



- I can draw the dilation image of a figure using both positive and negative scale factors.
- I can identify the scale factor of a dilation.
- I can find points on a dilation.

### Vocabulary

A **dilation** is a transformation that stretches or shrinks a figure to create a similar figure. In a dilation, the figure is enlarged or reduced with respect to a fixed point called the **center of dilation**. The **scale factor** describes how much the figure is enlarged or reduced.

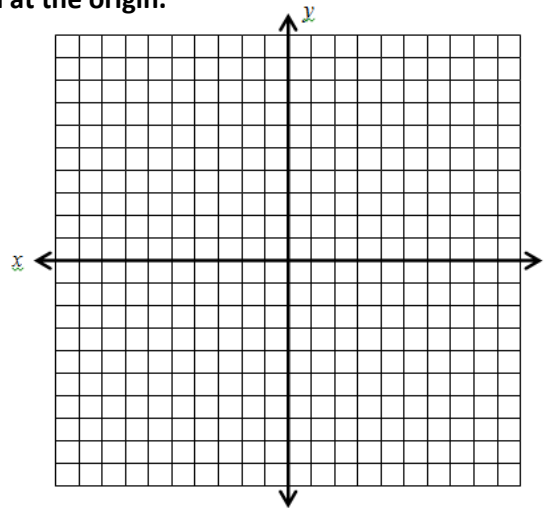
On the coordinate plane, you can describe a dilation with respect to the origin with the notation  $(x, y) \rightarrow (kx, ky)$ , where  $k$  is the scale factor.

- ✓ If  $0 < k < 1$ , the dilation is a **reduction**.
- ✓ If  $k > 1$ , the dilation is an **enlargement**.

### Example 1: Draw a dilation on the coordinate plane centered at the origin.

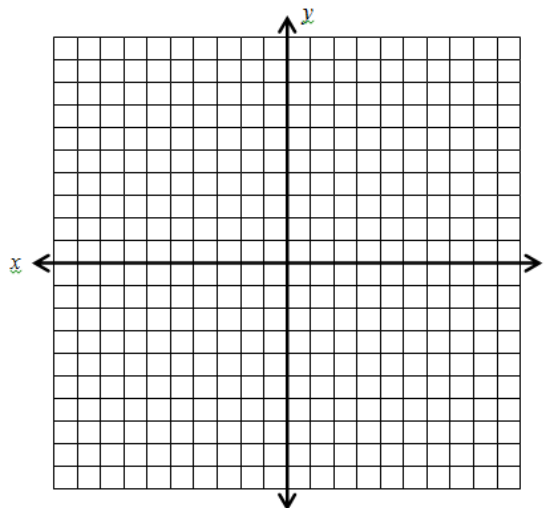
- a) Draw a dilation of quadrilateral  $ABCD$  with vertices  $A(0, 3)$ ,  $B(2, 3)$ ,  $C(3, 1)$ , and  $D(2, 0)$  about the origin with a scale factor of 3.

→ Was this dilation a reduction or an enlargement?



- b) Triangle  $ABC$  has vertices  $A(0,0)$ ,  $B(2, 6)$ , and  $C(6, 4)$ . Find the coordinates of the vertices of the image after a dilation about the origin with a scale factor of  $\frac{1}{2}$ .

→ Was this dilation a reduction or an enlargement?



- c) Dilate the following with respect to the origin.  
 $(x, y) \rightarrow (-2x, -2y)$

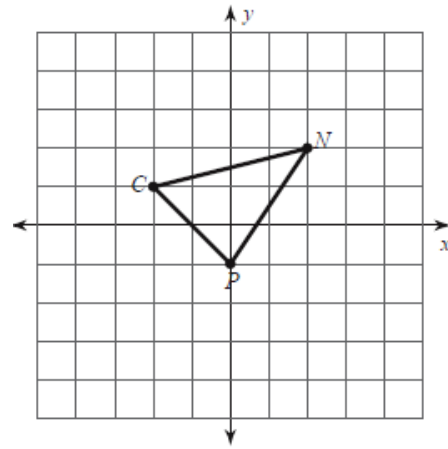
$P(0, -1) \rightarrow$

$C(-2, 1) \rightarrow$

$N(2, 2) \rightarrow$

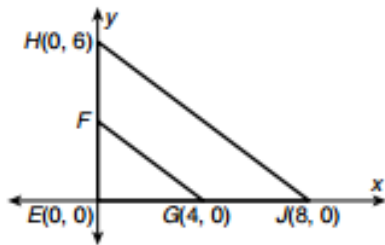
➔ Was this a reduction or an enlargement?

