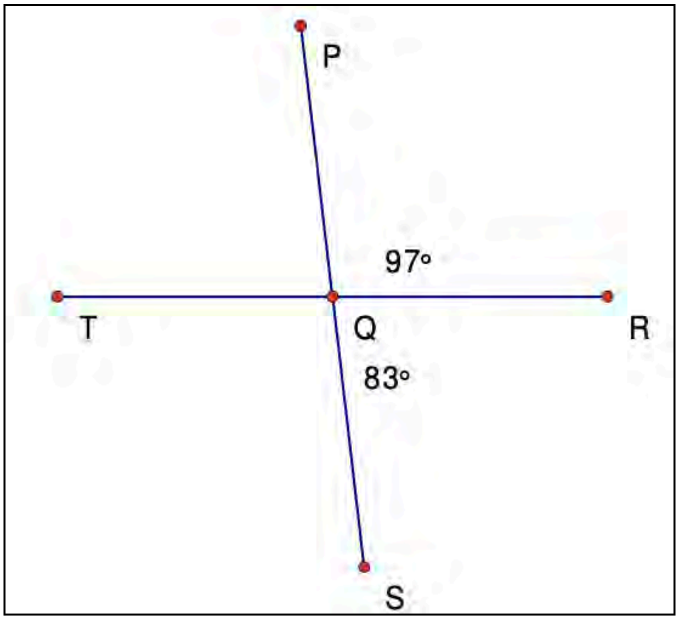


2. Angle ______ = ________ degrees because of the ____.

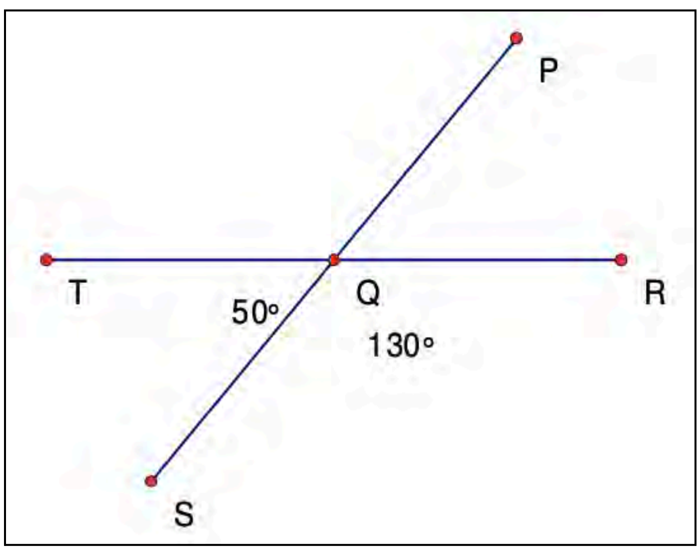
Name: ____ G8 U1 Lesson 8 - Independent Work

Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

Find the missing angles below. Explain how you know the measure of each angle.



1. Angle ______ = ________ degrees because of the ____.



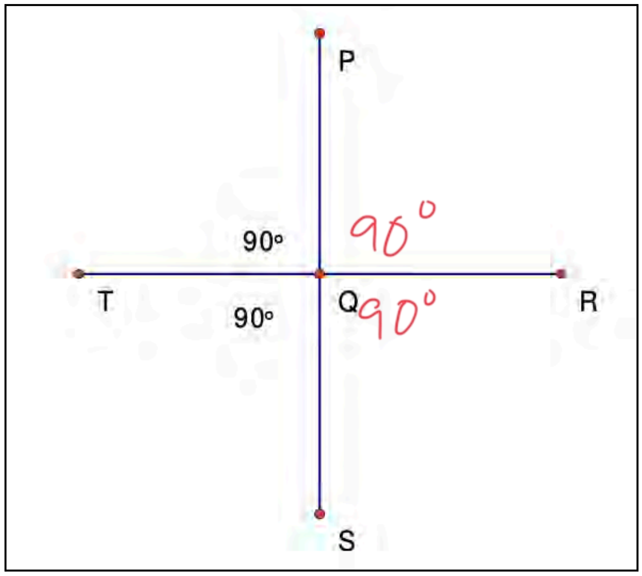
2. Angle ______ = ________ degrees because of the ____.

Name: Answer Key

G8 U1 Lesson 8 - Let's Try It

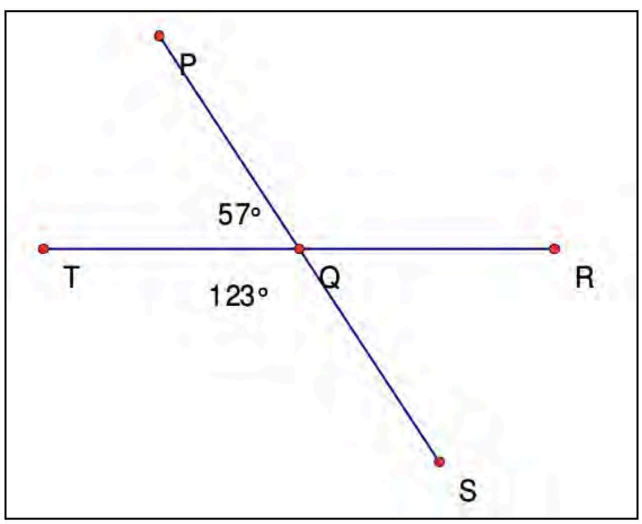
Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

Find the missing angles below. Explain how you know the measure of each angle.



1. Angle PQR = 90 degrees because of the Vertical Angle Theorem.

or RQS = 90



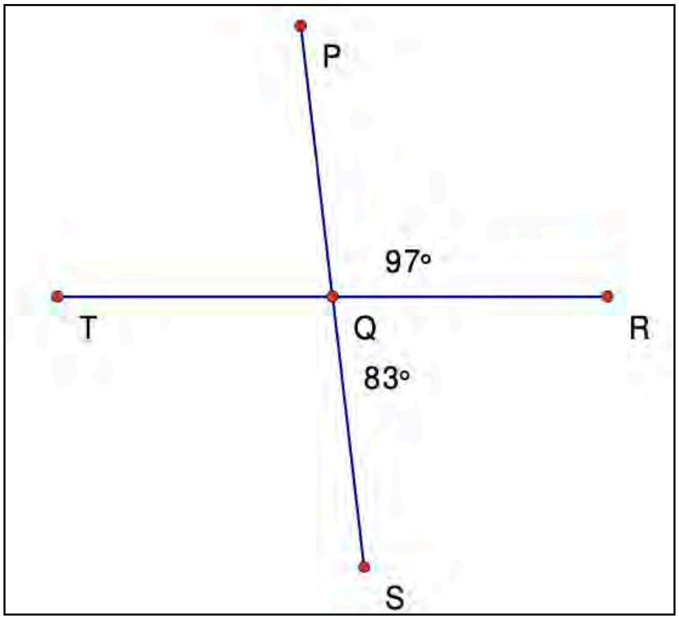
2. Angle RQS = 57° degrees because of the vertical Angle Theorem.

OR PQR = 123

Name: Answer Key

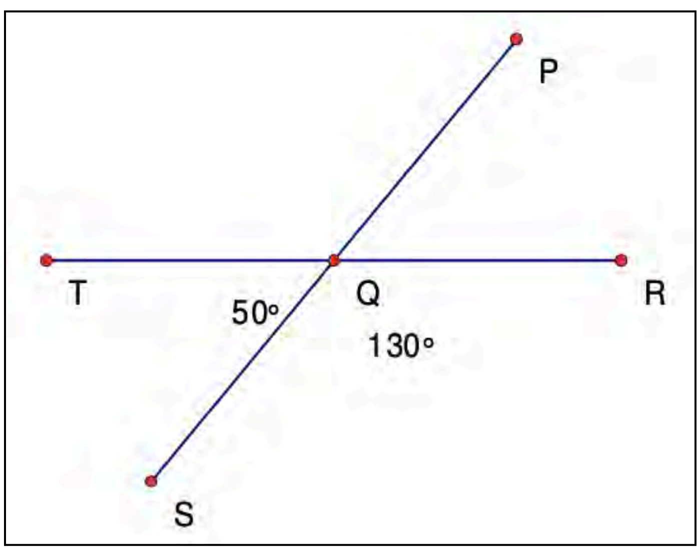
Understand that a rotation by 180 degrees about a point of two intersecting lines moves each angle to the angle that is vertical to it.

Find the missing angles below. Explain how you know the measure of each angle.



1. Angle SQT = 97 degrees because of the Vertical Angle Theorem.

OR TQP = 83 ''



2. Angle PQR = 50 degrees because of the Vertical Angle Theorem.

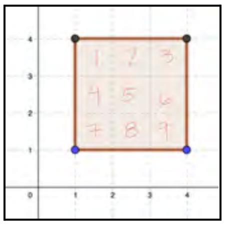
OR ∡TQP = 130 ''

G8 U1 Lesson 9
Determine whether two shapes are congruent by using properties of rigid transformations and each shape's area and perimeter.

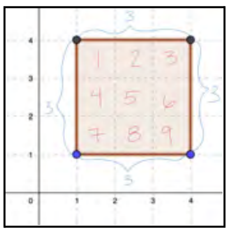
G8 U1 Lesson 9 - Determine whether two shapes are congruent by using properties of rigid transformations and each shape's area and perimeter.

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 3): Today we will determine whether two shapes are congruent by using properties of rigid transformations and each shape's area and perimeter. First, let's remember what area and perimeter are. Area is the space inside a shape - on a square grid, the total number of units that make up the space inside the shape. Perimeter is the distance around a shape. Let's find the area and perimeter of this square.



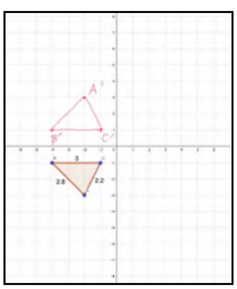
To find the area we'll count all of the boxes inside. *(Write a number in each box to demonstrate counting each box.)* The area of this square is 9 square units.



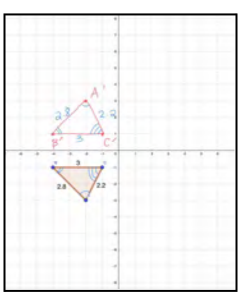
To find the perimeter we'll count the distance around the figure. *(Mark each side length with its measure.)* The perimeter of the square is 12 units.

Let's Talk (Slide 4): Now, let's recall the properties of rigid transformations by applying a reflection to a triangle we've seen before. What will be true about the angles and side lengths of triangle *ABC* after we reflect it over the *x*-axis?. Possible Students Answers, Key Points:

- The side lengths will be the same.
- The angles will be the same.



First, let's reflect triangle *ABC* over the *x*-axis and label the new vertices. *(Draw the reflection and label the vertices.)*

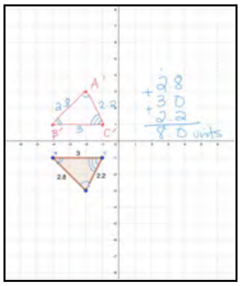


Recall that rigid transformations produce congruent corresponding sides and angles. So, we can label the side lengths by finding the corresponding side on the original shape. We can also mark and show the angles of the image without measuring them. Instead, we'll apply a different number of arcs to each angle to show they are congruent to their corresponding angle in the original shape. *(Write the side lengths and mark the angles.)*

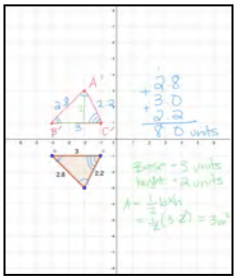
Since triangle *ABC* underwent a rigid transformation, all of its side lengths and angles are congruent. Now let's see what's true about its perimeter and area.

Let's Talk (Slide 5): What do you think will be true about the area and perimeter of the image of triangle *ABC*?
Possible Students Answers, Key Points:

- The perimeter will be the same since the side lengths are all the same.
- The area will be the same.



First, let's calculate the perimeter since we know all of the side lengths of the triangle. 2.8 + 3 + 2.2 = 8 units *(Show your calculation.)* Since triangle *ABC* has the same side lengths we know that its perimeter is also 8 units without adding the distances around the figure again. So, it seems that the perimeter of a rigid transformation is the same as the perimeter of the original shape.



Now let's calculate the area of the image. Recall that the formula to calculate the area of a triangle is *A=½(base x height)*. Triangle *A'B'C'* has an area of 3 square units. *(Show your calculation.)* Since triangle *ABC* has the same measurements we know that its area is also 3 square units without calculating again. So, it seems that the area of a rigid transformation is the same as the area of the original shape.

Let's Think (Slide 5): We've just confirmed that the area and perimeter of a rigid transformation will be the same for both figures. Since this is true, that means that we can use area and perimeter along with the properties of rigid transformations to determine if two figures are congruent. In order to be congruent, all corresponding side lengths and angles must be equal. In addition, the area and perimeter of the figure will be the same. Now let's determine which shapes are congruent using what we know about rigid transformations and area and perimeter.

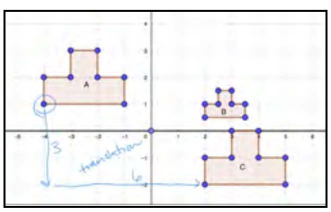
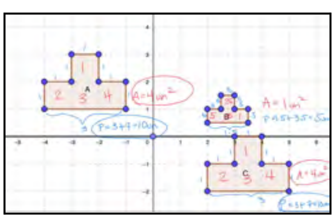


Figure C appears to be a translation 3 units down and 6 units to the right. *(Mark the grid to show the vectors used for the translation.)* It is possible that they are congruent. Figure B is not congruent to either A or C because the size is different and that doesn't follow the properties of rigid transformations even though the angle measure appears to be the same as those in A and C. To ensure that A and C are in fact congruent, I'll also calculate their area and perimeter.



