

Transformations and Similarity

MODULE



10



ESSENTIAL QUESTION

How can you use dilations and similarity to solve real-world problems?

LESSON 10.1

Properties of Dilations

 **CA CC** 8.G.3, 8.G.4

LESSON 10.2

Algebraic Representations of Dilations

 **CA CC** 8.G.3

LESSON 10.3

Similar Figures

 **CA CC** 8.G.4



 my.hrw.com

Real-World Video

To plan a mural, the artist first makes a smaller drawing showing what the mural will look like. Then the image is enlarged by a scale factor on the mural canvas. This enlargement is called a dilation.

© Houghton Mifflin Harcourt Publishing Company

GO
DIGITAL
my.hrw.com



my.hrw.com

Go digital with your write-in student edition, accessible on any device.



Math On the Spot

Scan with your smart phone to jump directly to the online edition, video tutor, and more.



Animated Math

Interactively explore key concepts to see how math works.



Personal Math Trainer

Get immediate feedback and help as you work through practice sets.

Are YOU Ready?

Complete these exercises to review skills you will need for this module.



Personal Math Trainer

Online Practice and Help

my.hrw.com

Simplify Ratios

EXAMPLE $\frac{35}{21} = \frac{35 \div 7}{21 \div 7}$
 $= \frac{5}{3}$

To write a ratio in simplest form, find the greatest common factor of the numerator and denominator. Divide the numerator and denominator by the GCF.

Write each ratio in simplest form.

1. $\frac{6}{15}$ _____ 2. $\frac{8}{20}$ _____ 3. $\frac{30}{18}$ _____ 4. $\frac{36}{30}$ _____

Multiply with Fractions and Decimals

EXAMPLE $2\frac{3}{5} \times 20$
 $= \frac{13 \times 20}{5 \times 1}$
 $= \frac{13 \times \cancel{20}^4}{\cancel{5} \times 1}$
 $= 52$

Write numbers as fractions and multiply. Simplify.

$$\begin{array}{r} 68 \\ \times 4.5 \\ \hline 340 \\ + 272 \\ \hline 306.0 \end{array}$$

Multiply as you would with whole numbers.

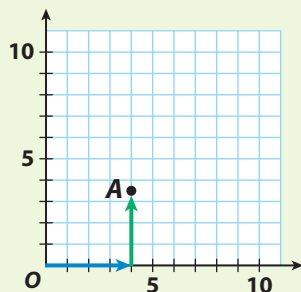
Place the decimal point in the answer based on the total number of decimal places in the two factors.

Multiply.

5. $60 \times \frac{25}{100}$ _____ 6. 3.5×40 _____ 7. 4.4×44 _____ 8. $24 \times \frac{8}{9}$ _____

Graph Ordered Pairs (First Quadrant)

EXAMPLE



Graph the point $A(4, 3.5)$. Start at the origin. Move 4 units right. Then move 3.5 units up. Graph point $A(4, 3.5)$.

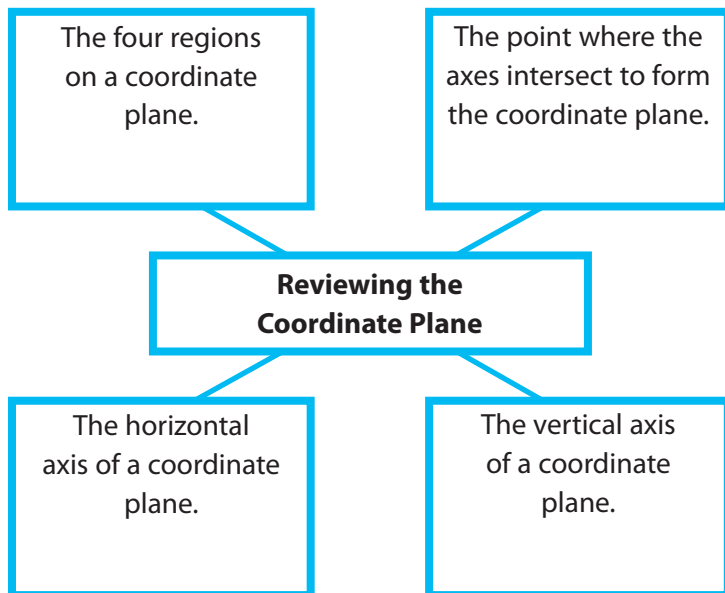
Graph each point on the coordinate grid above.

9. $B(9, 0)$ 10. $C(2, 7)$ 11. $D(0, 4.5)$ 12. $E(6, 2.5)$

Reading Start-Up

Visualize Vocabulary

Use the ✓ words to complete the graphic organizer.
You will put one word in each rectangle.



Understand Vocabulary

Complete the sentences using the preview words.

1. A figure larger than the original, produced through dilation, is an _____.
2. A figure smaller than the original, produced through dilation, is a _____.

Vocabulary

Review Words

- coordinate plane (*plano cartesiano*)
- image (*imagen*)
- ✓ origin (*origen*)
- preimage (*imagen original*)
- ✓ quadrants (*cuadrante*)
- ratio (*razón*)
- scale (*escala*)
- ✓ x-axis (*eje x*)
- ✓ y-axis (*eje y*)

Preview Words

- center of dilation (*centro de dilatación*)
- dilation (*dilatación*)
- enlargement (*agrandamiento*)
- reduction (*reducción*)
- scale factor (*factor de escala*)
- similar (*similar*)

Active Reading

Key-Term Fold Before beginning the module, create a key-term fold to help you learn the vocabulary in this module. Write the highlighted vocabulary words on one side of the flap. Write the definition for each word on the other side of the flap. Use the key-term fold to quiz yourself on the definitions used in this module.





GETTING READY FOR

Transformations and Similarity

Understanding the standards and the vocabulary terms in the standards will help you know exactly what you are expected to learn in this module.

CA CC 8.G.3

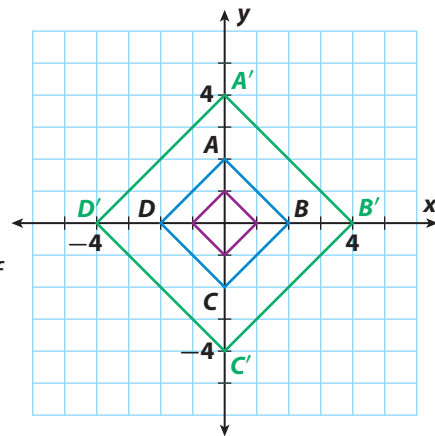
Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

What It Means to You

You will use an algebraic representation to describe a dilation.

