8th Grade

NYC Saturday Tutoring Program

Mathematics Department

11/1/2014

Name: _____ Class: _____

Lesson 4: Dilations

OBJECTIVES: SWBA to

Describe the effect of dilation on two-dimensional figures using coordinates. **(8. G.3)**

INTRODUCTION

For the past three meetings we have being talking about how geometric transformations are integral parts of our daily lives. We talked about reflections, translations and rotations. Today, we will discuss dilation, which is probably the most common transformation in our daily routine. Dilation refers to the act of expanding. In geometry, a dilation is a ***transformation in which a polygon or figure is enlarged or reduced by a given factor around a given center point.*** This factor is called the **scale factor**, k, and as the name implies, a factor is a multiplication! The scale factor is used to multiply the coordinate point or side length of the pre-image to generate an image.

For dilation, the coordinate of each vertex in the image can be found using **(x, y)→ (kx, ky).** That is, multiply the coordinates of each point in the pre-image by the scale factor, k (is a positive rational number).

The **scale factor**, k, can be less or greater than 1.

- If the **scale factor is less than 1**, the dilation shrinks the object or pre-image. This means that the image is smaller than the original object (pre-image)
- If the **scale factor is greater than 1**, the dilation enlarges the object or pre-image. This means that the image is larger than the original object (pre-image)

Dilation is the only transformation that changes the size of the original figure, but angles and shape are always preserved.

Every day examples of dilation include photographs, copies, selfies, scale model of cars, houses, and your shadow!

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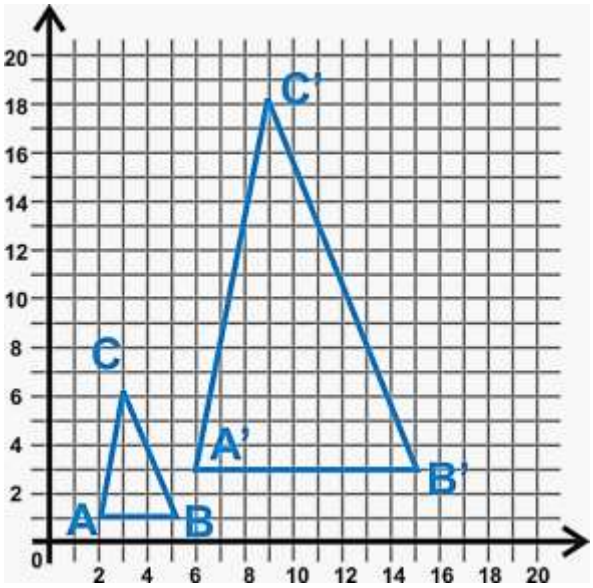
MINI-LESSON/Vocabulary (I DO):

Triangle A'B'C' is image of triangle ABC after dilation was performed.



Part A:

What type of dilation did triangle ABC go through? An enlargement or reduction, how do you know?

Solution:

Since the image, A'B'C', is larger than the pre-image or original figure ABC I conclude that the dilation was an enlargement.

Part B

What was the scale factor, k, of the dilation?

Solution:

To find the scale factor of the dilation we take two corresponding sides in the pre-image and the image. For instance:

*The length of segment **AB** = 3 units and the length of segment **A'B'**=9 units. To get from 3 to 9, we, multiply the length of segment AB by 3, so, 3 x 3 = 9. Therefore, the scale factor is 3.*

***k= 3** (notice that 3 is greater than 1 because the dilation was an enlargement.)*. The coordinate of each vertex in the image can be found as follow: **(x, y)---→ (3x, 3y)**