The perimeter, or the distance around all figures is the same for figures A and C, but not for figure B. This further lets us know that figure B is not congruent to A or C but that A and C might be congruent to each other. *(Mark the figures and then show your work to calculate the perimeter. Consider highlighting the distance around to ensure you don't miss a side.)*

The area of the figures A and C are 10 square units each. Given that they are a translation of each other and their perimeter and area are the same, figure A is congruent to figure C.

Let's Try it (Slides 7-8): Let's work on using the properties of rigid transformations and area and perimeter to determine if shapes are congruent to each other. We will work on this page together. Remember that shapes that undergo a rigid transformation and have the same area and perimeter are congruent to each other.

WARM WELCOME

Determine whether two shapes are congruent by using the properties of rigid transformations and each shape's area and perimeter.

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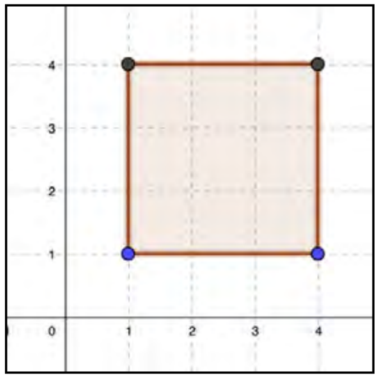
Let's Review:

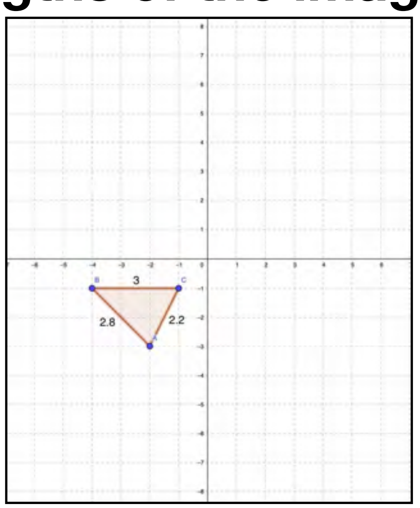
Area is the space inside of a shape and perimeter is the distance around a shape.



Let's Talk:

What do the properties of rigid transformations tell us about whether or not shapes are congruent?

Reflect triangle *ABC* over the *x*-axis. What is true about the angles and side lengths of the image?



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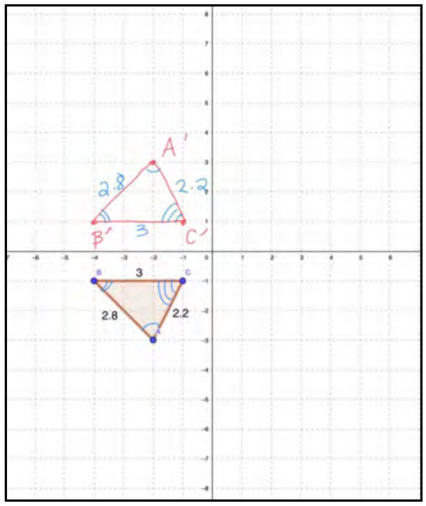
Let's Talk:

What do the properties of rigid transformations tell us about whether or not shapes are congruent?

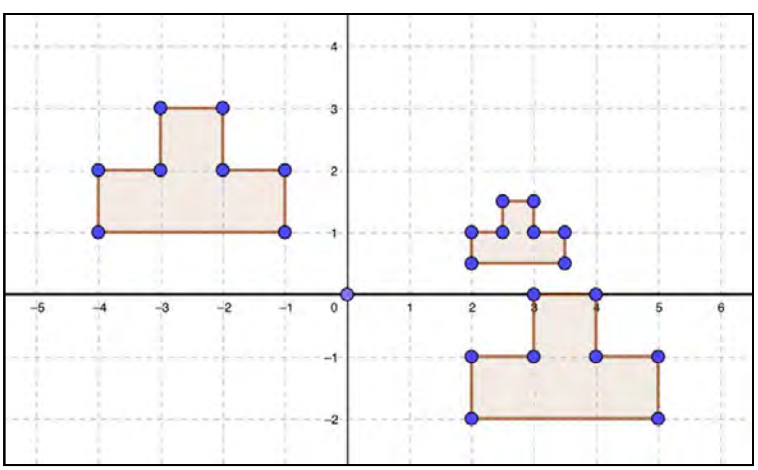
What will be true about the area and perimeter of the image of triangle *ABC*?



Let's Think:

What do the properties of rigid transformations tell us about whether or not shapes are congruent?

Which shapes are congruent? Explain using what you know about the properties of rigid transformations and area and perimeter.



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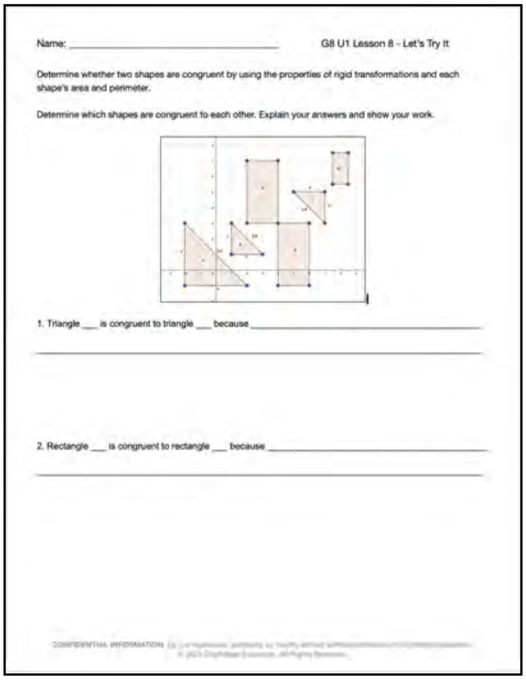
Let's Try It:

Let's practice determining if shapes are congruent.



Name: ______________________ G8 U1 Lesson 8 - Let's Try It

Determine whether two shapes are congruent by using the properties of rigid transformations and each shape's area and perimeter.

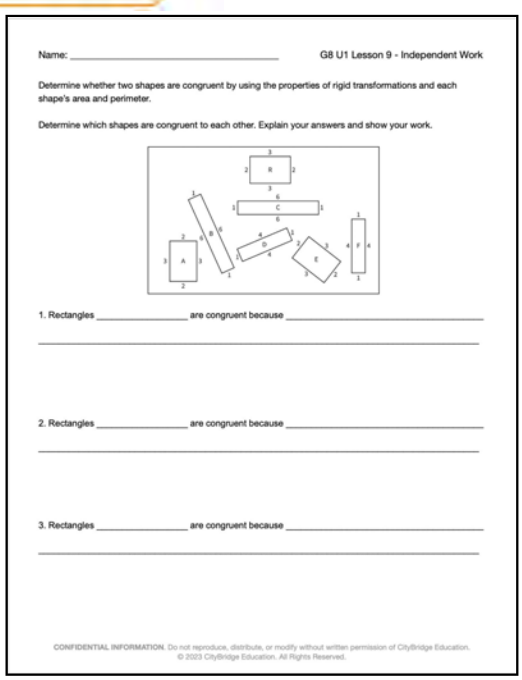
Determine which shapes are congruent to each other. Explain your answers and show your work.

1. Triangle ___ is congruent to triangle ___ because ______________________

2. Rectangle ___ is congruent to rectangle ___ because ______________________

On your Own:

Now it's time to determine if shapes are congruent on your own.



Name: ______________________ G8 U1 Lesson 9 - Independent Work

Determine whether two shapes are congruent by using the properties of rigid transformations and each shape's area and perimeter.

Determine which shapes are congruent to each other. Explain your answers and show your work.

1. Rectangles ____________ are congruent because ______________________

2. Rectangles ____________ are congruent because ______________________

3. Rectangles ____________ are congruent because ______________________

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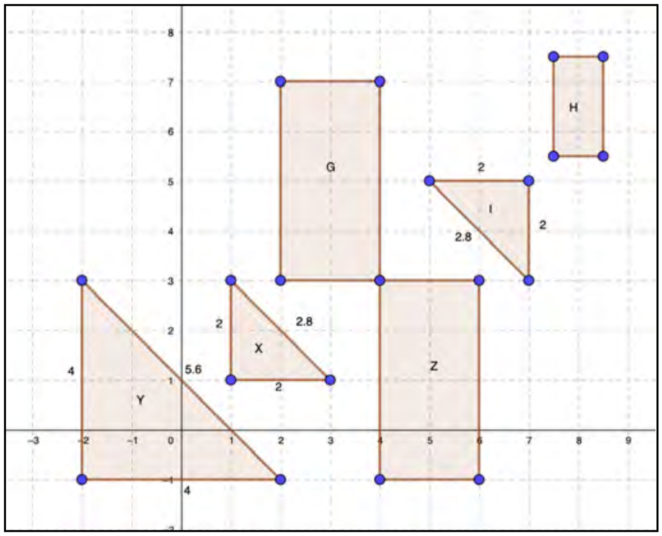
Name: ____ G8 U1 Lesson 9 - Let's Try It

Determine whether two shapes are congruent by using the properties of rigid transformations and each shape's area and perimeter.

Determine which shapes are congruent to each other. Explain your answers and show your work.



1. Triangle ___ is congruent to triangle ___ because ____

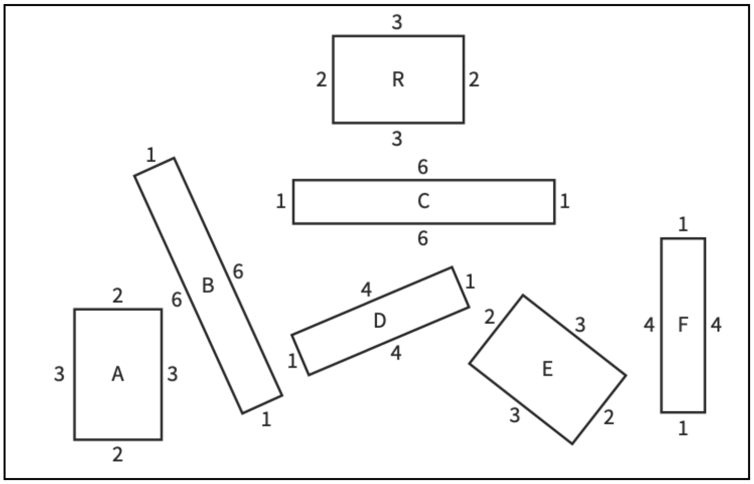
____

2. Rectangle ___ is congruent to rectangle ___ because ____

____

Determine whether two shapes are congruent by using the properties of rigid transformations and each shape's area and perimeter.

Determine which shapes are congruent to each other. Explain your answers and show your work.



1. Rectangles __________________ are congruent because ____

____

2. Rectangles __________________ are congruent because ____

____

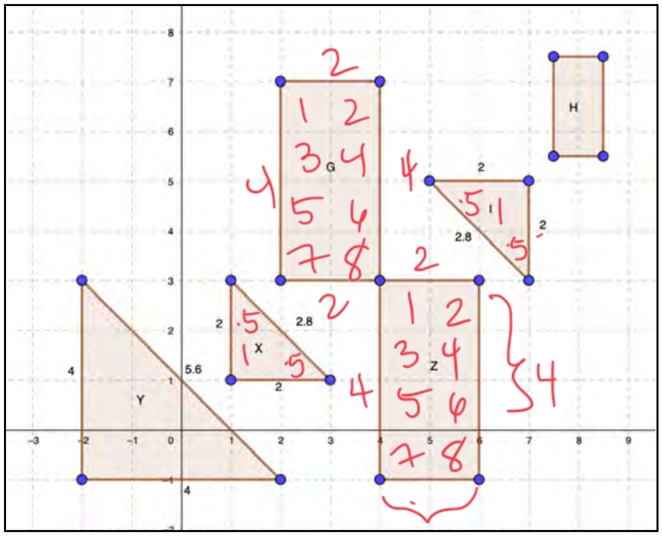
3. Rectangles __________________ are congruent because ____

____

Name: Answer Key

Determine whether two shapes are congruent by using the properties of rigid transformations and each shape's area and perimeter.

Determine which shapes are congruent to each other. Explain your answers and show your work.



1. Triangle X is congruent to triangle 1 because they have the same perimeter & area and can be created by a rigid trans from the other.

$A_X = 2\text{un}^2$ $A_1 = 2\text{un}^2$

$P_X = 2+2+2.8 = 6.8$ units $P_1 = 2+2+2.8 = 6.8$ units

2. Rectangle Z is congruent to rectangle G because they have the same perimeter & area and can be created from a rigid transformed from the other.

$A_Z = 8\text{un}^2$ $A_G = 8\text{un}^2$

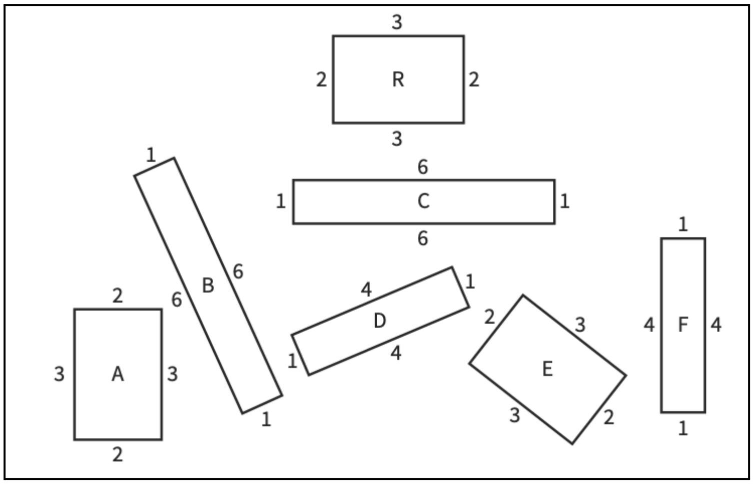
$P_Z = 4+2+4+2 = 12$ units $P_G = 4+2+4+2 = 12$ units

Name: Answer Key

G8 U1 Lesson 9 - Independent Work

Determine whether two shapes are congruent by using the properties of rigid transformations and each shape's area and perimeter.