EXAMPLE 8.G.3

The blue square $ABCD$ is the preimage. Write two algebraic representations, one for the dilation to the green square and one for the dilation to the purple square.



The coordinates of the vertices of the original image are multiplied by 2 for the green square.

Green square: $(x, y) \rightarrow (2x, 2y)$

The coordinates of the vertices of the original image are multiplied by $\frac{1}{2}$ for the purple square.

Purple square: $(x, y) \rightarrow (\frac{1}{2}x, \frac{1}{2}y)$

CA CC 8.G.4

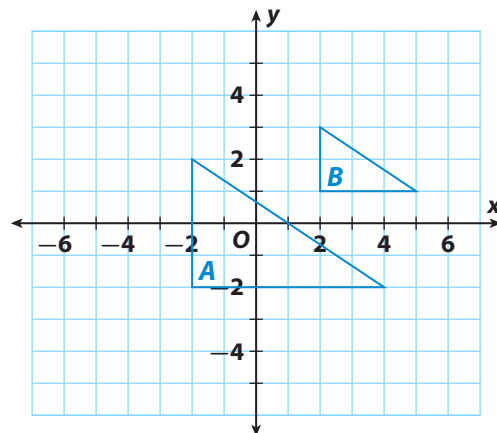
Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

What It Means to You

You will describe a sequence of transformations between two similar figures.

EXAMPLE 8.G.4

Identify a sequence of two transformations that will transform figure A into figure B.



Dilate with center at the origin by a scale factor of $\frac{1}{2}$.

Then translate right 3 units and up 2 units.



Visit my.hrw.com to see all **CA Common Core Standards** explained.

my.hrw.com

LESSON 10.1 Properties of Dilations



Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. *Also 8.G.3*



ESSENTIAL QUESTION

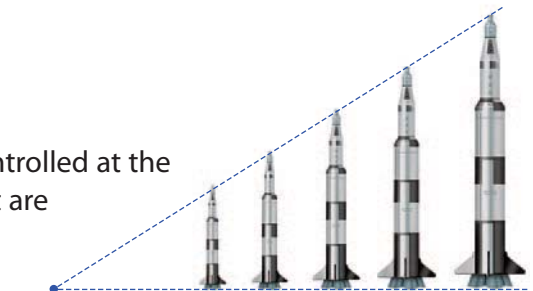
How do you describe the properties of dilations?

EXPLORE ACTIVITY 1



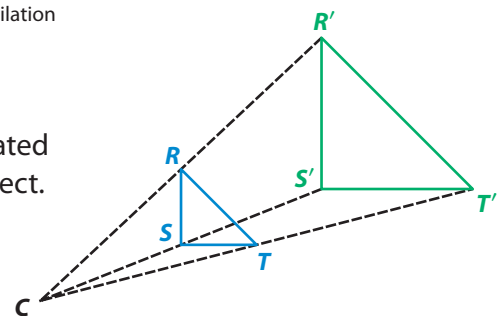
Exploring Dilations

The missions that placed 12 astronauts on the moon were controlled at the Johnson Space Center in Houston. The toy models at the right are scaled-down replicas of the Saturn V rocket that powered the moon flights. Each replica is a transformation called a **dilation**. Unlike the other transformations you have studied—translations, rotations, and reflections—dilations change the size (but not the shape) of a figure.



Every dilation has a fixed point called the **center of dilation** located where the lines connecting corresponding parts of figures intersect.

Triangle $R'S'T'$ is a dilation of triangle RST . Point C is the center of dilation.



- A** Use a ruler to measure segments \overline{CR} , $\overline{CR'}$, \overline{CS} , $\overline{CS'}$, \overline{CT} , and $\overline{CT'}$ to the nearest millimeter. Record the measurements and ratios in the table.

CR'	CR	$\frac{CR'}{CR}$	CS'	CS	$\frac{CS'}{CS}$	CT'	CT	$\frac{CT'}{CT}$

- B** Write a conjecture based on the ratios in the table.

- C** Measure and record the corresponding side lengths of the triangles.

$R'S'$	RS	$\frac{R'S'}{RS}$	$S'T'$	ST	$\frac{S'T'}{ST}$	$R'T'$	RT	$\frac{R'T'}{RT}$

- D** Write a conjecture based on the ratios in the table.

- E** Measure the corresponding angles and describe your results.

EXPLORE ACTIVITY 1 (cont'd)

Reflect

- Two figures that have the same shape but different sizes are called *similar*. Are triangles RST and $R'S'T'$ similar? Why or why not?

- Compare the orientation of a figure with the orientation of its dilation.

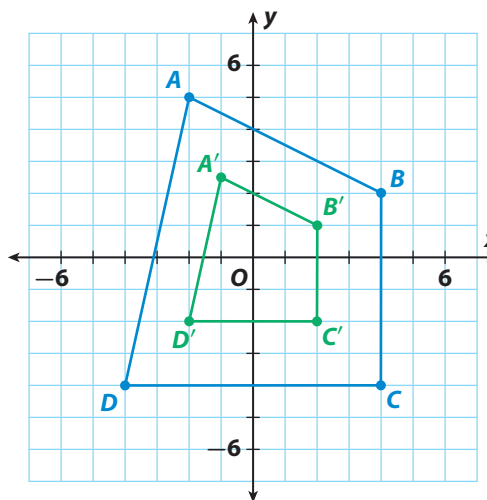
EXPLORE ACTIVITY 2



Exploring Dilations on a Coordinate Plane

In this activity you will explore how the coordinates of a figure on a coordinate plane are affected by a dilation.

- Complete the table. Record the x - and y -coordinates of the points in the two figures and the ratios of the x -coordinates and the y -coordinates.



Vertex	x	y	Vertex	x	y	Ratio of x -coordinates ($A'B'C'D' \div ABCD$)	Ratio of y -coordinates ($A'B'C'D' \div ABCD$)
A'			A				
B'			B				
C'			C				
D'			D				

- Write a conjecture about the ratios of the coordinates of a dilation image to the coordinates of the original figure.

How are dilations different from the other transformations you have learned about?