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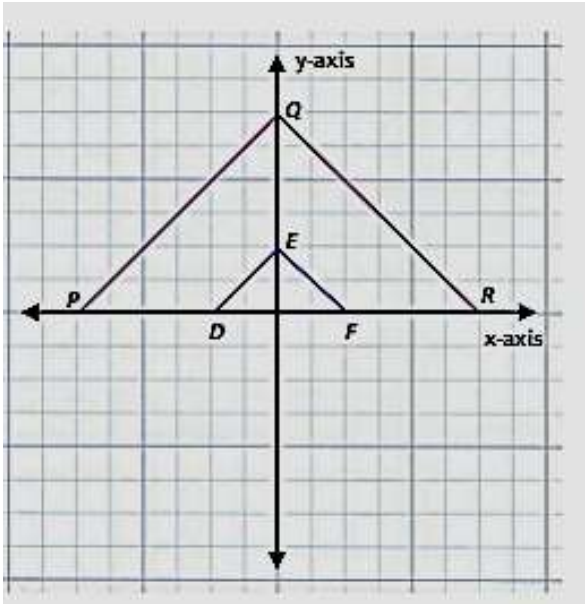
Guided Practice (We do):

Problem 2:

What is the scale factor of ΔDEF to ΔPQR?



Solution:

In order to solve this problem, first we have to determine if this dilation is a reduction or enlargement.

From the diagram on the left, we can see that the

Pre-image, ΔDEF is smaller than the image, ΔPQR. This tells us an enlargement took place.

To find the scale factor, simply find the length of **DF** and **PR** and the heights of each triangle.

DF is 4 units and **PR** is 12 units. The height of ΔDEF is 2 and the height of ΔPQR is 6.

From this information, we can conclude the scale factor is 3 because ΔPQR is 3 times larger than ΔDEF. How do we know this? Because, 4x3=14 and 2x3 =6. Using our notation from before, we can state:

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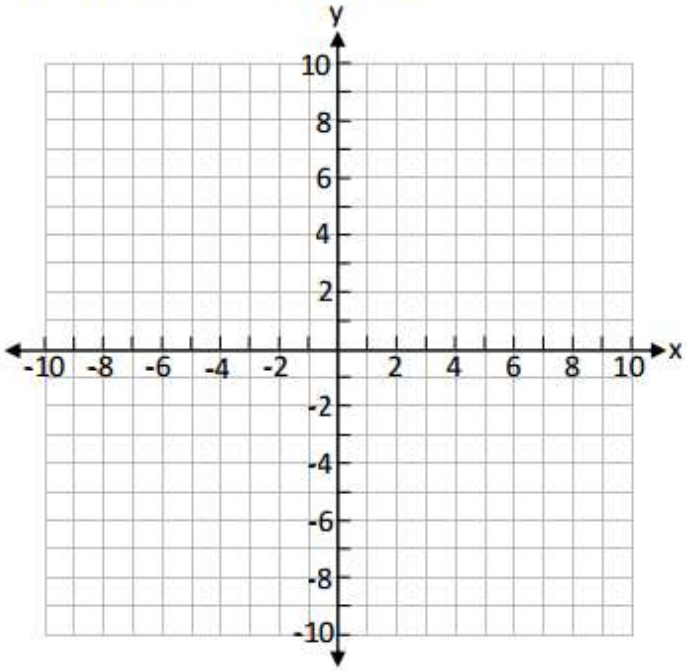
Independent Practice (You Do):

Problem 1:

1. Graph and connect these points: (2,2) (3,4) (5,2) (5,4).



2. Graph a new figure on the same coordinate plane by applying a scale factor of 2. When applying a scale factor of 2, multiply both the x and the y coordinate of each ordered pair by 2. Compare the original figure to the rotated figure, including coordinate pairs.

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3. Graph a new figure on the same coordinate plane by applying a scale factor of $\frac{1}{2}$ to your original coordinates. Compare the original figure to the rotated figure, including coordinate pairs.

_____

4. What happens when you apply a scale factor greater than 1 to a set of coordinates?

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5. What happens when you apply a scale factor less than 1 to a set of coordinates?

_____

6. Predict what would happen if you applied a scale factor of 1 to a set of coordinates.

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Problem 2:

The table below shows the coordinates of triangle RST and the coordinates of R′ in triangle R′S′T′. Triangle R′S′T′ is a dilation of triangle RST.

Triangle RST		Triangle R′S′T′	
R	(–2, –3)	R′	(–6, –9)
S	(0, 2)	S′	
T	(2, –3)	T′	

Part A

What are the coordinates of point S′ and point T′?

