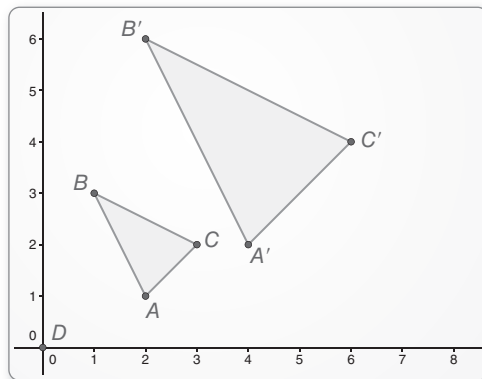


4.5**Dilations**

For use with Exploration 4.5

Essential Question What does it mean to dilate a figure?**1 EXPLORATION:** Dilating a Triangle in a Coordinate PlaneGo to *BigIdeasMath.com* for an interactive tool to investigate this exploration.**Work with a partner.** Use dynamic geometry software to draw any triangle and label it $\triangle ABC$.

- a. Dilate $\triangle ABC$ using a *scale factor* of 2 and a *center of dilation* at the origin to form $\triangle A'B'C'$. Compare the coordinates, side lengths, and angle measures of $\triangle ABC$ and $\triangle A'B'C'$.

Sample

- b. Repeat part (a) using a *scale factor* of $\frac{1}{2}$.
- c. What do the results of parts (a) and (b) suggest about the coordinates, side lengths, and angle measures of the image of $\triangle ABC$ after a dilation with a scale factor of k ?

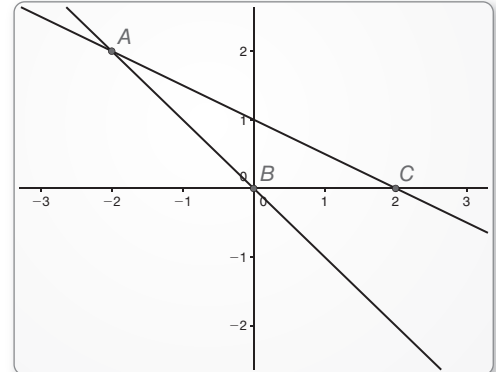
4.5 Dilations (continued)**2 EXPLORATION: Dilating Lines in a Coordinate Plane**

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software to draw \overline{AB} that passes through the origin and \overline{AC} that does not pass through the origin.

a. Dilate \overline{AB} using a scale factor of 3 and a center of dilation at the origin. Describe the image.

b. Dilate \overline{AC} using a scale factor of 3 and a center of dilation at the origin. Describe the image.



c. Repeat parts (a) and (b) using a scale factor of $\frac{1}{4}$.

d. What do you notice about dilations of lines passing through the center of dilation and dilations of lines not passing through the center of dilation?

Communicate Your Answer

3. What does it mean to dilate a figure?

4. Repeat Exploration 1 using a center of dilation at a point other than the origin.

4.5**Notetaking with Vocabulary**

For use after Lesson 4.5

In your own words, write the meaning of each vocabulary term.

dilation

center of dilation

scale factor

enlargement

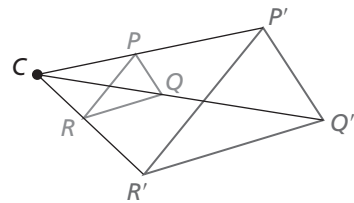
reduction

Core Concepts**Dilations**

A **dilation** is a transformation in which a figure is enlarged or reduced with respect to a fixed point C called the **center of dilation** and a **scale factor** k , which is the ratio of the lengths of the corresponding sides of the image and the preimage.

A dilation with center of dilation C and scale factor k maps every point P in a figure to a point P' so that the following are true.

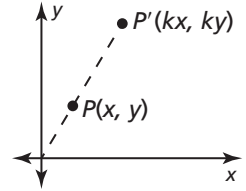
- If P is the center point C , then $P = P'$.
- If P is not the center point C , then the image point P' lies on \overline{CP} .
The scale factor k is a positive number such that $k = \frac{CP'}{CP}$.
- Angle measures are preserved.