➔ What effect did the negative have on the dilation?



**Example 2: Use similar figures to find coordinates of dilation.**

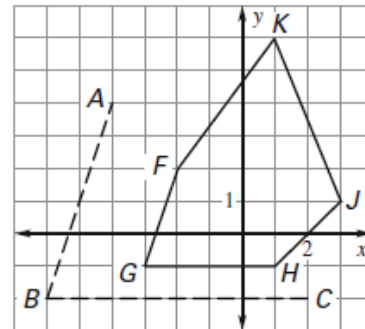
- a)  $\triangle FEG \sim \triangle HEJ$ . Find the coordinates of  $F$  and the scale factor.



- b) You want to create a pentagon  $ABCDE$  that is similar to pentagon  $FGHIK$  in the diagram below.

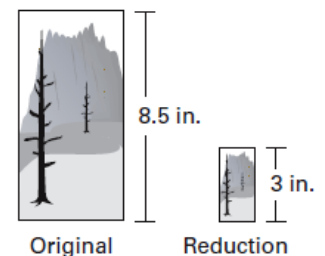
➤ What is the scale factor?

➤ What are the coordinates of  $D$  and  $E$ ?



**Example 3: Find a scale factor**

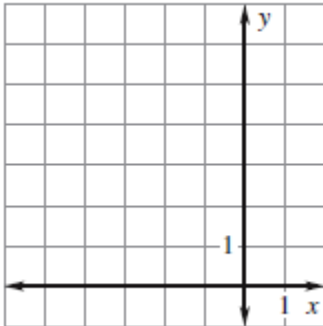
- a) A digital photograph has the height shown in the diagram. You want to reduce the size of the photograph to the height shown. What is the scale factor of the reduction?



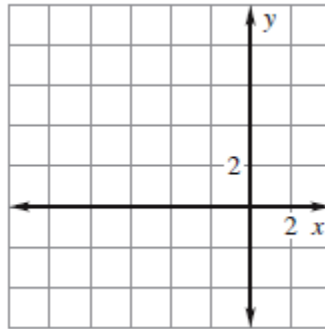
- b) You find a picture that you want to enlarge for a poster. The original picture is 2.5 cm wide, and you want to enlarge it proportionally so that the new width is 7.5 cm. What is the scale factor of the enlargement?

Use the given scale factor  $k$  to find the coordinates of the vertices of the image of the given polygon.  
Draw the dilation image.

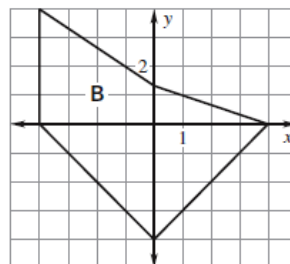
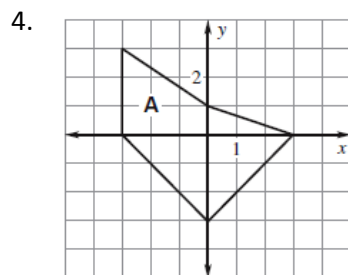
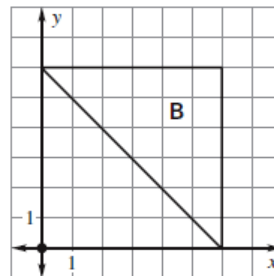
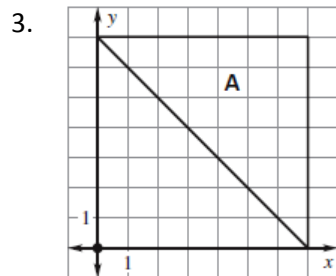
1.  $A(-3, 6), B(0, 0), C(-6, 0)$ ;  $k = 2/3$



2.  $A(-2, -2), B(-2, 4), C(0, 2)$ ;  $k = 3/2$



Determine whether the dilation from Figure A to Figure B is a *reduction* or an *enlargement*. Then find its scale factor.



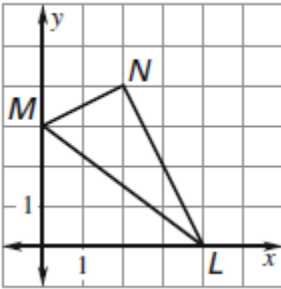
Use the given point coordinates to determine whether  $\triangle DEF$  is a dilation of  $\triangle ABC$ . If so, state the scale factor of the dilation.