Answer S′ = (_____ , _____)

T′ = (_____ , _____)

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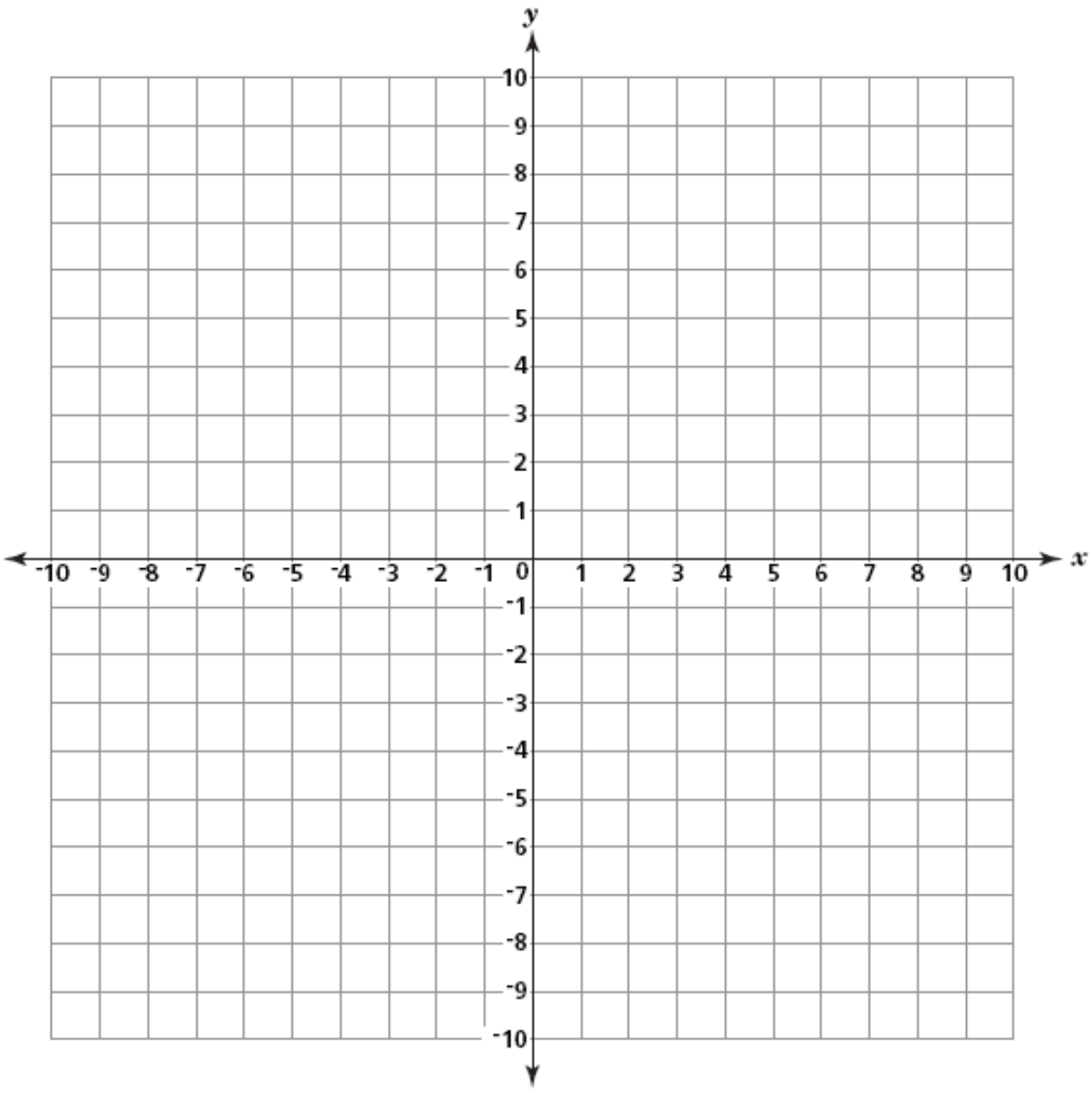
Part B

On the grid below, draw triangle RST and triangle R'S'T'.