Determine which shapes are congruent to each other. Explain your answers and show your work.



1. Rectangles B and C are congruent because they have the same area and perimeter and one can be created from the other by rigid transformations.

2. Rectangles A, R, and E are congruent because they have the same area and perimeter and they can be created from the other by rigid transformations.

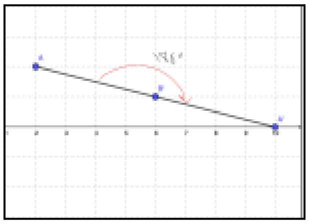
3. Rectangles D and F are congruent because they have the same area and perimeter and they can be created from the other by rigid transformations.

G8 U1 Lesson 10
Use the properties of a straight angle to calculate supplementary angle measures.

G8 U1 Lesson 10 - Use the properties of a straight angle to calculate supplementary angles.

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 3): Today we will use the properties of a straight angle to calculate supplementary angles. First, remember that a straight angle measures 180 degrees.

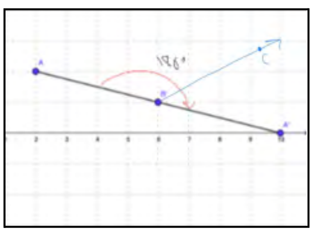


This line segment was created by rotating line segment *AB* 180 degrees about point *B*. By doing so, we found that a segment rotated 180 degrees creates an image that extends the line. Applying the rotation helped us to verify that a straight line or a straight angle measures 180 degrees.

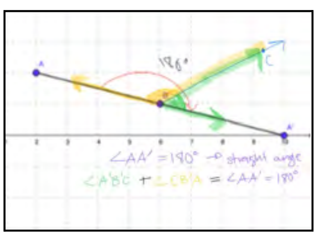
A supplementary angle uses the properties of a straight angle. The sum of angles that make a straight line are considered supplementary. Let's explore this concept.

Let's Talk (Slide 4): Let's take the same straight angle *AA'* and break it into two smaller angles. What will be true about the sum of the two smaller angles? Possible Students Answers, Key Points:

- The sum of the angles will be 180 degrees.



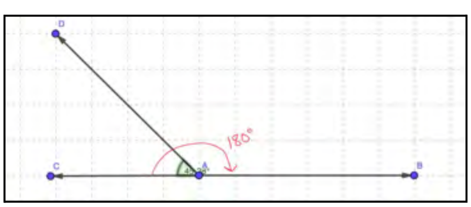
Let's use point *B* to divide our straight angle into two smaller angles. *(Draw a ray or vector B'C and label point C.)*



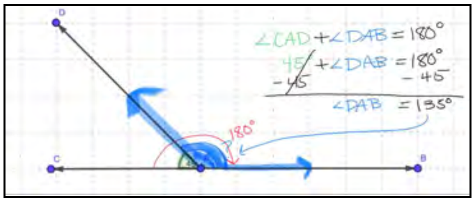
Notice that we didn't change the straight angle at all. I'll mark our two new angles so we can see that the two smaller angles combine to equal the straight angle. *(Draw the angle arcs and show a formula to demonstrate that the angles are supplementary.*

So we can say that angle *A'B'C* is supplementary to angle *CB'A* which means that the sum of the two angles equals 180 degrees.

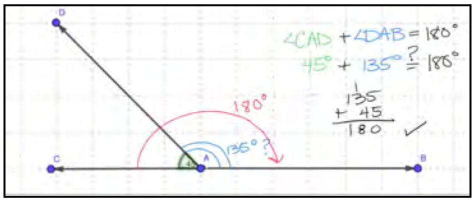
Let's Think (Slide 5): Now that we know that supplementary angles have a sum of 180 degrees, let's use this to find a missing angle on a straight angle.



First, let's notice that angle *CAB* is a straight angle. That means that angles *CAD* and *DAB* are supplementary. I am going to mark the straight angle on my paper.



Now let's use what we know about supplementary angles to calculate the missing angle *DAB*. We can say that angle *CAD* plus angle *DAB* is 180 degrees because the angles are supplementary. *(Write out the supplementary formulas.)* Let's substitute angle *CAD*'s measure in the formula since we know its value. Now we have a simple one step equation to solve. Since 180 minus 45 is 135, angle *DAB* is 135 degrees.



We can check our work by plugging both angle measures into the original formula that I wrote and verify that the sum of the angle measures is 180 degrees. In this case, our calculation is correct. Angle *CAD* + angle *DAB* is 180 degrees.

Let's Try it (Slides 6-7): Let's work on using the definition of supplementary angles to find the missing angle on a straight angle. We will work on this page together. Remember that supplementary angles are two adjacent angles on a straight line and have a sum of 180 degrees.

WARM WELCOME

Use the properties of a straight angle to calculate supplementary angles.

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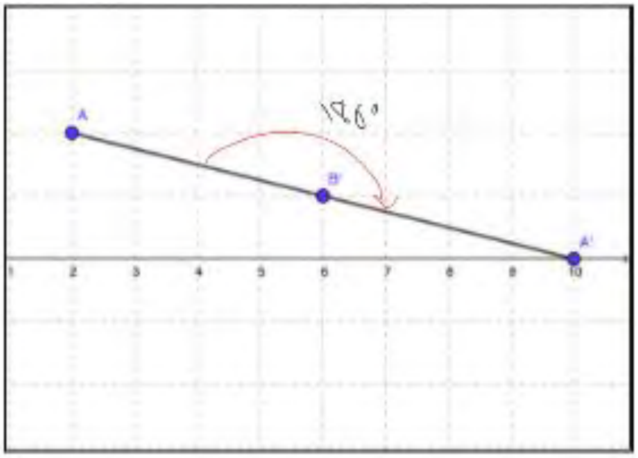
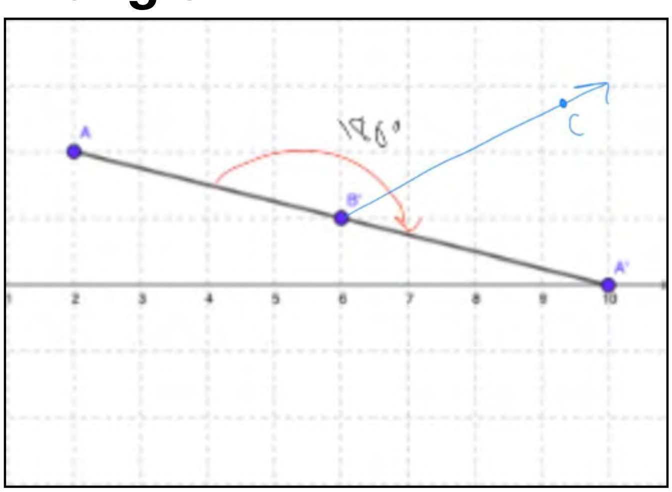
Let's Review:

A straight angle measures 180 degrees.



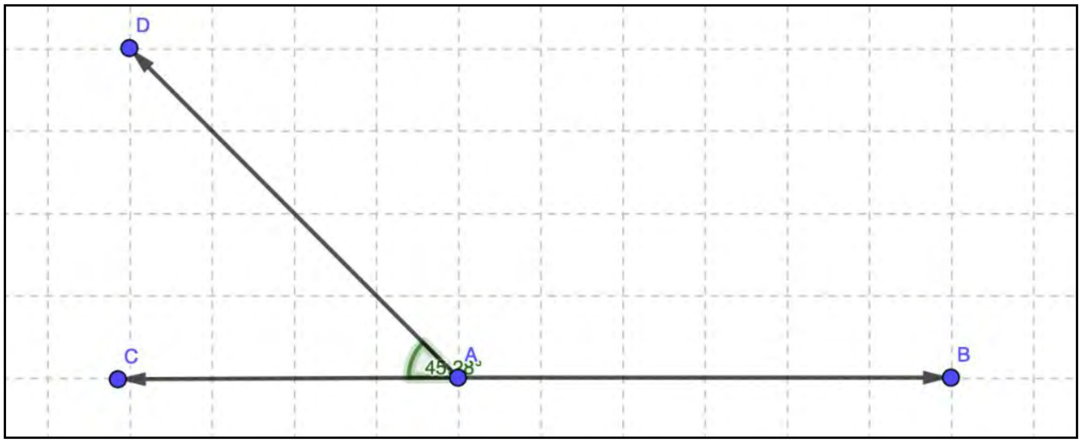
Let's Talk: What are supplementary angles?

What is true about the sum of two smaller angles formed from a straight angle?

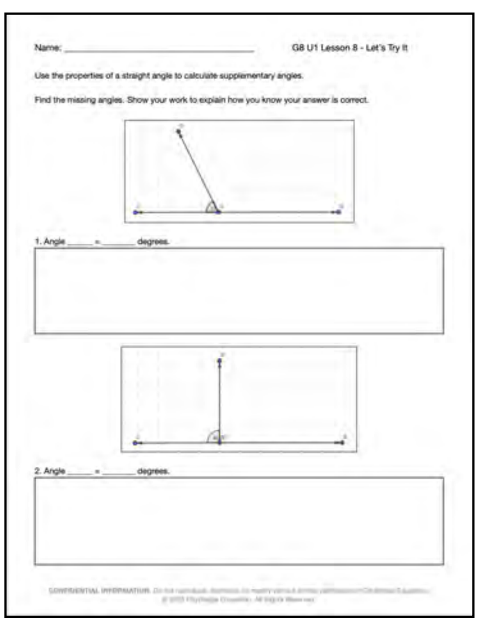


Let's Think: What are supplementary angles?

What is the value of the missing angle if angle *CAD* = 45 degrees?



Let's Try It: Let's practice calculating angles using the definition of supplementary angles.



Name: ______________________ G8 U1 Lesson 8 - Let's Try It

Use the properties of a straight angle to calculate supplementary angles.

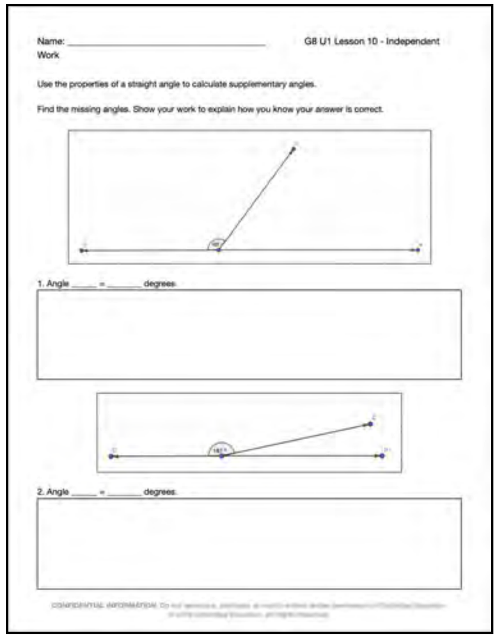
Find the missing angles. Show your work to explain how you know your answer is correct.

1. Angle _____ = _____ degrees.

2. Angle _____ = _____ degrees.

On your Own:

Now it’s time to calculate angles using the definition of supplementary angles on your own.



Name: ______________________ G8 U1 Lesson 10 - Independent Work

Use the properties of a straight angle to calculate supplementary angles.

Find the missing angles. Show your work to explain how you know your answer is correct.

1. Angle _____ = _______ degrees.

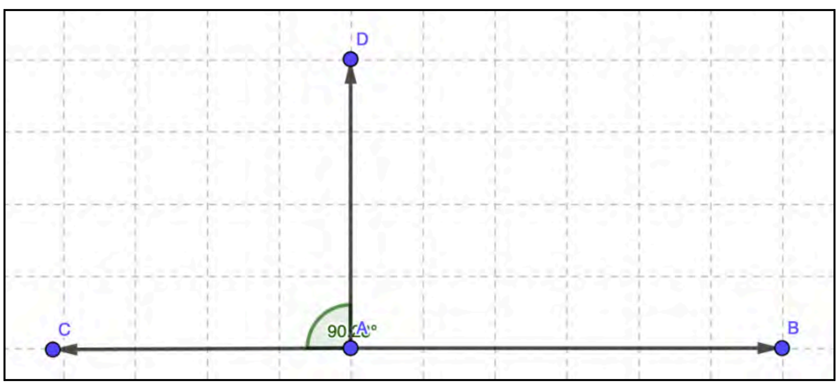
2. Angle _____ = _______ degrees.

Name: ____ G8 U1 Lesson 10 - Let's Try It

Use the properties of a straight angle to calculate supplementary angles.

Find the missing angles. Show your work to explain how you know your answer is correct.

1. Angle ______ = ________ degrees.

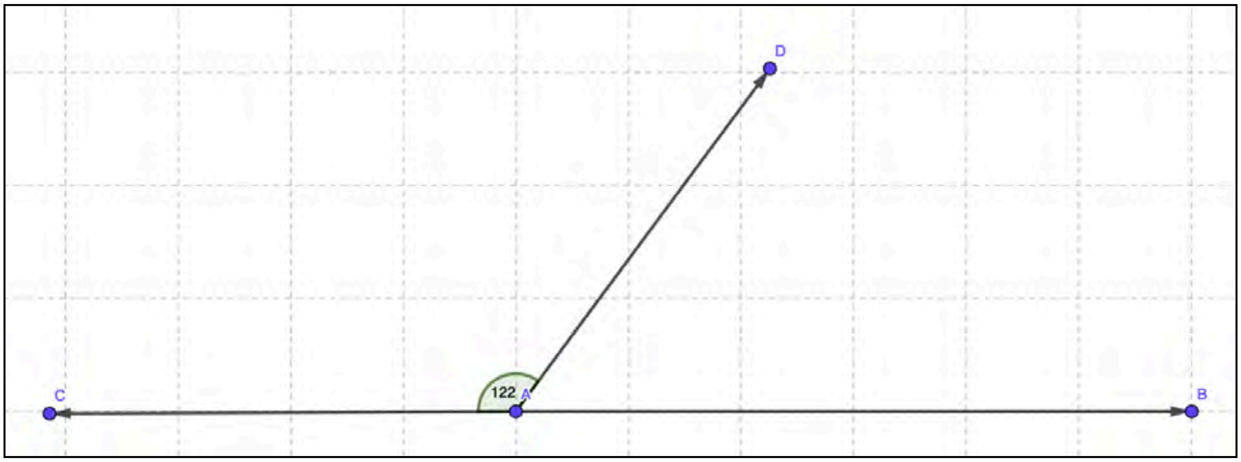


2. Angle ______ = ________ degrees.

Name: ____

Use the properties of a straight angle to calculate supplementary angles.