Reflect

3. In Explore Activity 1, triangle $R'S'T'$ was larger than triangle RST . How is the relationship between quadrilateral $A'B'C'D'$ and quadrilateral $ABCD$ different?
-

Finding a Scale Factor

As you have seen in the two activities, a dilation can produce a larger figure (an **enlargement**) or a smaller figure (a **reduction**). The **scale factor** describes how much the figure is enlarged or reduced. The scale factor is the ratio of a length of the image to the corresponding length on the original figure.

In Explore Activity 1, the side lengths of triangle $R'S'T'$ were twice the length of those of triangle RST , so the scale factor was 2. In Explore Activity 2, the side lengths of quadrilateral $A'B'C'D'$ were half those of quadrilateral $ABCD$, so the scale factor was 0.5.

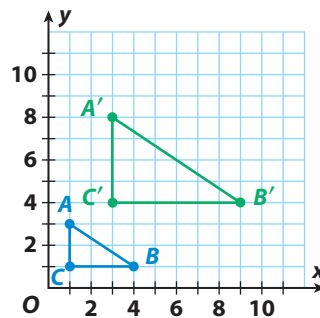


EXAMPLE 1



CA CC 8.G.4

An art supply store sells several sizes of drawing triangles. All are dilations of a single basic triangle. The basic triangle and one of its dilations are shown on the grid. Find the scale factor of the dilation.



Since the scale factor is the same for all corresponding sides, you can record just two pairs of side lengths. Use one pair as a check on the other.

STEP 1 Use the coordinates to find the lengths of the sides of each triangle.

Triangle ABC : $AC = 2$ $CB = 3$

Triangle $A'B'C'$: $A'C' = 4$ $C'B' = 6$

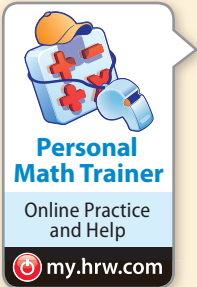
STEP 2 Find the ratios of the corresponding sides.

$$\frac{A'C'}{AC} = \frac{4}{2} = 2 \quad \frac{C'B'}{CB} = \frac{6}{3} = 2$$

The scale factor of the dilation is 2.

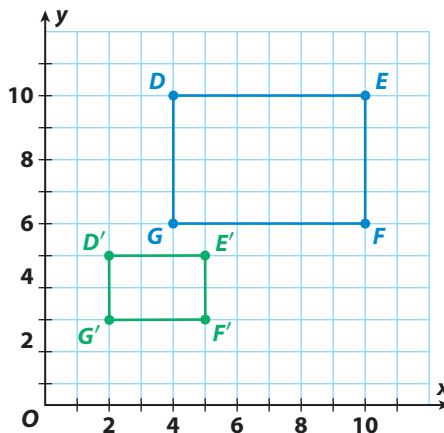
Reflect

4. Is the dilation an enlargement or a reduction? How can you tell?
-
-



YOUR TURN

5. Find the scale factor of the dilation.



Math Talk

Mathematical Practices

Which scale factors lead to enlargements? Which scale factors lead to reductions?

Guided Practice

Use triangles ABC and $A'B'C'$ for 1–5. (Explore Activities 1 and 2, Example 1)

1. For each pair of corresponding vertices, find the ratio of the x-coordinates and the ratio of the y-coordinates.

ratio of x-coordinates = _____

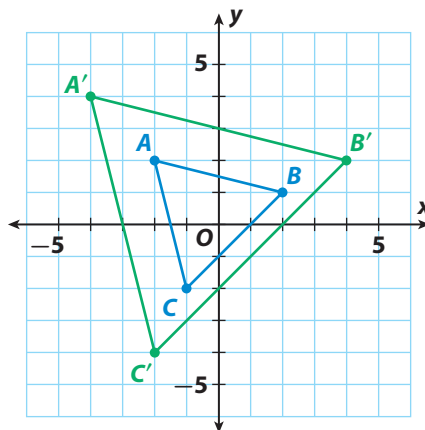
ratio of y-coordinates = _____

2. I know that triangle $A'B'C'$ is a dilation of triangle ABC because the ratios of the corresponding x-coordinates are _____ and the ratios of the corresponding y-coordinates are _____.

3. The ratio of the lengths of the corresponding sides of triangle $A'B'C'$ and triangle ABC equals _____.

4. The corresponding angles of triangle ABC and triangle $A'B'C'$ are _____.

5. The scale factor of the dilation is _____.




ESSENTIAL QUESTION CHECK-IN

6. How can you find the scale factor of a dilation?

10.1 Independent Practice

 **CA CC** 8.G.3, 8.G.4



Personal Math Trainer
Online Practice and Help

my.hrw.com

For 7–11, tell whether one figure is a dilation of the other or not. Explain your reasoning.

7. Quadrilateral $MNPQ$ has side lengths of 15 mm, 24 mm, 21 mm, and 18 mm. Quadrilateral $M'N'P'Q'$ has side lengths of 5 mm, 8 mm, 7 mm, and 4 mm.

8. Triangle RST has angles measuring 38° and 75° . Triangle $R'S'T'$ has angles measuring 67° and 38° . The sides are proportional.

9. Two triangles, Triangle 1 and Triangle 2, are similar.

10. Quadrilateral $MNPQ$ is the same shape but a different size than quadrilateral $M'N'P'Q'$.

11. On a coordinate plane, triangle UVW has coordinates $U(20, -12)$, $V(8, 6)$, and $W(-24, -4)$. Triangle $U'V'W'$ has coordinates $U'(15, -9)$, $V'(6, 4.5)$, and $W'(-18, -3)$.

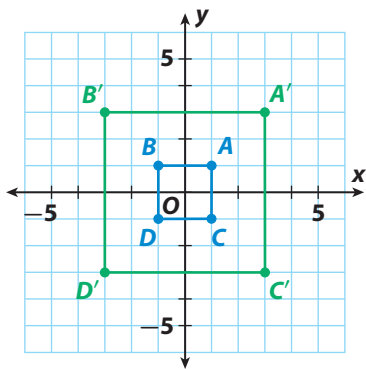
Complete the table by writing “same” or “changed” to compare the image with the original figure in the given transformation.

Image Compared to Original Figure			
	Orientation	Size	Shape
12.	Translation		
13.	Reflection		
14.	Rotation		
15.	Dilation		

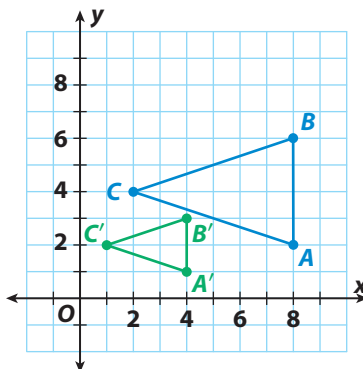
16. Describe the image of a dilation with a scale factor of 1.