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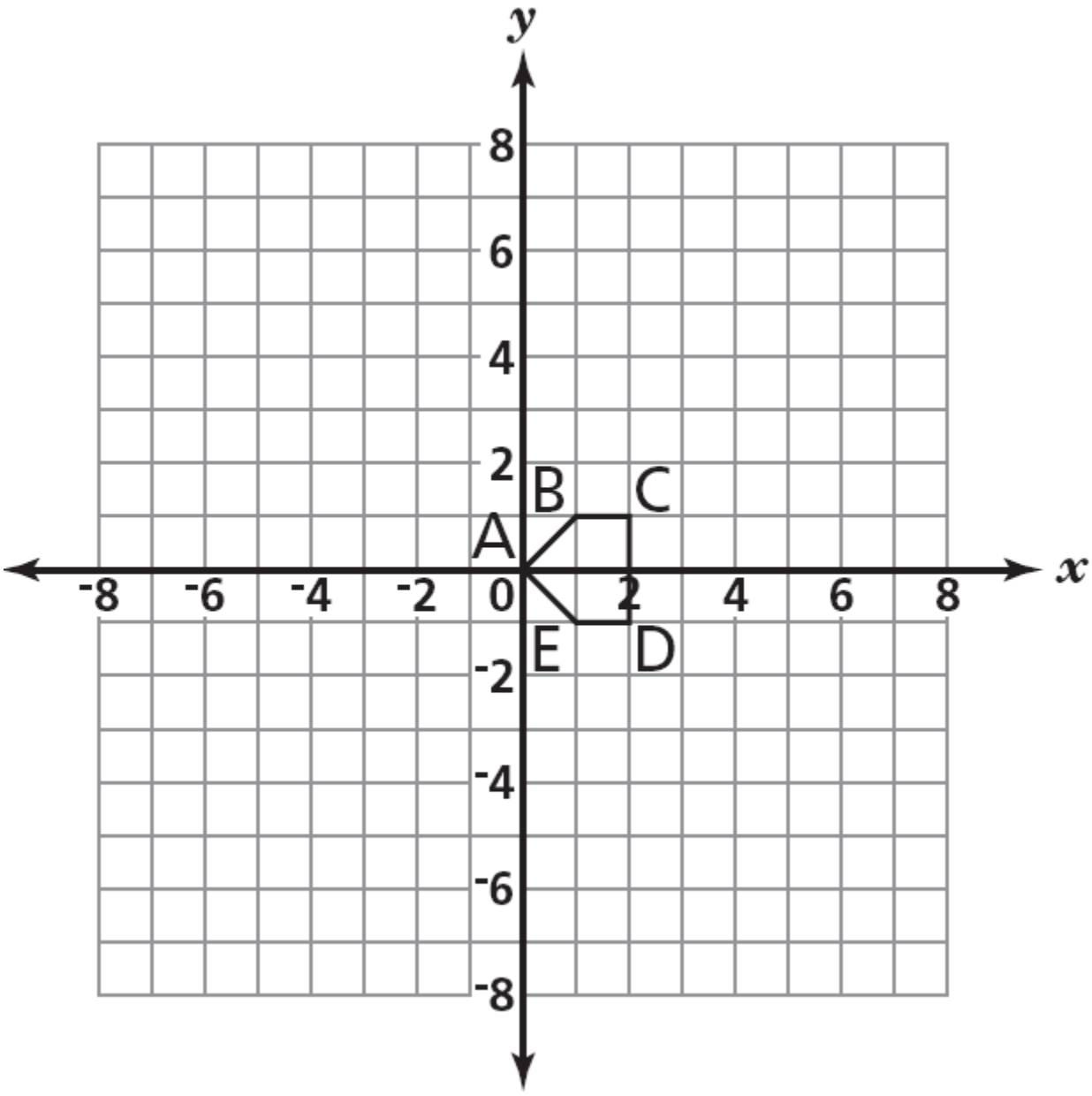
Problem 3:

On the grid below, draw the image of pentagon ABCDE with center at the origin after a dilation of 3. Label the image A'B'C'D'E'.