**Notes:**

4.5 Notetaking with Vocabulary (continued)

Coordinate Rule for Dilations

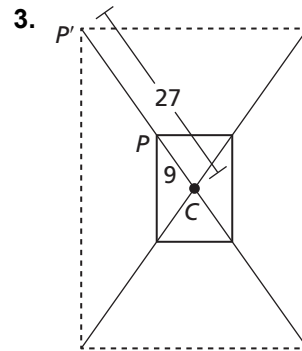
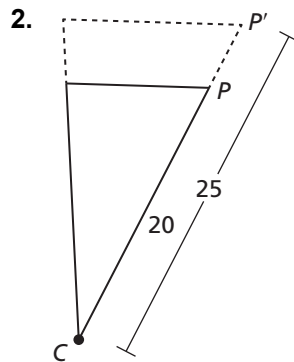
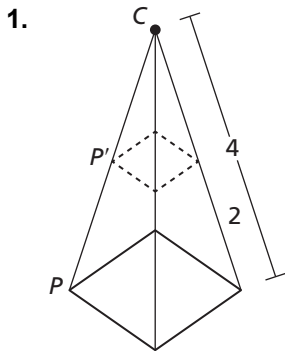
If $P(x, y)$ is the preimage of a point, then its image after a dilation centered at the origin $(0, 0)$ with scale factor k is the point $P'(kx, ky)$.



Notes:

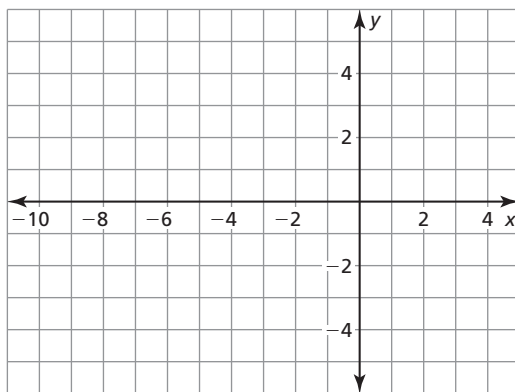
Extra Practice

In Exercises 1–3, find the scale factor of the dilation. Then tell whether the dilation is a *reduction* or an *enlargement*.



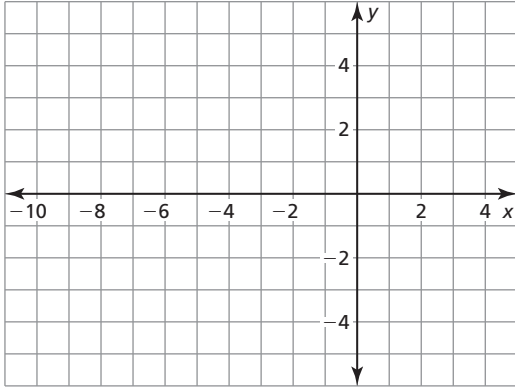
In Exercises 4 and 5, graph the polygon and its image after a dilation with scale factor k .

4. $A(-3, 1), B(-4, -1), C(-2, -1); k = 2$



4.5 Notetaking with Vocabulary (continued)

5. $P(-10, 0)$, $Q(-5, 0)$, $R(0, 5)$, $S(-5, 5)$; $k = \frac{1}{5}$



In Exercises 6 and 7, find the coordinates of the image of the polygon after a dilation with scale factor k .

6. $A(-3, 1)$, $B(-4, -1)$, $C(-2, -1)$; $k = -6$

7. $P(-8, 4)$, $Q(20, -8)$, $R(16, 4)$, $S(0, 12)$; $k = -0.25$

8. You design a poster on an 8.5-inch by 11-inch paper for a contest at your school. The poster of the winner will be printed on a 34-inch by 44-inch canvas to be displayed. What is the scale factor of this dilation?

9. A biology book shows the image of an insect that is 10 times its actual size. The image of the insect is 8 centimeters long. What is the actual length of the insect?