Find the missing angles. Show your work to explain how you know your answer is correct.



1. Angle ______ = ________ degrees.

2. Angle ______ = ________ degrees.

Name: Answer Key

G8 U1 Lesson 10 - Let's Try It

Use the properties of a straight angle to calculate supplementary angles.

Find the missing angles. Show your work to explain how you know your answer is correct.

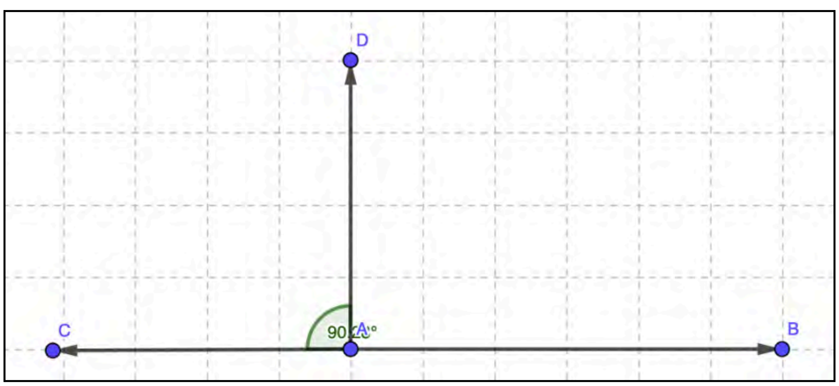
1. Angle DAB = 117 degrees.

$\angle CAD + \angle DAB = 180^\circ$ → supplementary angle

$\cancel{63} + \angle DAB = 180^\circ$

$-\cancel{63} \qquad\qquad -63$

$\angle DAB = 117^\circ$



2. Angle DAB = 90 degrees.

$\angle CAD + \angle DAB = 180^\circ$

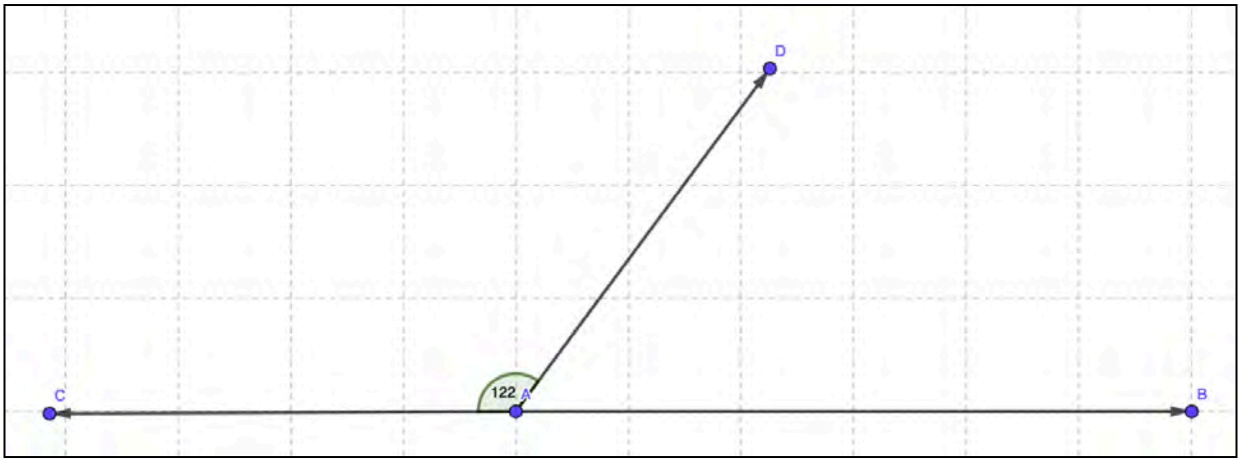
$\cancel{90} + \angle DAB = 180^\circ$

$-\cancel{90} \qquad\qquad -90$

$\angle DAB = 90^\circ$

Use the properties of a straight angle to calculate supplementary angles.

Find the missing angles. Show your work to explain how you know your answer is correct.



1. Angle DAB = 58 degrees.

$\angle CAD + \angle DAB = 180°$ supplementary angles

$\cancel{122} + \angle DAB = 180°$

$-\cancel{122} \qquad -122$

$\angle DAB = 58°$

2. Angle DAB = 13 degrees.

$\angle CAD + \angle DAB = 180°$

$\cancel{167} + \angle DAB = 180$

$-\cancel{167} \qquad -167$

$\angle DAB = 13°$

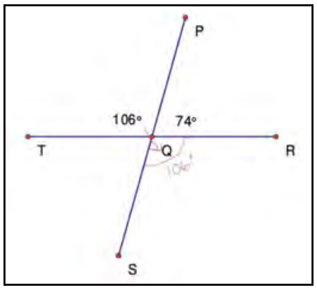
G8 U1 Lesson 11
Apply what you know about vertical angles and supplementary angles to calculate the measures of unknown angles.

CITYTUTOR DC

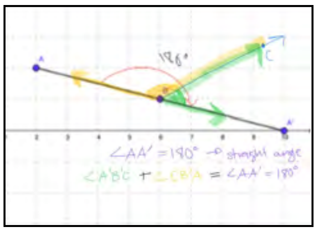
G8 U1 Lesson 11 - Apply what you know about vertical angles and supplementary angles to calculate the measures of unknown angles.

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 4): Today we will apply what we know about vertical angles and supplementary angles to calculate the measures of unknown angles.



Recall that vertical angles are nonadjacent angles created by the intersection of two lines - vertical angles are congruent.

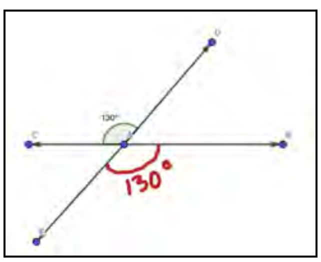


Supplementary angles are adjacent angles on a straight angle - the sum of supplementary angles is 180 degrees.

Let's Talk (Slide 5): Now let's consider how vertical angles and supplementary angles work together to help us calculate the missing angles on a pair of intersecting lines. What is the value of $\angle BAE$ if $\angle CAD$ is 130°?

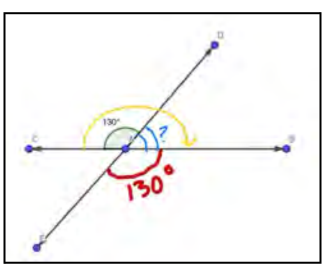
Possible Students Answers, Key Points:

- The angles are the same.

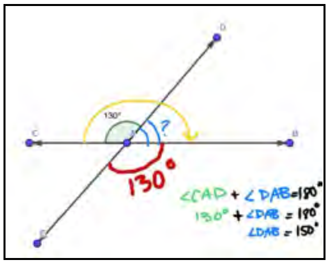


$\angle BAE$ is 130° because it is vertical to $\angle CAD$. *(Mark $\angle BAE$ and it's value.)*

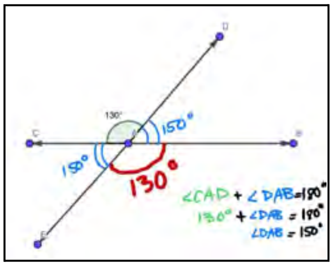
Let's Think (Slide 6): Now that we identified the vertical angles and their values, we will use what we know about supplementary angles to find the value of $\angle DAB$ and $\angle EAC$.



First, notice that $\angle CAD$ and $\angle DAB$ are adjacent and on a straight angle. *(Mark one of the missing angles, $\angle DAB$, and the straight angle.)* Now we can use the definition of supplementary angles to find the missing value.



$\angle CAD + \angle DAB = 180°$ because they are supplementary angles. I will substitute 130° for $\angle CAD$ to show that the missing angle, $\angle DAB$, is 150°. *(Write the equation and solve for the missing angle.)*



Since $\angle DAB = 150°$, $\angle EAC = 150°$ because the angles are vertical to each other.

Let's Try it (Slides 7-8): Let's work on applying vertical angles and supplementary angles to finding the missing angles on a pair of intersecting lines. We will work on this page together. Remember that on a pair of intersecting lines, you only need one angle to find the others. Use the Vertical Angles Theorem and the definition of supplementary angles to find the missing values.

WARM WELCOME

Apply what you know about vertical angles and supplementary angles to calculate the measure of unknown angles.

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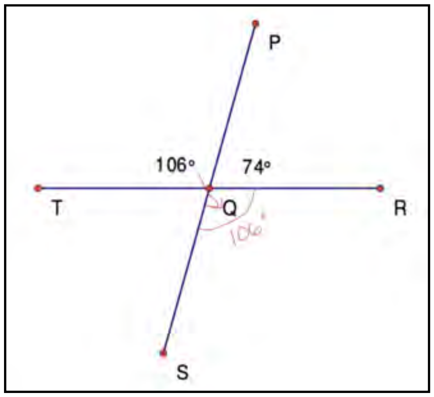
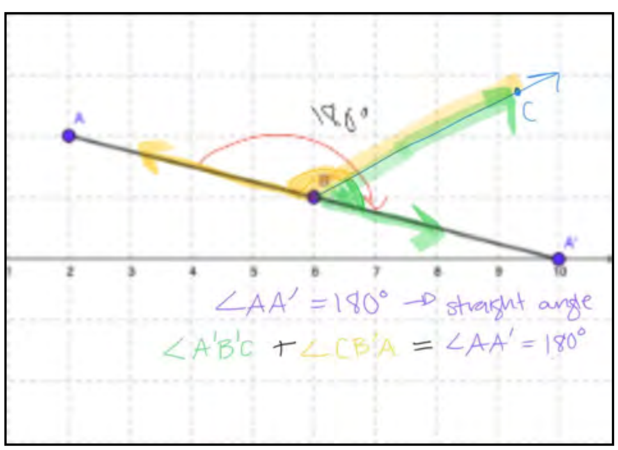
Let's Review:

Vertical angles are congruent.



Let's Review:

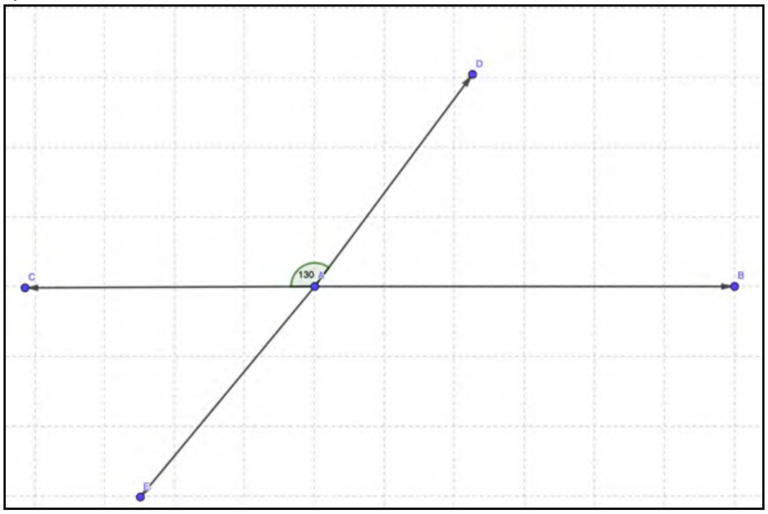
The sum of supplementary angles is 180 degrees.



Let's Talk:

How do vertical angles and supplementary angles work together to help us calculate missing angles of a pair of intersecting lines?

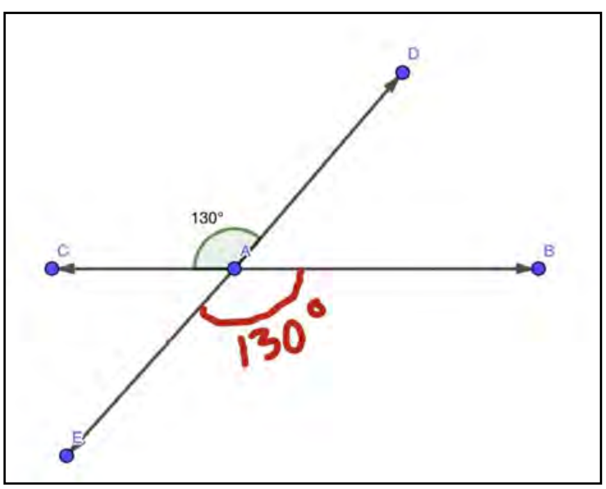
If $\angle CAD = 130°$, what is the value of $\angle BAE$?



Let's Think:

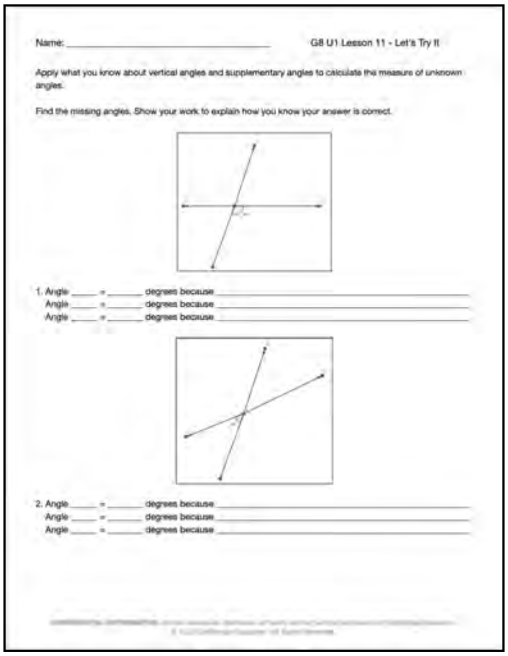
How do vertical angles and supplementary angles work together to help us calculate missing angles of a pair of intersecting lines?