Identify the scale factor used in each dilation.

17.



18.



FOCUS ON HIGHER ORDER THINKING

19. **Critical Thinking** Explain how you can find the center of dilation of a triangle and its dilation.

20. **Make a Conjecture**

a. A square on the coordinate plane has vertices at $(-2, 2)$, $(2, 2)$, $(2, -2)$, and $(-2, -2)$. A dilation of the square has vertices at $(-4, 4)$, $(4, 4)$, $(4, -4)$, and $(-4, -4)$. Find the scale factor and the perimeter of each square.

b. A square on the coordinate plane has vertices at $(-3, 3)$, $(3, 3)$, $(3, -3)$, and $(-3, -3)$. A dilation of the square has vertices at $(-6, 6)$, $(6, 6)$, $(6, -6)$, and $(-6, -6)$. Find the scale factor and the perimeter of each square.

c. Make a conjecture about the relationship of the scale factor to the perimeter of a square and its image.

Work Area

LESSON 10.2 Algebraic Representations of Dilations

 CA CC 8.G.3

Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.



ESSENTIAL QUESTION

How can you describe the effect of a dilation on coordinates using an algebraic representation?

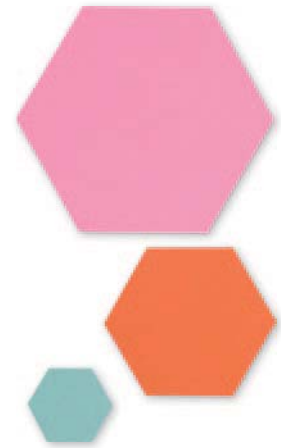
EXPLORE ACTIVITY 1

 CA CC 8.G.3

Graphing Enlargements

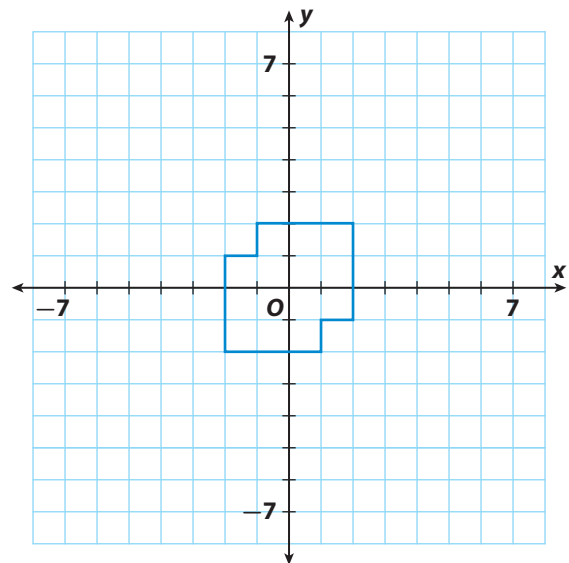
When a dilation in the coordinate plane has the origin as the center of dilation, you can find points on the dilated image by multiplying the x - and y -coordinates of the original figure by the scale factor. For scale factor k , the algebraic representation of the dilation is $(x, y) \rightarrow (kx, ky)$. For enlargements, $k > 1$.

The figure shown on the grid is the preimage. The center of dilation is the origin.



- A** List the coordinates of the vertices of the preimage in the first column of the table.

Preimage (x, y)	Image ($3x, 3y$)
(2, 2)	(6, 6)



- B** What is the scale factor for the dilation? _____
- C** Apply the dilation to the preimage and write the coordinates of the vertices of the image in the second column of the table.
- D** Sketch the image after the dilation on the coordinate grid.

Math Talk

 Mathematical Practices

What effect would the dilation $(x, y) \rightarrow (4x, 4y)$ have on the radius of a circle?

EXPLORE ACTIVITY 1 (cont'd)**Reflect**

- How does the dilation affect the length of line segments?

- How does the dilation affect angle measures?

EXPLORE ACTIVITY 2

CA CC 8.G.3

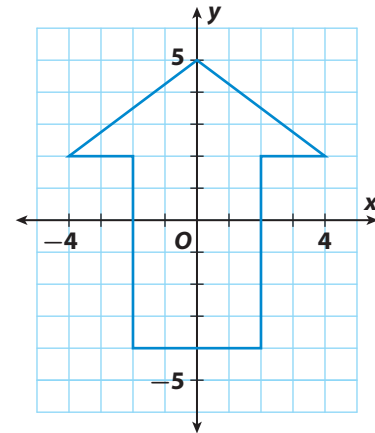
Graphing Reductions

For scale factors between 0 and 1, the image is smaller than the preimage. This is called a reduction.

The arrow shown is the preimage. The center of dilation is the origin.

- List the coordinates of the vertices of the preimage in the first column of the table.
- What is the scale factor for the dilation? _____
- Apply the dilation to the preimage and write the coordinates of the vertices of the image in the second column of the table.
- Sketch the image after the dilation on the coordinate grid.

Preimage (x, y)	Image ($\frac{1}{2}x, \frac{1}{2}y$)

**Reflect**

- How does the dilation affect the length of line segments?

- How would a dilation with scale factor 1 affect the preimage?

Center of Dilation Outside the Image

The center of dilation can be inside or outside the original image and the dilated image. The center of dilation can be anywhere on the coordinate plane as long as the lines that connect each pair of corresponding vertices between the original and dilated image intersect at the center of dilation.



EXAMPLE 1

CA CC 8.G.3

Graph the image of $\triangle ABC$ after a dilation with the origin as its center and a scale factor of 3. What are the vertices of the image?

STEP 1 Multiply each coordinate of the vertices of $\triangle ABC$ by 3 to find the vertices of the dilated image.