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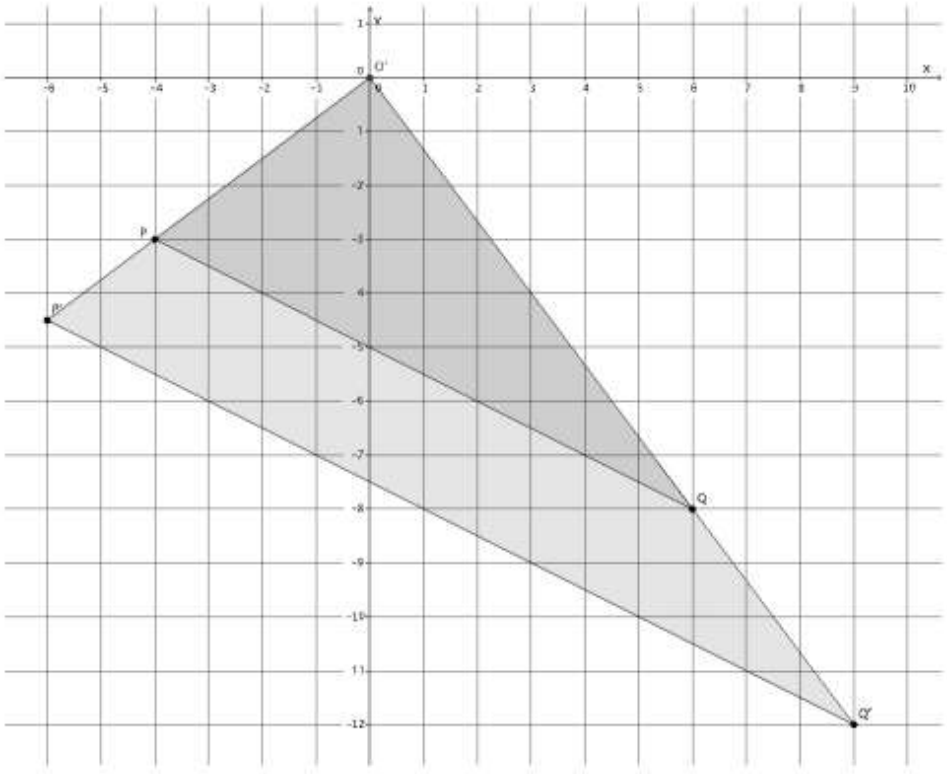
Problem 4:

Use the diagram below to answer the questions that follow.

Let D be the dilation with center O and scale factor $r > 0$ so that $D(P) = P'$ and $D(Q) = Q'$.



Part A:

Use lengths $|OQ|$ = 10 units and $|OQ'|$ = 15 units, to determine the scale factor r, of dilation D.

Describe how to determine the coordinates of P' using the coordinates of P.

Part B:

If $|OQ|$ = 10 units, $|OQ'|$ = 15 units, and $|P'Q'|$ = 11.2 units, determine the length of $|PQ|$. Round your answer to the tenths place, if necessary.