What are the values of the missing angles?



Let's Try It:

Let's practice finding the missing angles of a pair of intersecting lines.



Name: ______________________ G8 U1 Lesson 11 - Let's Try It

Apply what you know about vertical angles and supplementary angles to calculate the measure of unknown angles.

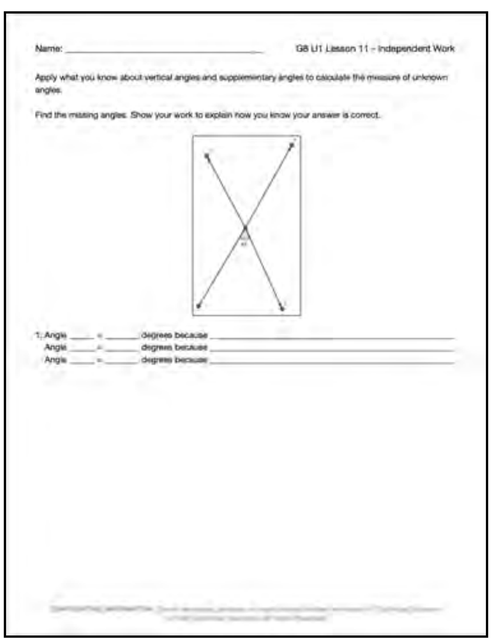
Find the missing angles. Show your work to explain how you know your answer is correct.

1. Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________

2. Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________

On your Own:

Now it's time to find the value of the missing angles of a pair of intersecting lines on your own.

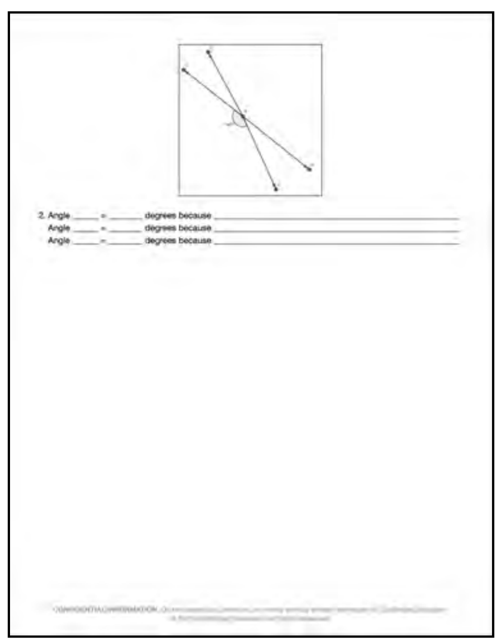


Name: ______________________ G8 U1 Lesson 11 - Independent Work

Apply what you know about vertical angles and supplementary angles to calculate the measure of unknown angles.

Find the missing angles. Show your work to explain how you know your answer is correct.

1. Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________

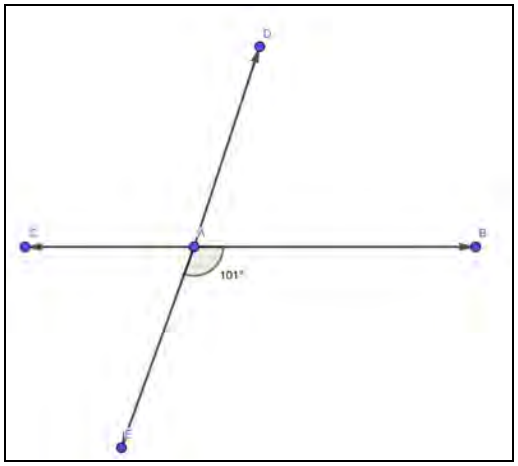


2. Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________
   Angle _____ = ______ degrees because ______________________

Name: ____

Apply what you know about vertical angles and supplementary angles to calculate the measure of unknown angles.

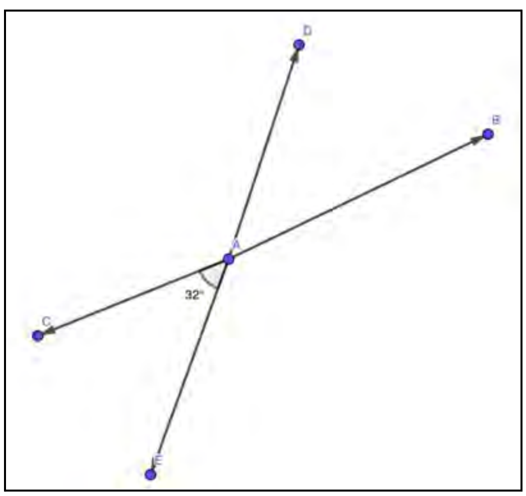
Find the missing angles. Show your work to explain how you know your answer is correct.



1. Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____



2. Angle ______ = ________ degrees because ____

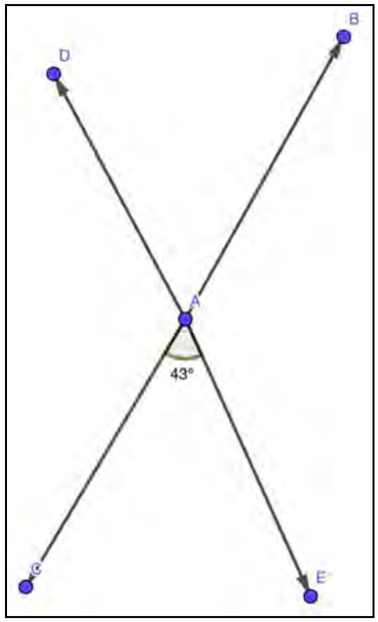
   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

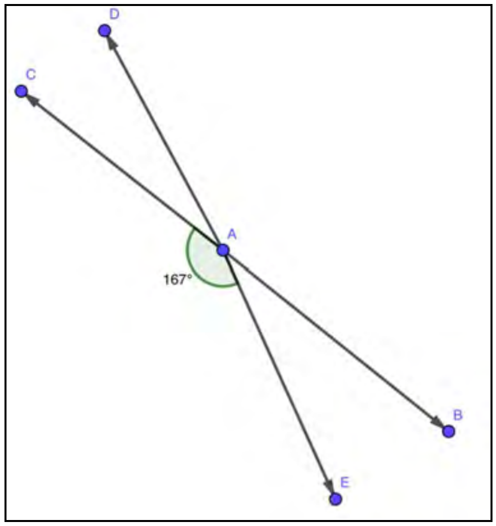
Name: ____

Apply what you know about vertical angles and supplementary angles to calculate the measure of unknown angles.

Find the missing angles. Show your work to explain how you know your answer is correct.



1. Angle ______ = ________ degrees because ____
   Angle ______ = ________ degrees because ____
   Angle ______ = ________ degrees because ____



2. Angle ______ = ________ degrees because ____

Angle ______ = ________ degrees because ____

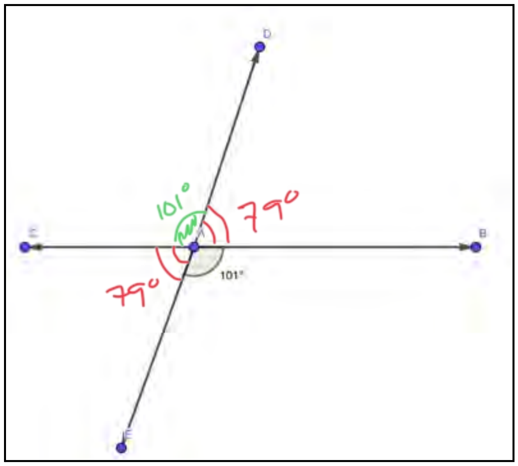
Angle ______ = ________ degrees because ____

Name: Answer Key

Apply what you know about vertical angles and supplementary angles to calculate the measure of unknown angles.

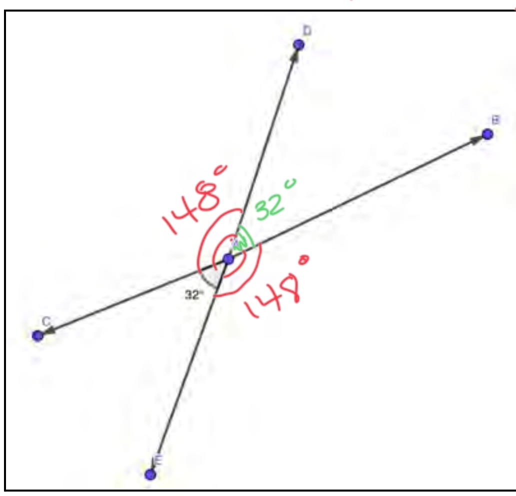
Find the missing angles. Show your work to explain how you know your answer is correct.

180
−101
79



1. Angle CAD = 101 degrees because vertical angle theorem
   Angle DAB = 79 degrees because it is supplementary to ∠CAD OR ∠BAE.
   Angle EAC = 79 degrees because it is vertical to ∠DAB
   OR it is supplementary to ∠CAD OR ∠BAE

180
− 32
148



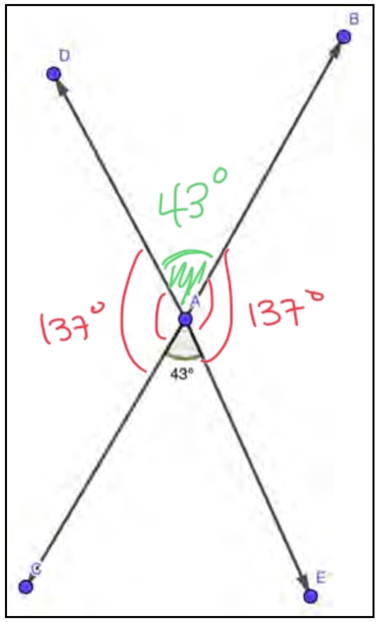
2. Angle DAB = 32 degrees because it is vertical to ∠EAC.
   Angle CAD = 148 degrees because it is supplementary to ∠EAC OR ∠DAB.
   Angle BAE = 148 degrees because it is vertical to ∠CAD OR it is supplementary to ∠EAC OR ∠DAB.

* Students only need one explanation per line. The "OR" statements are for the tutors.

Name: Answer Key

Apply what you know about vertical angles and supplementary angles to calculate the measure of unknown angles.

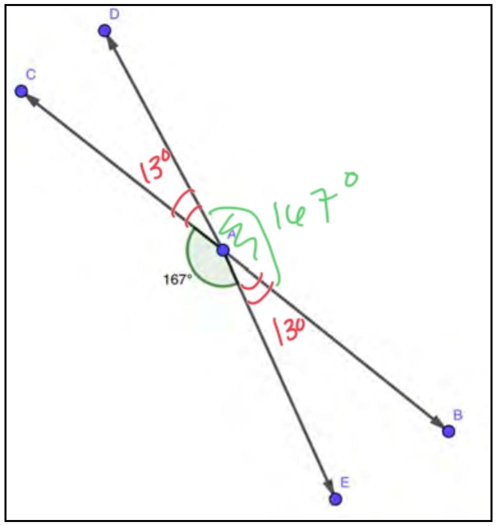
Find the missing angles. Show your work to explain how you know your answer is correct.



$$\begin{array}{r} 180 \\ -\ 43 \\ \hline 137 \end{array}$$

1. Angle DAB = 43 degrees because it is vertical to ∠EAC.
   Angle BAE = 137 degrees because it is supplementary to ∠DAB OR ∠EAC.
   Angle CAD = 137 degrees because it is vertical to ∠BAE OR supplementary to ∠DAB OR ∠EAC.

*Students only need one explanation per line. The "or" statements are for the tutors.



180
-167
13

2. Angle DAB = 167 degrees because it is vertical to ∠EAC.
Angle BAE = 13 degrees because it is supplementary to ∠EAC OR ∠DAB.
Angle CAD = 13 degrees because it is vertical to ∠BAE OR supplementary to ∠DAB OR ∠EAC.

G8 U1 Lesson 12
Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

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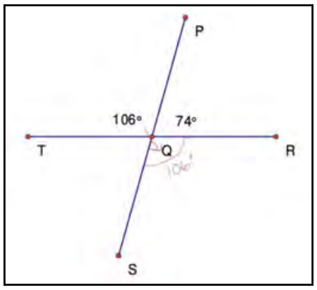
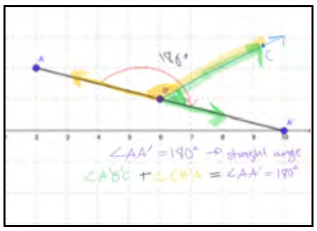
G8 U1 Lesson 12 - Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

Warm Welcome (Slide 1): Tutor Choice

Frame the Learning/Connection to Prior Learning (Slides 2 - 4): Today we will calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.



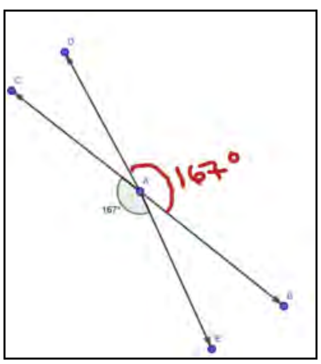
Recall that vertical angles are nonadjacent angles created by the intersection of two lines - vertical angles are congruent.



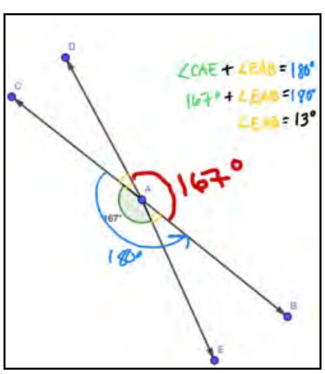
Supplementary angles are adjacent angles on a straight angle - the sum of supplementary angles is 180 degrees.