5.  $A(42, 28), B(35, 14), C(14, 21)$ ;  $D(36, 24), E(30, 12), F(12, 16)$

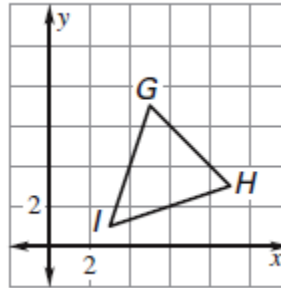
6.  $A(-54, 108), B(45, 36), C(-27, -18)$ ;  $D(-72, 144), E(60, 48), F(-96, -24)$

The polygon shown is the image of a polygon after a dilation using the scale factor  $k$ . Find the coordinates of the vertices of the original polygon.

7.  $k = 1/3$

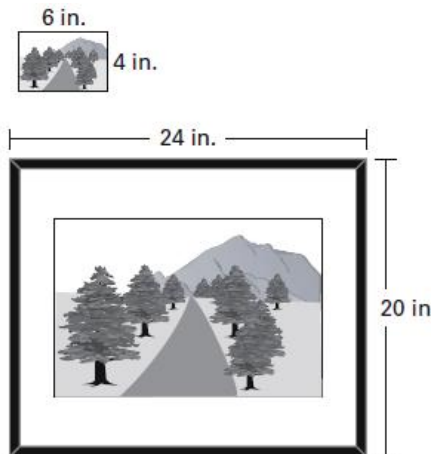


8.  $k = 3$

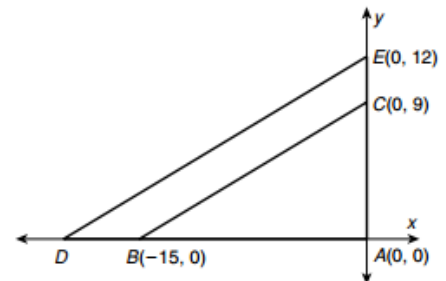


9. You are going to enlarge a 4-inch by 6-inch photograph to the largest size that can be centered within a 20-inch by 24-inch picture frame with a matte border of at least 3 inches on all four sides.

- What size do you need to make the enlarged photo?
- What scale factor should you use for the enlargement?
- How wide should the matte border be on each side?

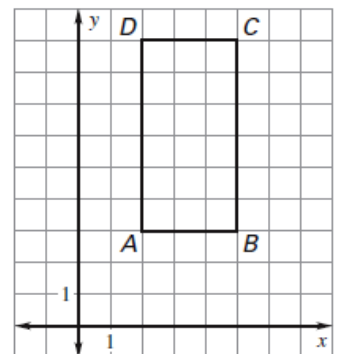


10. Given that  $\triangle ADE$  is the dilation image of  $\triangle ABC$  with respect to the origin. Find the scale factor and coordinates of  $D$ .

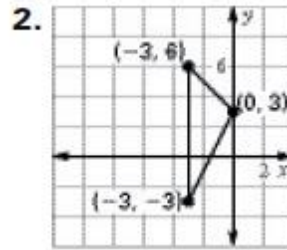
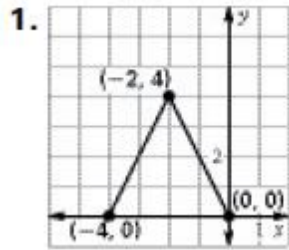


11. The vertices of rectangle  $ABCD$  are  $A(2, 3)$ ,  $B(5, 3)$ ,  $C(5, 9)$ , and  $D(2, 9)$ .

- Find the perimeter of  $ABCD$ . What is the scale factor of the dilation that produces an image with a perimeter that is twice that of the original?
- Find the area of  $ABCD$ . What is the scale factor of the dilation that produces an image with an area that is twice that of the original?
- Are the scale factors from parts (a) and (b) equal? *Explain* why or why not.



## ANSWER KEY



3. reduction;  $\frac{6}{7}$

4. enlargement;  $\frac{4}{3}$

5. no

6. no

7. Original coordinates: M(0, 9), N(6, 12), L(12, 0)

8. Original coordinates: I(1,  $\frac{1}{3}$ ), G( $\frac{5}{3}$ ,  $\frac{7}{3}$ ), H(3, 1)

9. a) 12 in. by 18 in.    b)  $\frac{3}{1}$     c) 3 in. on the right and left sides, 4 in. on the top and bottom sides

10.  $\frac{4}{3}$ ; (-20, 0)

11. a) 18 units;  $\frac{2}{1}$     b.  $\frac{\sqrt{2}}{1}$     c. No;  $\frac{2}{1} \neq \frac{\sqrt{2}}{1}$