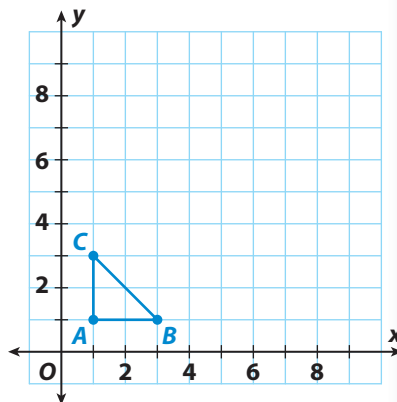
$$\triangle ABC (x, y) \rightarrow (3x, 3y) \triangle A'B'C'$$

$$A(1, 1) \rightarrow A'(1 \cdot 3, 1 \cdot 3) \rightarrow A'(3, 3)$$

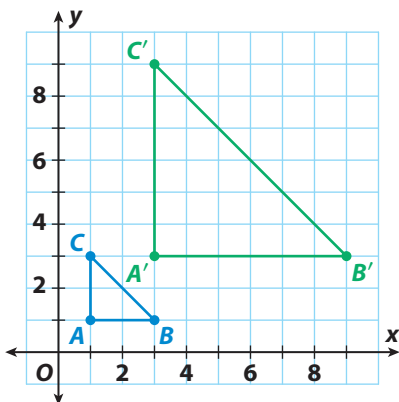
$$B(3, 1) \rightarrow B'(3 \cdot 3, 1 \cdot 3) \rightarrow B'(9, 3)$$

$$C(1, 3) \rightarrow C'(1 \cdot 3, 3 \cdot 3) \rightarrow C'(3, 9)$$

The vertices of the dilated image are $A'(3, 3)$, $B'(9, 3)$, and $C'(3, 9)$.



STEP 2 Graph the dilated image.

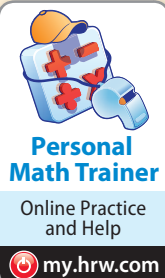
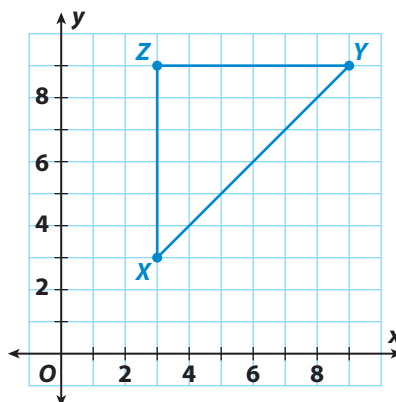


Math Talk

Mathematical Practices
Describe how you can check graphically that you have drawn the image triangle correctly.

YOUR TURN

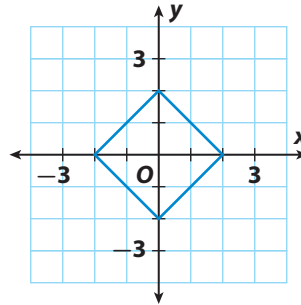
5. Graph the image of $\triangle XYZ$ after a dilation with a scale factor of $\frac{1}{3}$ and the origin as its center. Then write an algebraic rule to describe the dilation.



Guided Practice

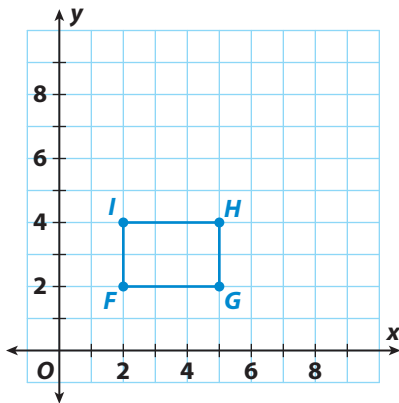
1. The grid shows a diamond-shaped preimage. Write the coordinates of the vertices of the preimage in the first column of the table. Then apply the dilation $(x, y) \rightarrow (\frac{3}{2}x, \frac{3}{2}y)$ and write the coordinates of the vertices of the image in the second column. Sketch the image of the figure after the dilation. (*Explore Activities 1 and 2*)

Preimage	Image
(2, 0)	(3, 0)

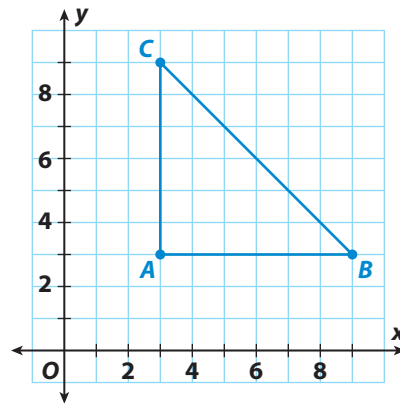


Graph the image of each figure after a dilation with the origin as its center and the given scale factor. Then write an algebraic rule to describe the dilation. (*Example 1*)

2. scale factor of 1.5



3. scale factor of $\frac{1}{3}$






ESSENTIAL QUESTION CHECK-IN

4. A dilation of $(x, y) \rightarrow (kx, ky)$ when $0 < k < 1$ has what effect on the figure? What is the effect on the figure when $k > 1$?

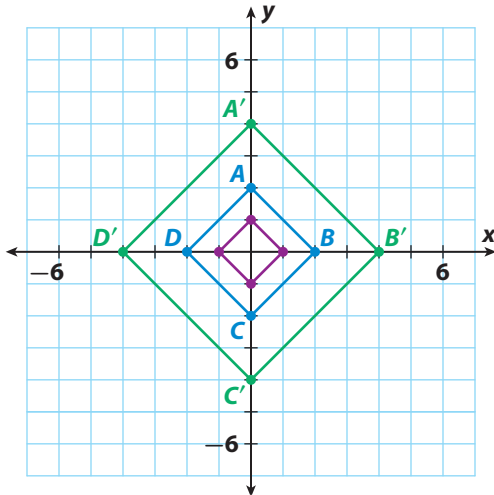
10.2 Independent Practice

 **CA CC** 8.G.3



Personal Math Trainer
Online Practice and Help
my.hrw.com

5. The blue square is the preimage. Write two algebraic representations, one for the dilation to the green square and one for the dilation to the purple square.



6. **Critical Thinking** A triangle has vertices $A(-5, -4)$, $B(2, 6)$, and $C(4, -3)$. The center of dilation is the origin and $(x, y) \rightarrow (3x, 3y)$. What are the vertices of the dilated image?

7. **Critical Thinking** $M'N'O'P'$ has vertices at $M'(3, 4)$, $N'(6, 4)$, $O'(6, 7)$, and $P'(3, 7)$. The center of dilation is the origin. $MNOP$ has vertices at $M(4.5, 6)$, $N(9, 6)$, $O(9, 10.5)$, and $P(4.5, 10.5)$. What is the algebraic representation of this dilation?