Let's Talk (Slide 5): Let's consider a pair of intersecting lines where only one of its angles is known. How will we find the other angles? Possible Students Answers, Key Points:

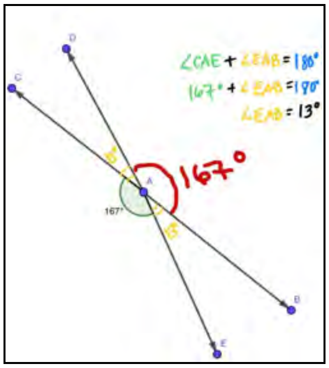
- Use the Vertical Angle Theorem to find the angle across from the given angle.
- Use the definition of supplementary angles to calculate the sum of adjacent angles on a straight line.



The given $\angle CAE$ is 167°. Since *$\angle DAB$ is vertical to $\angle CAE$ and vertical angles are congruent,* $\angle DAB$ = 167°.

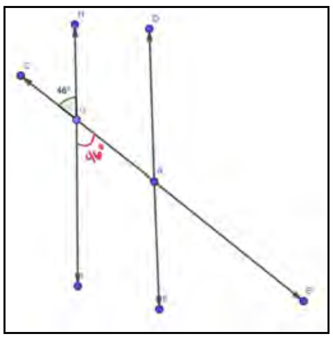


Now that we know the value of two angles, we'll use the definition of supplementary angles to find the value of an adjacent angle to one of the known angles. $\angle CAE + \angle EAB = 180°$. Substitute the known values to find the missing angle. *(Mark the angles and write the supplementary angles formula.)* $\angle EAB = 13°$.

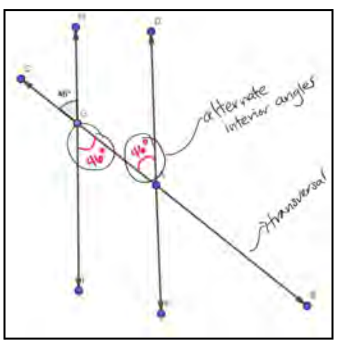


Now that we know $\angle EAB$ = 13°, $\angle DAC$ = 13° also because they are vertical angles.

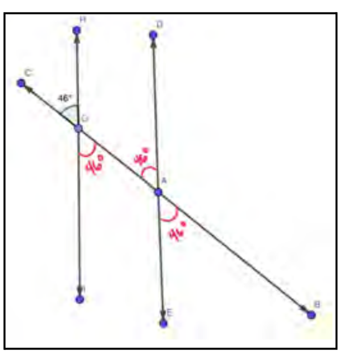
Let's Think (Slide 6): Now let's consider what happens when we intersect a pair of parallel lines with a third line. Can we use what we know about properties of parallel lines, vertical angles, and supplementary angles to find the missing values?



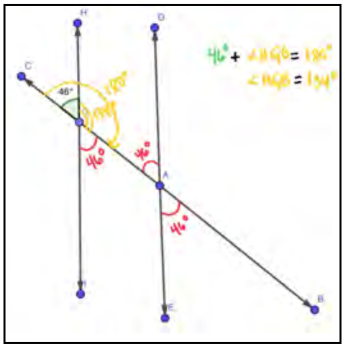
First, notice that $\angle CGH$ and $\angle BGI$ are vertical angles which means they are congruent. *Mark the unknown angle and write its value.)* are adjacent and on a straight angle. *(Mark one of the missing angles, $\angle DAB$, and the straight angle.)* Now we can use the definition of supplementary angles to find the missing value.



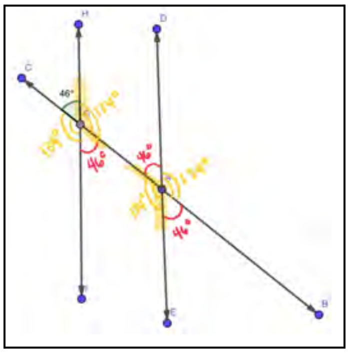
We know that the parallel lines share the same properties. So $\angle CAD$ = 46° because it is congruent to $\angle CGH$, the same angle created by the line intersecting the parallel lines. *(Mark the angles.)* The intersecting line is known as a transversal. Since $\angle BGI$ is vertical to $\angle CGH$ and thus congruent to $\angle CGH$, $\angle BGI$ is also congruent to $\angle CAD$. $\angle BGI$ and $\angle BGI$ are known as alternate interior angles because of their location between the parallel lines and on the transversal. Alternate interior angles are congruent. (*Label the new vocabulary.)*



Now we have enough information to find the other angles using vertical angles, supplementary angles, and alternate interior angles. $\angle CAD$ is vertical to $\angle BAE$ so $\angle BAE$ = 46° by the Vertical Angles Theorem.



Finally, let's consider what we know about supplementary angles to find ∠*HGB* which is supplementary to ∠*CGH* because they are adjacent angles on a straight line. 180 minus 46 is 134 so ∠*HGB* = 134°.



Now we can use alternate interior angles to find ∠*EAG*. ∠*EAG* is congruent to ∠*HGB* because they are alternate interior angles so ∠*EAG* = 134°. *(Highlight or outline the alternate interior angles and write the value of ∠EAG before using vertical angles to fill in the remaining values.)* We can use vertical angles to determine that the remaining angles also have a measure of 134°.

Let's Try it (Slides 7-8): Let's work on finding unknown angle measurements when a pair of parallel lines are cut by a transversal. We will work on this page together. Remember that a transversal is a line that intersects a pair of parallel lines and alternate interior angles are created by the transversal, on alternate sides of the transversal but between the parallel lines. They cannot be adjacent or they would be supplementary and alternate interior angles are congruent.

WARM WELCOME

Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

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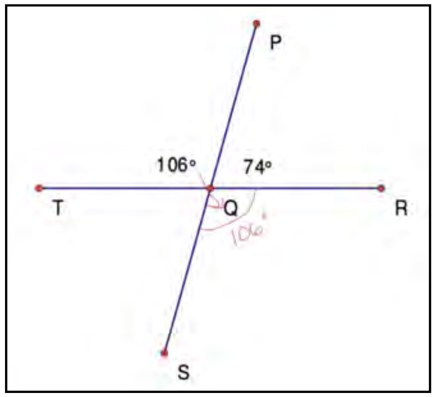
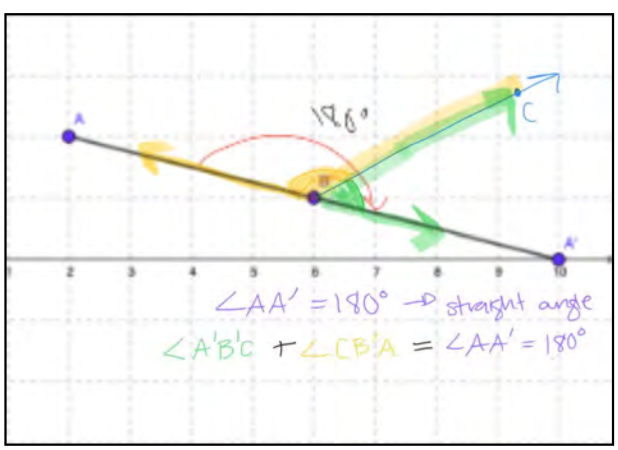
Let's Review:

Vertical angles are congruent.



Let's Review:

The sum of supplementary angles is 180 degrees.



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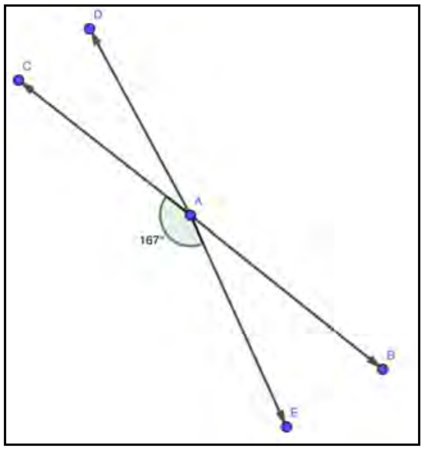
Let's Talk:

How do vertical angles and supplementary angles work together to help us calculate missing angles of a pair of intersecting lines?

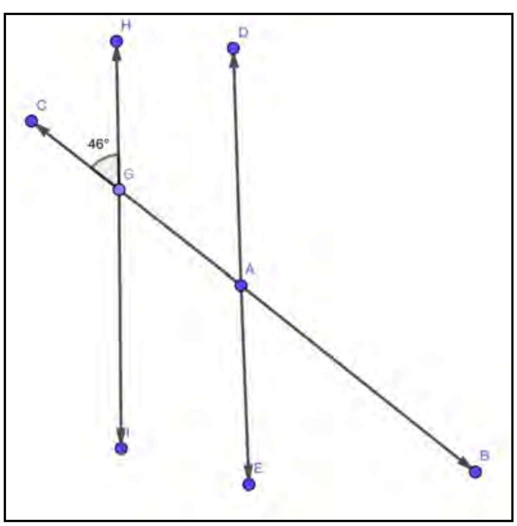
Calculate the value of the missing angles.



Let's Think:

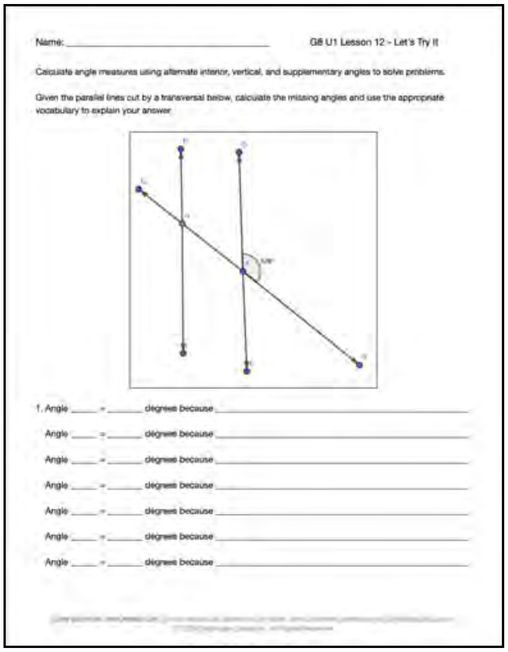
How do we use vertical angles and supplementary angles to calculate the unknown angles when a pair of parallel lines are cut by a transversal?

What are the values of the unknown angles?



Let's Try It:

Let's practice finding the missing angles of a pair of parallel lines cut by a transversal.



Name: ______________________ G8 U1 Lesson 12 - Let's Try It

Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

Given the parallel lines cut by a transversal below, calculate the missing angles and use the appropriate vocabulary to explain your answer.

1. Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

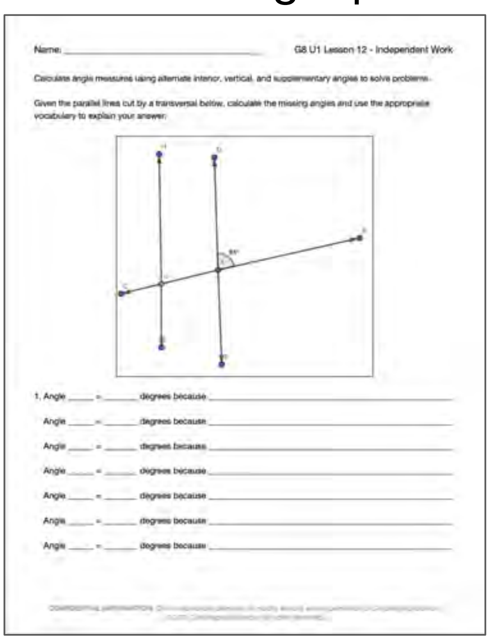
Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

On your Own:

Now it's time to calculate the missing values of angles created by a transversal cutting a pair of parallel lines on your own.



Name: ______________________ G8 U1 Lesson 12 - Independent Work

Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

Given the parallel lines cut by a transversal below, calculate the missing angles and use the appropriate vocabulary to explain your answer.

1. Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

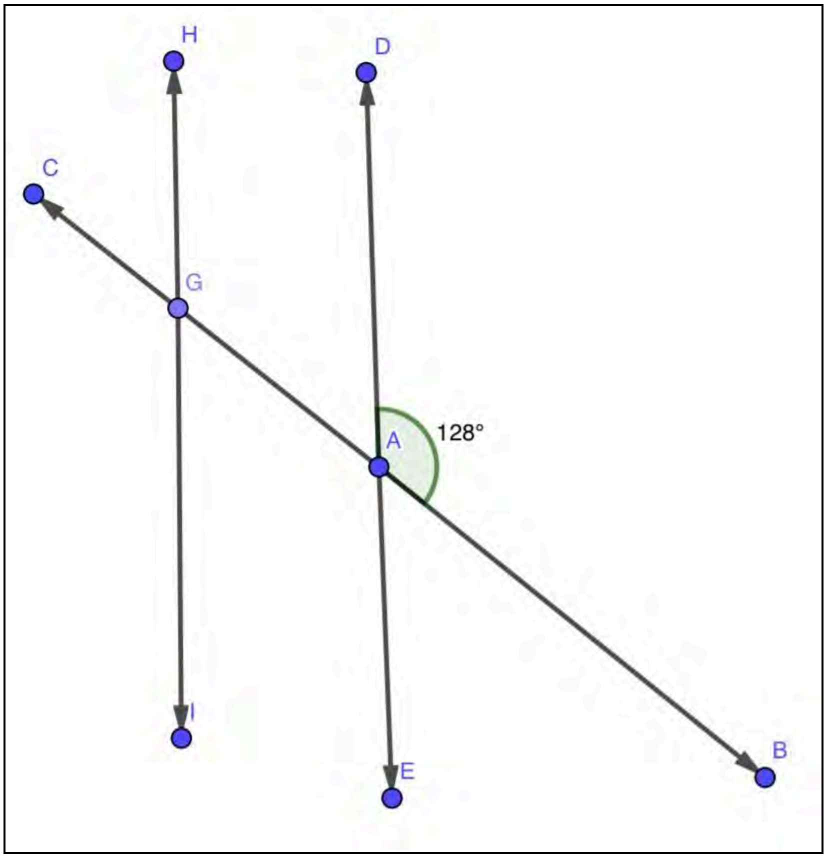
Angle _____ = _______ degrees because ______________________

Angle _____ = _______ degrees because ______________________

Name: ____ G8 U1 Lesson 12 - Let's Try It

Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

Given the parallel lines cut by a transversal below, calculate the missing angles and use the appropriate vocabulary to explain your answer.



1. Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

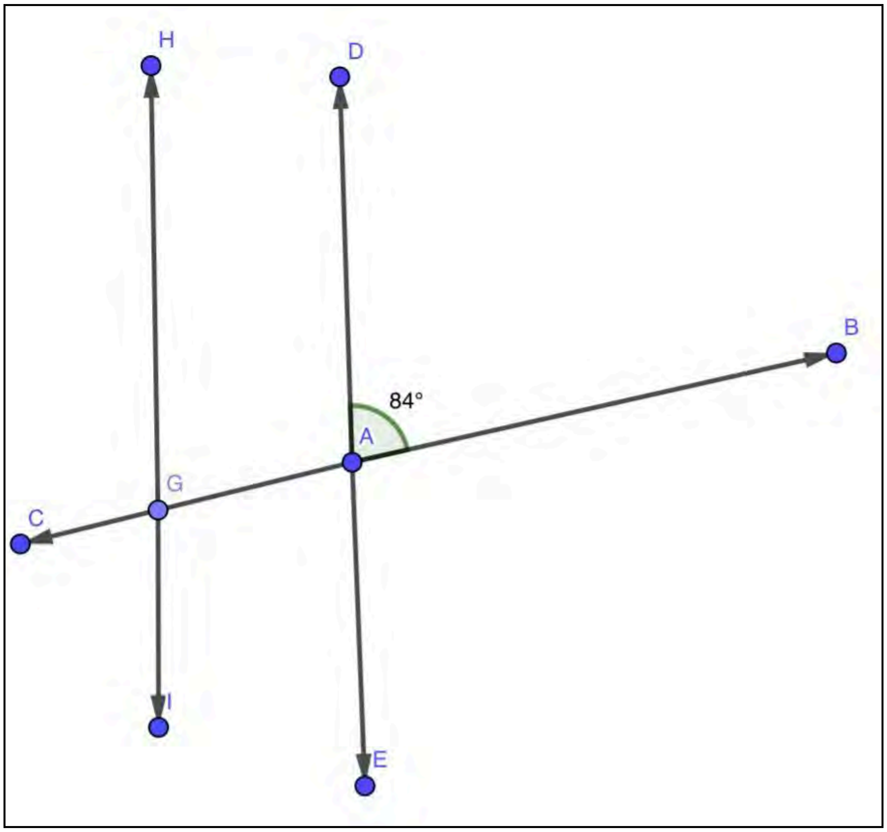
   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

Name: ____ G8 U1 Lesson 12 - Independent Work

Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

Given the parallel lines cut by a transversal below, calculate the missing angles and use the appropriate vocabulary to explain your answer.



1. Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

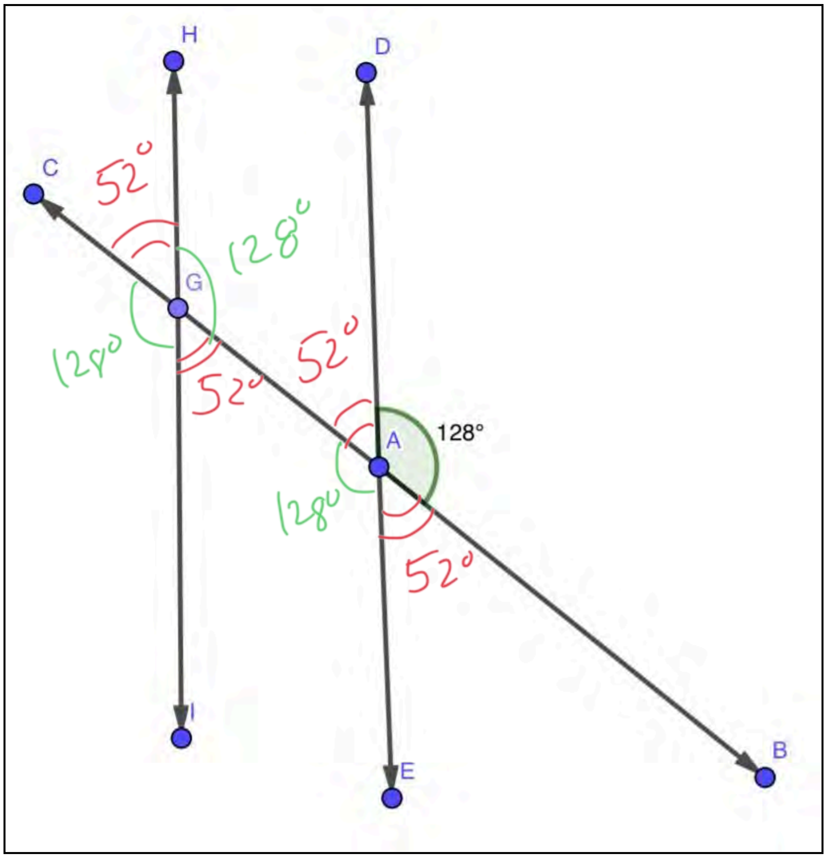
   Angle ______ = ________ degrees because ____

   Angle ______ = ________ degrees because ____

Name: ____ G8 U1 Lesson 12 - Let's Try It

Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

Given the parallel lines cut by a transversal below, calculate the missing angles and use the appropriate vocabulary to explain your answer.



$$\begin{array}{r} 180 \\ -128 \\ \hline 52 \end{array}$$

1. Angle GAE = 128 degrees because vertical angle theorem

Angle BAE = 52 degrees because supplementary to ∠DAB or ∠GAE

Angle CAD = 52 degrees because verticle angle theorem

Angle BGI = 52 degrees because alternate interior to ∠CAD

Angle HGB = 128 degrees because alternate interior to ∠EAC

Angle CGI = 128 degrees because vertical to ∠HGB

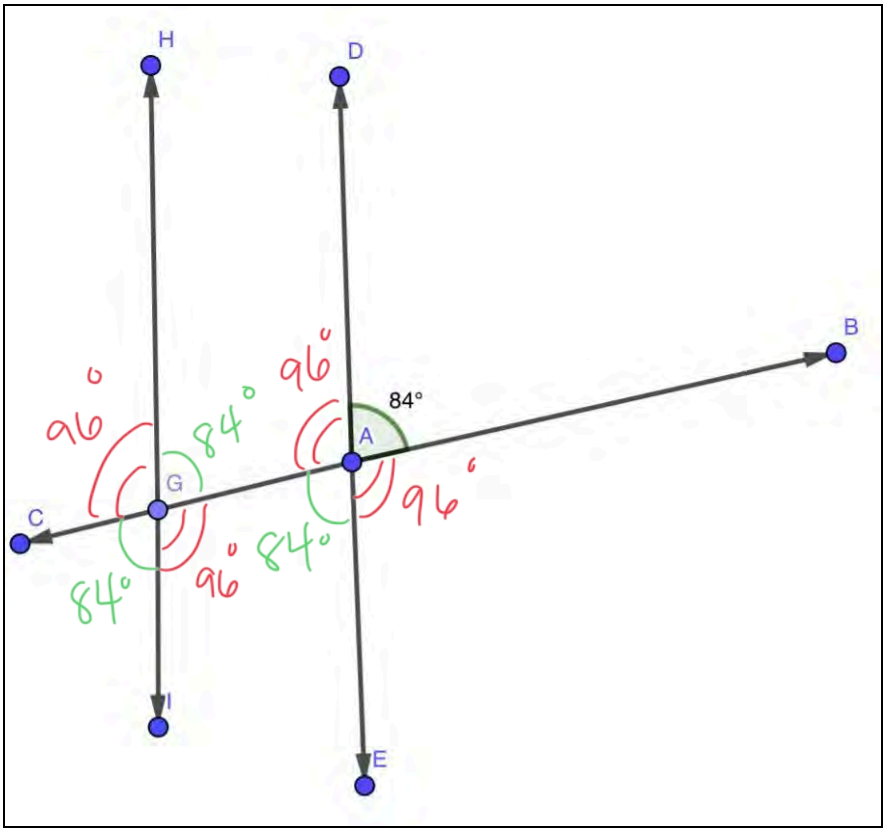
Angle CGH = 52 degrees because vertical to ∠BGI

* There are many explanations that work.

Name: Answer Key

Calculate angle measures using alternate interior, vertical, and supplementary angles to solve problems.

Given the parallel lines cut by a transversal below, calculate the missing angles and use the appropriate vocabulary to explain your answer.



$$\begin{array}{r} 180 \\ -84 \\ \hline 96 \end{array}$$

1. Angle BAE = 96 degrees because supplementary to given ∠

Angle DAC = 96 degrees because vertical to ∠ BAE

Angle EAC = 84 degrees because vertical to given ∠

Angle HGB = 84 degrees because alternate interior to ∠EAC

Angle BGI = 96 degrees because alternate interior to ∠DAC

Angle CGI = 84 degrees because vertical to ∠ HGB

Angle HGC = 96 degrees because vertical to ∠BGI

* There are many possible explanations.

G8 U1 Lesson 13
Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

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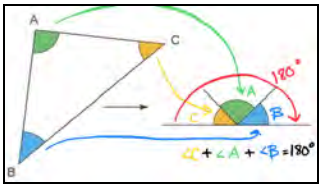
G8 U1 Lesson 13 - Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

Warm Welcome (Slide 1): Tutor Choice

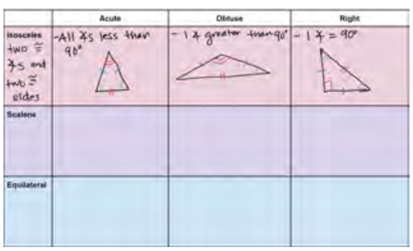
Frame the Learning/Connection to Prior Learning (Slides 2 - 3): Today we will calculate the measures of missing angles and exterior angles of triangles. First, let's recall that the sum of the interior angles of a triangle is 180°. In your classes you might have proved this to be true using what you know about a straight angle.



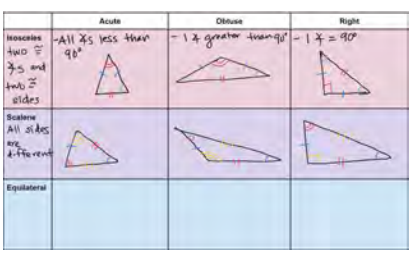
Notice that the angles of triangle *ABC* fit together like puzzle pieces on a straight angle. *(Draw arrows to show how the interior angles moved to form the straight angle.)* Even though we don't know the value of any of the triangle's interior angles, because together they form the straight angle *(Draw an arc to show the straight angle and label its measure.),* we know that the sum of the triangle's angles must be 180 degrees. *(Write a formula beneath the straight angle to show that the three angles have a sum of 180 degrees.)* Thus, the Triangle Sum Theorem.

Let's Talk (Slide 4): Let's apply this to finding the missing angles in a triangle. But first, let's talk about the properties of triangles which will help us to make decisions about the angles of a triangle. Tell me what you know about different types of triangles. Possible Students Answers, Key Points:

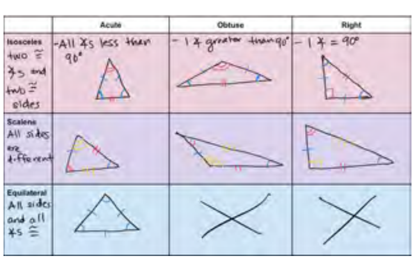
- One triangle is a right triangle because it has a 90 degree angle.
- One type of triangle has two sides and two angles that are always congruent.
- One type of triangle has everything different.



First, let's discuss isosceles triangles. Isosceles triangles have two congruent sides and two congruent angles. *(Write this in this in the space below the term "isosceles.")* They can be classified as acute (having all interior angles that measure less than 90 degrees each), obtuse (having one angle with a measure greater than 90 degrees), and right (having one angle measure exactly 90 degrees). *(Write and draw images as you describe each one.)*



Next, we have scalene triangles. Scalene triangles have all different side lengths which means all three interior angles are also different. Like an isosceles triangle, scalene triangles can be acute, obtuse, or right.

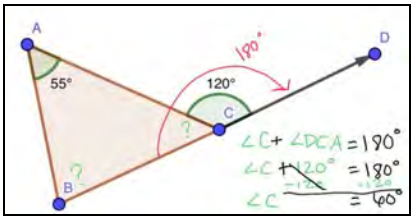


Finally, there is the equilateral triangle. Since the sum of the interior angles of a triangle is 180 degrees and an equilateral triangle has all parts equal, sides and angles, we know that all angles in an equilateral triangle will always be 60 degrees because 60 + 60 + 60 = 180. What does that tell us about classifying equilateral triangles? Possible Students Answers, Key Points:

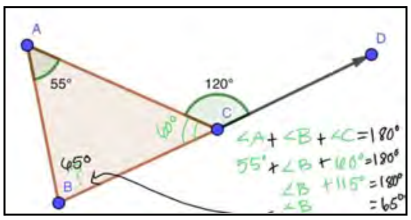
- All of the sides are all equal.
- They can't be obtuse since none of the angles are greater than 90 degrees.
- They can't be right because none of the angles equal 90 degrees.

That's right. This means that an equilateral triangle can be acute, but never right or obtuse.

Let's Think (Slide 5): Now that we recall all types of triangles, let's use their classifications and the Triangle Sum Theorem to find some missing angles.