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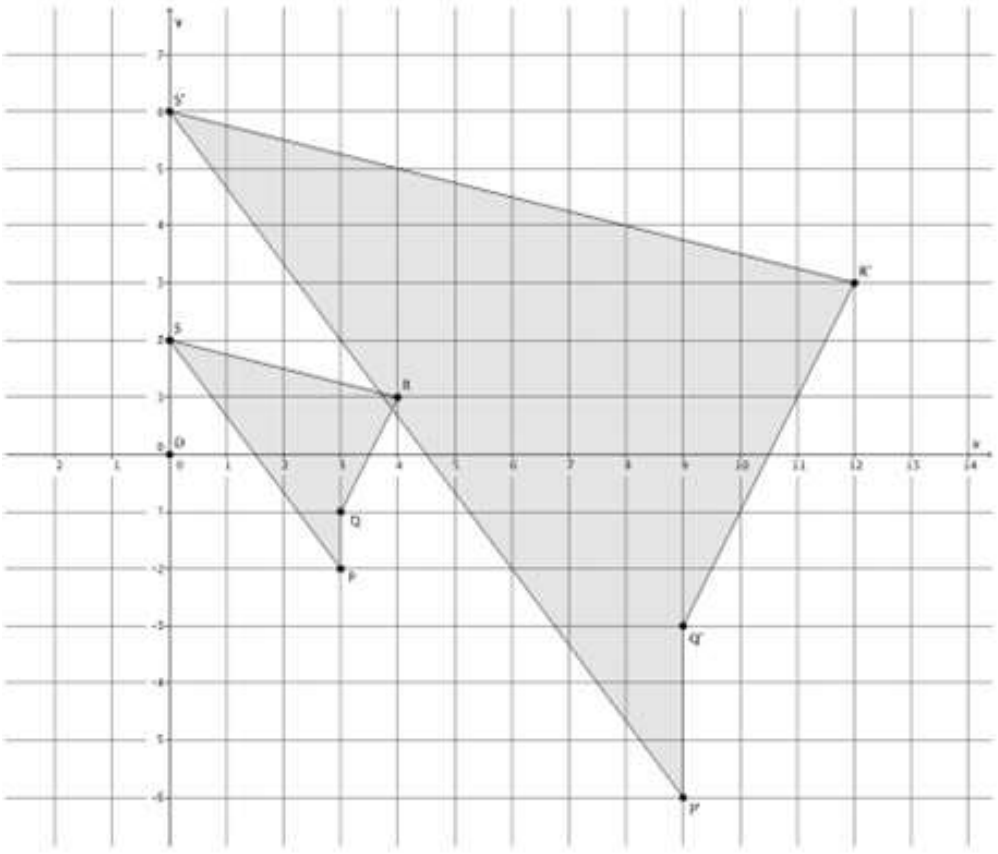
Problem 5:

Use a ruler and compass, as needed, to answer parts (a) and (b).

Is there a dilation D with center O that would map figure $PQRS$ to figure $P'Q'R'S'$? If yes, describe the dilation in terms of coordinates of corresponding points.



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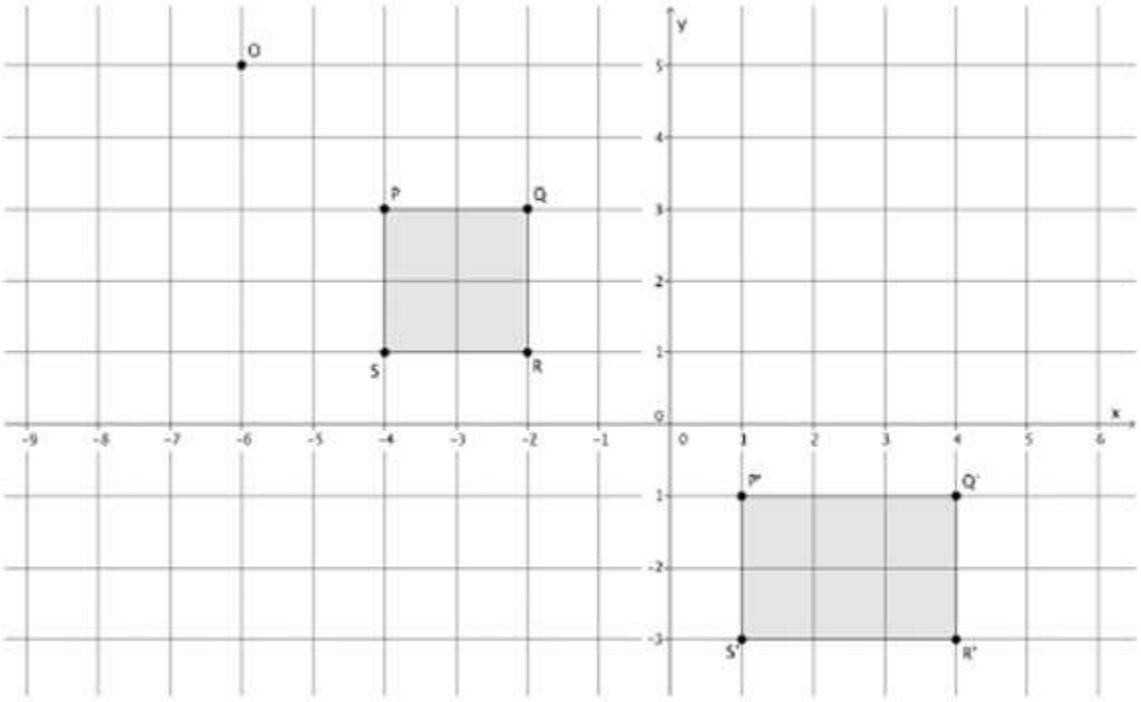
Part B:

Is there a dilation D with center O that would map figure $PQRS$ to figure $P'Q'R'S'$? If yes, describe the dilation in terms of coordinates of corresponding points.



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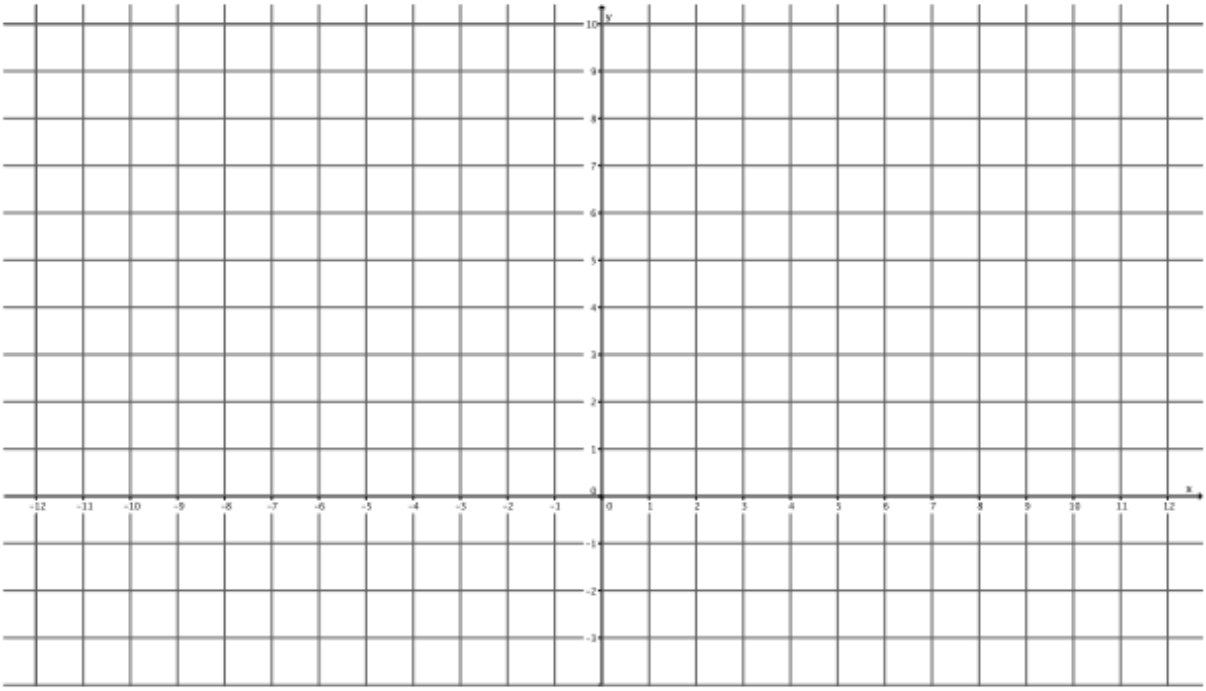
Part C

Triangle ABC is located at points A = (−4, 3), B = (3, 3), and C = (2, −1) and has been dilated from the origin by a scale factor of 3. Draw and label the vertices of triangle ABC. Determine the coordinates of the dilated triangle $A'B'C'$ and draw and label it on the coordinate plane.