8. **Critical Thinking** A dilation with center $(0,0)$ and scale factor k is applied to a polygon. What dilation can you apply to the image to return it to the original preimage?

9. **Represent Real-World Problems** The blueprints for a new house are scaled so that $\frac{1}{4}$ inch equals 1 foot. The blueprint is the preimage and the house is the dilated image. The blueprints are plotted on a coordinate plane.

a. What is the scale factor in terms of inches to inches?

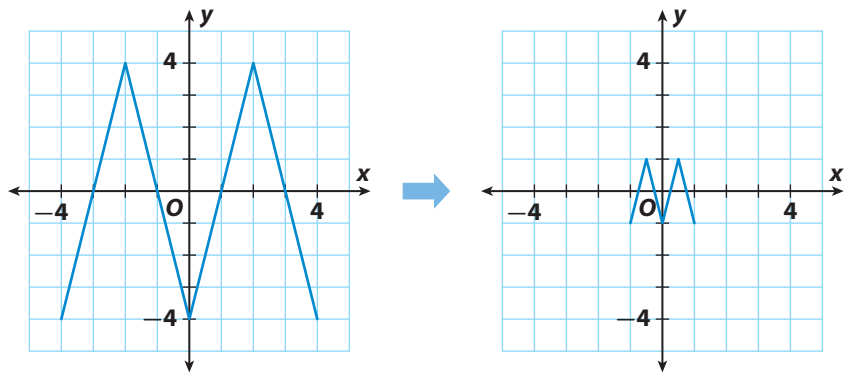
b. One inch on the blueprint represents how many inches in the actual house? How many feet?

c. Write the algebraic representation of the dilation from the blueprint to the house.

d. A rectangular room has coordinates $Q(2, 2)$, $R(7, 2)$, $S(7, 5)$, and $T(2, 5)$ on the blueprint. The homeowner wants this room to be 25% larger. What are the coordinates of the new room?

e. What are the dimensions of the new room, in inches, on the blueprint? What will the dimensions of the new room be, in feet, in the new house?

10. Write the algebraic representation of the dilation shown.



FOCUS ON HIGHER ORDER THINKING

11. **Critique Reasoning** The set for a school play needs a replica of a historic building painted on a backdrop that is 20 feet long and 16 feet high. The actual building measures 400 feet long and 320 feet high. A stage crewmember writes $(x, y) \rightarrow (\frac{1}{12}x, \frac{1}{12}y)$ to represent the dilation. Is the crewmember's calculation correct if the painted replica is to cover the entire backdrop? Explain.

12. **Communicate Mathematical Ideas** Explain what each of these algebraic transformations does to a figure.

a. $(x, y) \rightarrow (y, -x)$ _____

b. $(x, y) \rightarrow (-x, -y)$ _____

c. $(x, y) \rightarrow (x, 2y)$ _____

d. $(x, y) \rightarrow (\frac{2}{3}x, y)$ _____

e. $(x, y) \rightarrow (0.5x, 1.5y)$ _____

13. **Communicate Mathematical Ideas** Triangle ABC has coordinates $A(1, 5)$, $B(-2, 1)$, and $C(-2, 4)$. Sketch triangle ABC and $A'B'C'$ for the dilation $(x, y) \rightarrow (-2x, -2y)$. What is the effect of a negative scale factor?

Work Area

LESSON 10.3 Similar Figures

CA CC 8.G.4

Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.



ESSENTIAL QUESTION

What is the connection between transformations and the orientations of similar figures?

EXPLORE ACTIVITY

CA CC 8.G.4

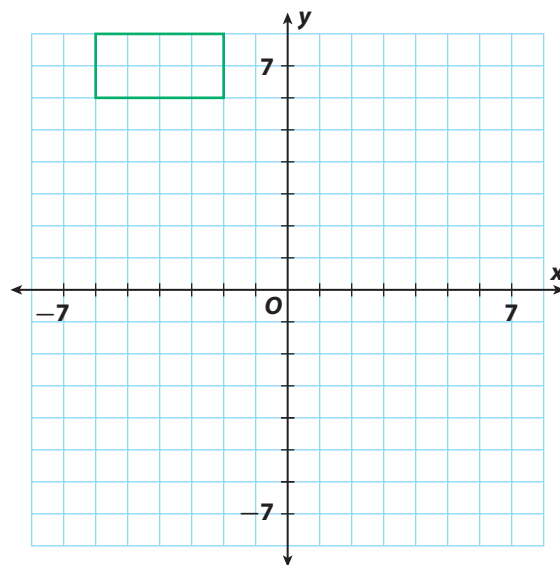
Combining Transformations with Dilations

When creating an animation, figures need to be translated, reflected, rotated, and sometimes dilated. As an example of this, apply the indicated sequence of transformations to the rectangle. Each transformation is applied to the image of the previous transformation, not to the original figure. Label each image with the letter of the transformation applied.



- A** $(x, y) \rightarrow (x + 7, y - 2)$
- B** $(x, y) \rightarrow (x, -y)$
- C** rotation 90° clockwise around the origin
- D** $(x, y) \rightarrow (x + 5, y + 3)$
- E** $(x, y) \rightarrow (3x, 3y)$
- F** List the coordinates of the vertices of rectangle E .

- G** Compare the following attributes of rectangle E to those of the original figure.



Shape	
Size	
Angle Measures	

Reflect

1. Which transformation represents the dilation? How can you tell?

2. A sequence of transformations containing a single dilation is applied to a figure. Are the original figure and its final image congruent? Explain.



Similar Figures

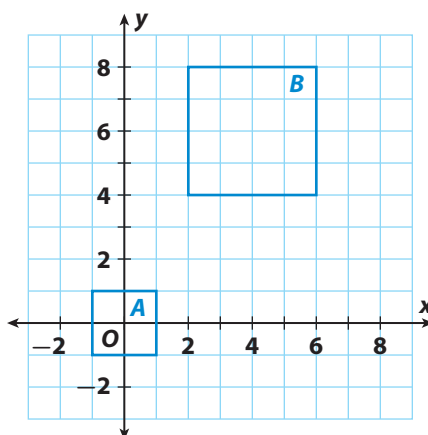
Two figures are **similar** if one can be obtained from the other by a sequence of translations, reflections, rotations, and dilations. Similar figures have the same shape but may be different sizes.

When you are told that two figures are similar, there must be a sequence of translations, reflections, rotations, and/or dilations that can transform one to the other.