Let's always start with what we know or the given information. I have one interior angle but I don't know anything about the side lengths so I can't be sure if any of the angles are congruent to each other. *(Write a question mark in the angle spaces where we don't know their measure.)* While that's tricky, we do know the measure of the exterior angle *DCA*. Since the exterior angle is on a straight angle with interior angle *C*, we can use what we know about supplementary angles to find the value of angle *C*. *(Draw an arc and label it to show 180 degrees.)* $\angle C + \angle DCA = 180°$, so $\angle C = 60°$. *(Write the equation and solve for angle C.)*



Now that we know the value of interior $\angle C$, we can use the other given angle, $\angle A$, to calculate the value of interior $\angle B$. Remember, by the Triangle Sum Theorem, $\angle A + \angle B + \angle C = 180°$. So $\angle B = 65°$.

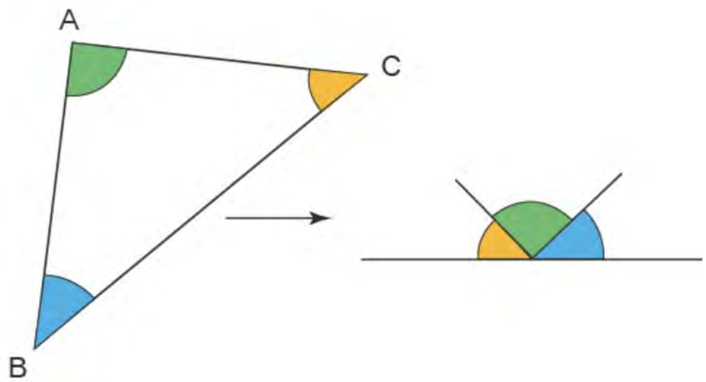
Let's Try it (Slides 7-8): Let's work on calculating the missing angle measures interior and/or exterior to a given triangle. Remember, the Triangle Sum Theorem tells us that the sum of the interior angles of a triangle equals 180 degrees. If you only know one interior angle, consider what other information you may have that can help you to find the missing angles.

WARM WELCOME

Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

Let's Review:

The Triangle Sum Theorem tells us that the sum of all interior angles in a triangle is 180°.



Let's Talk:

How do we find the unknown angles, interior and exterior, to triangles?

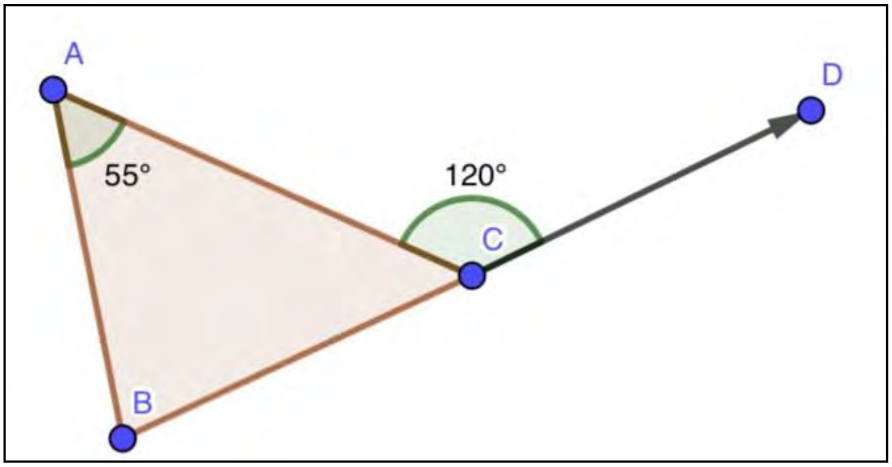
Let's classify triangles and define their properties.

	Acute	Obtuse	Right
Isosceles			
Scalene			
Equilateral			

Let's Think:

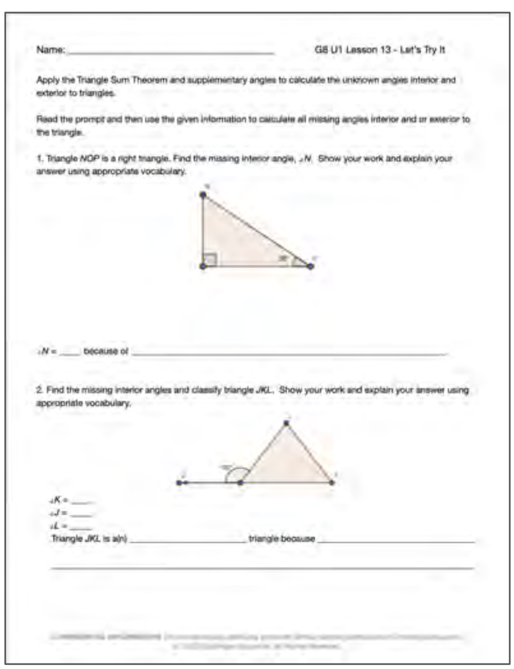
How do we find the unknown angles, interior and exterior, to triangles?

Calculate the missing angles.



Let's Try It:

Let's practice calculating the interior and exterior angles of triangles.



Name: ______________________ G8 U1 Lesson 13 - Let's Try It

Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

Read the prompt and then use the given information to calculate all missing angles interior and or exterior to the triangle.

1. Triangle *NOP* is a right triangle. Find the missing interior angle, ∠*N*. Show your work and explain your answer using appropriate vocabulary.

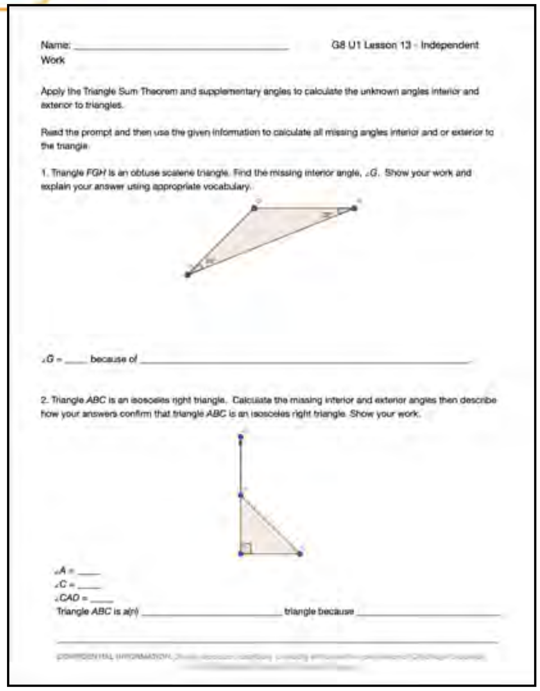
∠*N* = ____ because of ______________________

2. Find the missing interior angles and classify triangle *JKL*. Show your work and explain your answer using appropriate vocabulary.

∠*K* = ____
∠*J* = ____
∠*L* = ____
Triangle *JKL* is a(n) ____________ triangle because ____________

On your Own:

Now it’s time to calculate interior and/or exterior angles of triangles on your own.



Name: ______________________ G8 U1 Lesson 13 - Independent Work

Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

Read the prompt and then use the given information to calculate all missing angles interior and or exterior to the triangle.

1. Triangle *FGH* is an obtuse scalene triangle. Find the missing interior angle, $\angle G$. Show your work and explain your answer using appropriate vocabulary.

$\angle G$ = ____ because of ______________________

2. Triangle *ABC* is an isosceles right triangle. Calculate the missing interior and exterior angles then describe how your answers confirm that triangle *ABC* is an isosceles right triangle. Show your work.

$\angle A$ = ____

$\angle C$ = ____

$\angle CAD$ = ____

Triangle *ABC* is a(n) ______________ triangle because ______________

Name: ____ G8 U1 Lesson 13 - Let's Try It

Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

Read the prompt and then use the given information to calculate all missing angles interior and or exterior to the triangle.

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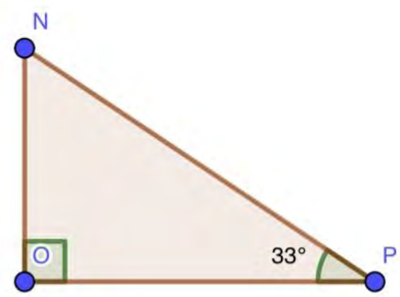
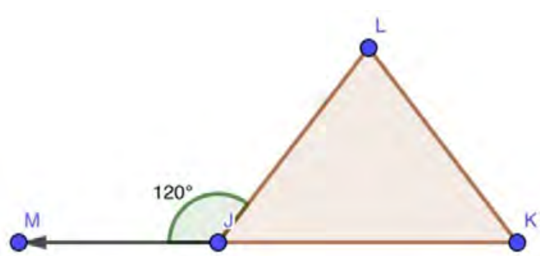


$\angle N$ = _____ because of ____.

2. Interior angle *K* is 60 degrees. Find the missing interior angles and classify triangle *JKL*. Show your work and explain your answer using appropriate vocabulary.



$\angle J$ = _____

$\angle L$ = _____

Triangle *JKL* is a(n) _______________________ triangle because ______________________________

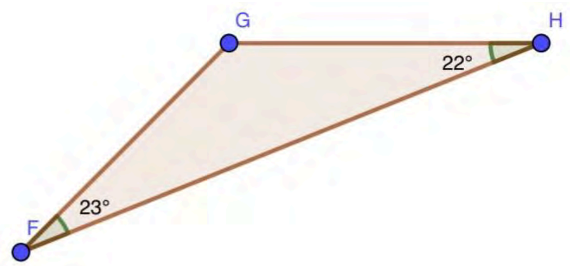
____

Name: ____ G8 U1 Lesson 13 - Independent Work

Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

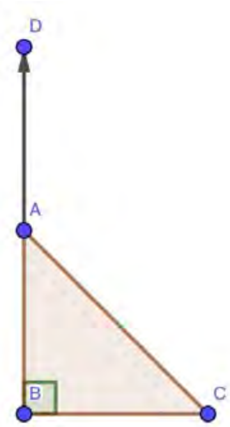
Read the prompt and then use the given information to calculate all missing angles interior and or exterior to the triangle.

1. Triangle *FGH* is an obtuse scalene triangle. Find the missing interior angle, $\angle G$. Show your work and explain your answer using appropriate vocabulary.



$\angle G$ = _____ because of ____.

2. Triangle *ABC* is an isosceles right triangle. Calculate the missing interior and exterior angles then describe how your answers confirm that triangle *ABC* is an isosceles right triangle. Show your work.



$\angle A$ = _____
$\angle C$ = _____
$\angle CAD$ = _____
Triangle *ABC* is a(n) ______________________________ triangle because _______________________________

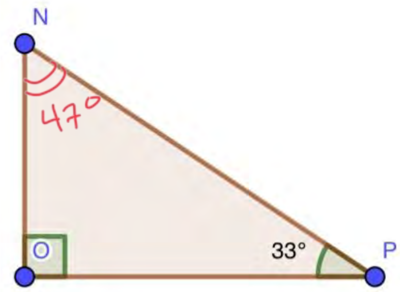
Name: Answer Key

Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

Read the prompt and then use the given information to calculate all missing angles interior and or exterior to the triangle.

1. Triangle *NOP* is a right triangle. Find the missing interior angle, $\angle N$. Show your work and explain your answer using appropriate vocabulary.

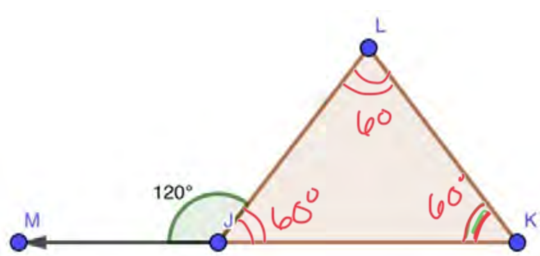
$\angle O + \angle P + \angle N = 180°$
$90° + 33° + \angle N = 180°$
$123° + \angle N = 180°$
$\angle N = 47°$



$\angle N$ = 47° because of Δ sum theorem.

2. Find the missing interior angles and classify triangle *JKL*. Show your work and explain your answer using appropriate vocabulary.

$\angle MJL + \angle J = 180$
$120 + \angle J = 180$
$\angle J = 60°$



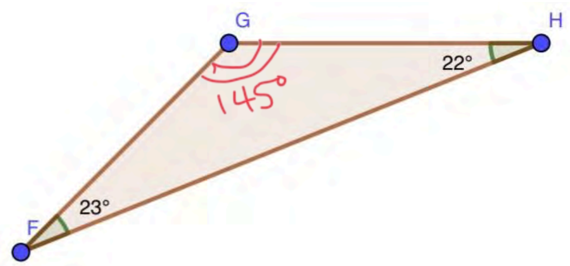
$\angle K$ = 60°
$\angle J$ = 60°
$\angle L$ = 60°
Triangle *JKL* is a(n) equilateral triangle because all ∠s are congruent.

Name: Answer Key G8 U1 Lesson 13 - Independent Work

Apply the Triangle Sum Theorem and supplementary angles to calculate the unknown angles interior and exterior to triangles.

Read the prompt and then use the given information to calculate all missing angles interior and or exterior to the triangle.

1. Triangle *FGH* is an obtuse scalene triangle. Find the missing interior angle, ∠*G*. Show your work and explain your answer using appropriate vocabulary.



$\angle F + \angle G + \angle H = 180$

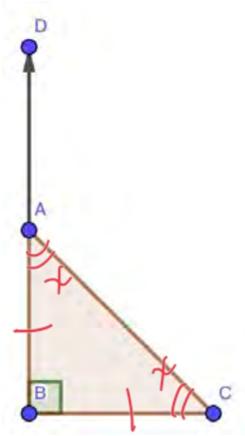
$23 + \angle G + 22 = 180$

$\angle G + 45 = 180$

$\angle G = 145^\circ$

∠*G* = 145° because of △ sum theorem.

2. Triangle *ABC* is an isosceles right triangle. Calculate the missing interior and exterior angles then describe how your answers confirm that triangle *ABC* is an isosceles right triangle. Show your work.



$\angle A + \angle B + \angle C = 180$

$x + 90 + x = 180$

$90 + 2x = 180$

$2x = 90$

$x = 45$

∠*A* = 45°

∠*C* = 45°

∠*CAD* = 145 $180 - 45 = 145$

Triangle *ABC* is a(n) isosceles right triangle because it has 1 right ∡ and two congruent ∡s.