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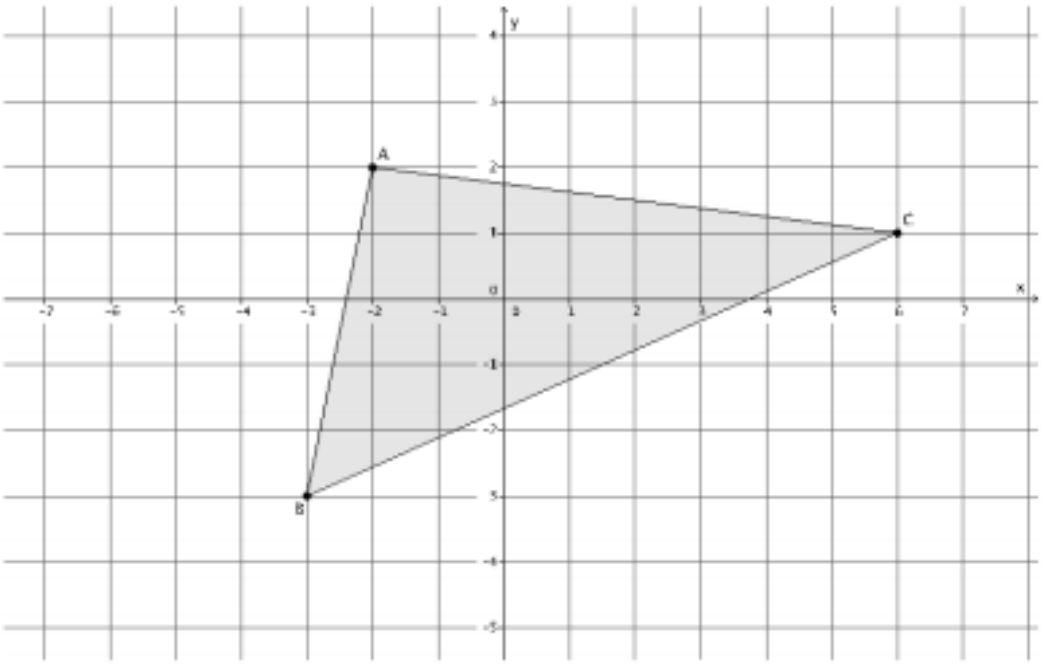
Problem 6:

The coordinates of triangle $\boldsymbol{ABC}$ are shown on the coordinate plane below. The triangle is dilated from the origin by scale factor $\boldsymbol{r}$ = $\mathbf{12}$. Identify the coordinates of the dilated triangle $\boldsymbol{A'B'C'}$.



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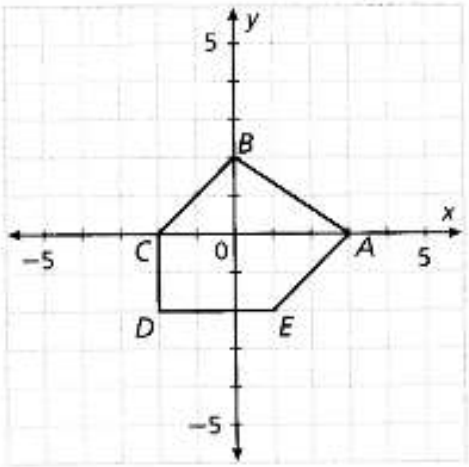
Problem 7:

Draw the image of the pentagon after a dilation with scale factor $\frac{3}{2}$.



A In the table below, list the vertices of the pentagon. Then use the rule for the dilation to write the vertices of the image.

Pre-Image (x, y)	Image $\left(\frac{3}{2}x, \frac{3}{2}y\right)$
$A(3, 0)$	$A'(4\frac{1}{2}, 0)$
$B(0, 2)$	

B Plot the vertices of the image. Connect the vertices to complete the image.

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Final Summary

In a U-Shape:

1. Re-state the objective to assess if students learn it
2. Elicit from students what they have learned and what they want to learn more about.
3. Tie what they learn to the lesson, and upcoming lessons **(Next Saturday, they will learn about Dilations).**