EXAMPLE 1



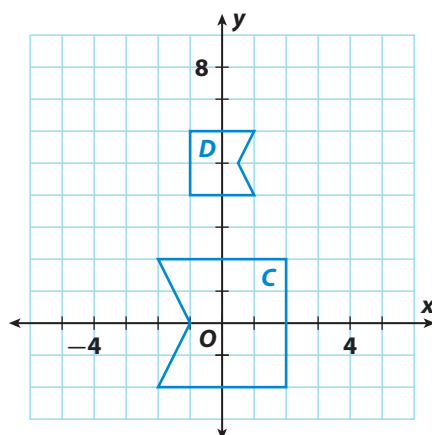
- A Identify a sequence of transformations that will transform figure A into figure B. Tell whether the figures are congruent. Tell whether they are similar.



Both figures are squares whose orientations are the same, so no reflection or rotation is needed. Figure B has sides twice as long as figure A, so a dilation with a scale factor of 2 is needed. Figure B is moved to the right and above figure A, so a translation is needed. A sequence of transformations that will accomplish this is a dilation by a scale factor of 2 centered at the origin followed by the translation $(x, y) \rightarrow (x + 4, y + 6)$. The figures are not congruent, but they are similar.

My Notes

- B** Identify a sequence of transformations that will transform figure *C* into figure *D*. Include a reflection. Tell whether the figures are congruent. Tell whether they are similar.



The orientation of figure *D* is reversed from that of figure *C*, so a reflection over the *y*-axis is needed. Figure *D* has sides that are half as long as figure *C*, so a dilation with a scale factor of $\frac{1}{2}$ is needed. Figure *D* is moved above figure *C*, so a translation is needed. A sequence of transformations that will accomplish this is a dilation by a scale factor of $\frac{1}{2}$ centered at the origin, followed by the reflection $(x, y) \rightarrow (-x, y)$, followed by the translation $(x, y) \rightarrow (x, y + 5)$. The figures are not congruent, but they are similar.

- C** Identify a sequence of transformations that will transform figure *C* into figure *D*. Include a rotation.

The orientation of figure *D* is reversed from that of figure *C*, so a rotation of 180° is needed. Figure *D* has sides that are half as long as figure *C*, so a dilation with a scale factor of $\frac{1}{2}$ is needed. Figure *D* is moved above figure *C*, so a translation is needed. A sequence of transformations that will accomplish this is a rotation of 180° about the origin, followed by a dilation by a scale factor of $\frac{1}{2}$ centered at the origin, followed by the translation $(x, y) \rightarrow (x, y + 5)$.

Math Talk

Mathematical Practices

A figure and its image have different sizes and orientations. What do you know about the sequence of transformations that generated the image?

YOUR TURN

- 3.** Look again at the Explore Activity. Start with the original figure. Create a new sequence of transformations that will yield figure *E*, the final image. Your transformations do not need to produce the images in the same order in which they originally appeared.



Personal Math Trainer

Online Practice and Help

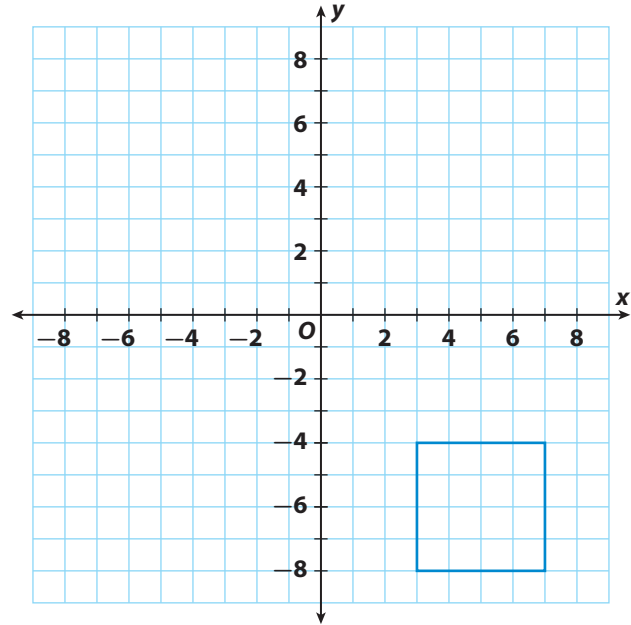
my.hrw.com

Guided Practice

1. Apply the indicated sequence of transformations to the square. Apply each transformation to the image of the previous transformation. Label each image with the letter of the transformation applied.

(Explore Activity)

- A** $(x, y) \rightarrow (-x, y)$
- B** Rotate the square 180° around the origin.
- C** $(x, y) \rightarrow (x - 5, y - 6)$
- D** $(x, y) \rightarrow (\frac{1}{2}x, \frac{1}{2}y)$

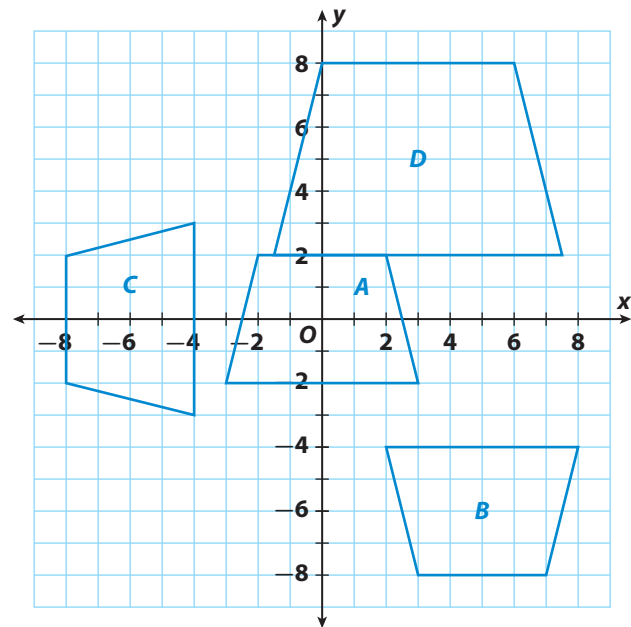


Identify a sequence of two transformations that will transform figure A into the given figure. (Example 1)

2. figure B

3. figure C

4. figure D




ESSENTIAL QUESTION CHECK-IN

5. If two figures are similar but not congruent, what do you know about the sequence of transformations used to create one from the other?

10.3 Independent Practice

 **CA CC** 8.G.4



Personal Math Trainer

Online Practice and Help

my.hrw.com

6. A designer creates a drawing of a triangular sign on centimeter grid paper for a new business. The drawing has sides measuring 6 cm, 8 cm, and 10 cm, and angles measuring 37° , 53° , and 90° . To create the actual sign shown, the drawing must be dilated using a scale factor of 40.

a. Find the lengths of the sides of the actual sign.

b. Find the angle measures of the actual sign.

c. The drawing has the hypotenuse on the bottom. The business owner would like it on the top. Describe two transformations that will do this.

d. The shorter leg of the drawing is currently on the left. The business owner wants it to remain on the left after the hypotenuse goes to the top. Which transformation in part c will accomplish this?



In Exercises 7–10, the transformation of a figure into its image is described. Describe the transformations that will transform the image back into the original figure. Then write them algebraically.

7. The figure is reflected across the x -axis and dilated by a scale factor of 3.

8. The figure is dilated by a scale factor of 0.5 and translated 6 units left and 3 units up.

9. The figure is dilated by a scale factor of 5 and rotated 90° clockwise.

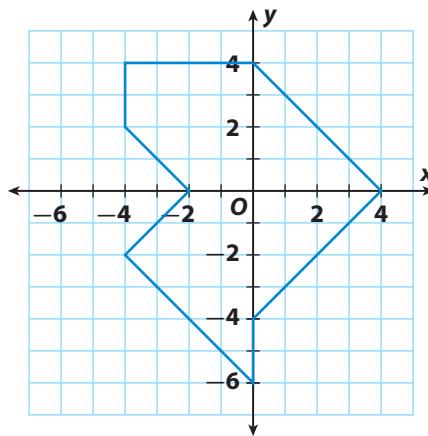
10. The figure is reflected across the y-axis and dilated by a scale factor of 4.



FOCUS ON HIGHER ORDER THINKING

11. **Draw Conclusions** A figure undergoes a sequence of transformations that include dilations. The figure and its final image are congruent. Explain how this can happen.

12. **Multistep** A graphic artist is using transformations to sketch ideas for a logo design. Start with the image provided and label each transformation with the letter of the sequence that is applied. Apply each sequence of transformations to the previous image.




A. $(x, y) \rightarrow (\frac{1}{2}x, \frac{1}{2}y)$ with the center at the origin, $(x, y) \rightarrow (x, y - 1)$.

B. $(x, y) \rightarrow (x - 4, y + 1)$,
 $(x, y) \rightarrow (x, -y)$.

13. **Justify Reasoning** In Exercise 12A, the sketch was dilated by a scale factor of $\frac{1}{2}$ and translated down 1 unit. Is this the same as translating the sketch down 1 unit and then dilating by a scale factor of $\frac{1}{2}$? Explain how the two results are related.

Work Area

Ready to Go On?



Personal Math Trainer
Online Practice and Help
my.hrw.com

10.1 Properties of Dilations

Determine whether one figure is a dilation of the other. Justify your answer.

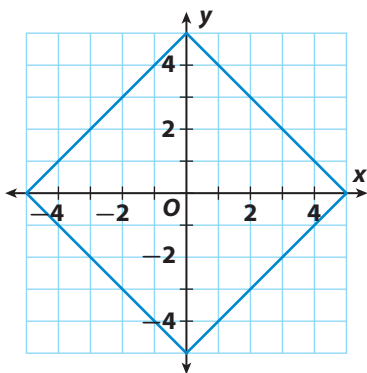
1. Triangle XYZ has angles measuring 54° and 29° . Triangle $X'Y'Z'$ has angles measuring 29° and 92° .

2. Quadrilateral $DEFG$ has sides measuring 16 m, 28 m, 24 m, and 20 m. Quadrilateral $D'E'F'G'$ has sides measuring 20 m, 35 m, 30 m, and 25 m.

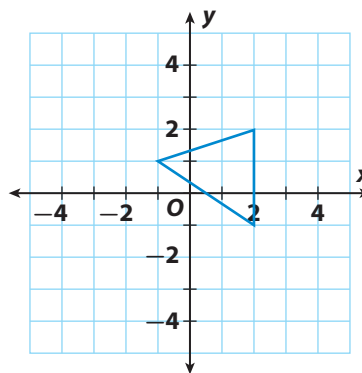
10.2 Algebraic Representations of Dilations

Dilate each figure with the origin as the center of dilation.

3. $(x, y) \rightarrow (0.8x, 0.8y)$



4. $(x, y) \rightarrow (2.5x, 2.5y)$



10.3 Similar Figures

5. Describe what happens to a figure when the given sequence of transformations is applied to it: $(x, y) \rightarrow (-x, y)$; $(x, y) \rightarrow (0.5x, 0.5y)$; $(x, y) \rightarrow (x - 2, y + 2)$



ESSENTIAL QUESTION

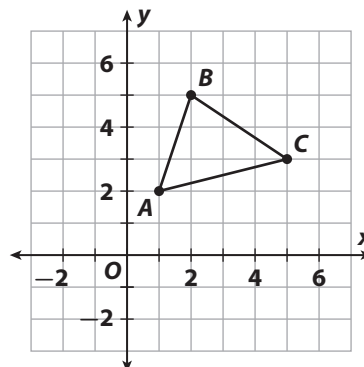
6. How can you use dilations to solve real-world problems?



1. Triangle ABC is dilated by a scale factor of 2 with the origin as its center and then reflected across the y -axis. Look at each ordered pair. Is the ordered pair a vertex of the image?

Select Yes or No for ordered pairs A–C.

- A. $(-4, 10)$ Yes No
 B. $(-2, 4)$ Yes No
 C. $(10, -6)$ Yes No



2. Choose True or False for each statement.

- A. No integers are irrational numbers. True False
 B. No real numbers are rational numbers. True False
 C. All integers are whole numbers. True False
 D. All whole numbers are integers. True False

3. In a video game, a rectangular map has vertices $M(10, 10)$, $N(10, 20)$, $P(40, 20)$, and $Q(40, 10)$. When a player clicks the map, it is enlarged by a scale factor of 4.5 with the origin as the center of dilation. What are the coordinates of the vertices of the enlarged map? Describe the algebraic rule you used to find the coordinates.

4. An engineer is working on the design of a bridge. He draws the two triangles shown. Is triangle A similar to triangle B ? Use a sequence of transformations to explain how you know.

