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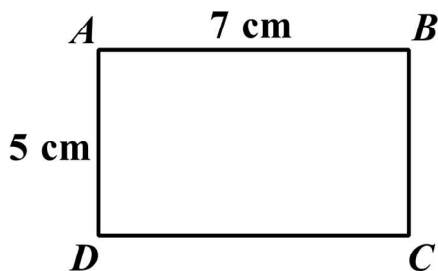
Date: \_\_\_\_\_

**AREAS OF SIMILAR FIGURES**  
**N-GEN MATH® GEOMETRY**



In many real-world applications, images are *dilated* by making them larger or smaller, but retain their overall shape. When this happens, the areas of the image and pre-image are related.

**Exercise #1:** Rectangle  $ABCD$  is shown below with a width of 5 cm and a length of 7 cm. Rectangle  $A'B'C'D'$  is the image of  $ABCD$  after a dilation with a scale factor equal to 2.



- (a) Draw a sketch of  $A'B'C'D'$  to the right of  $ABCD$  with its new width and length labeled.
- (b) Calculate the area of both rectangles below. Show your calculations.
- (c) What is the ratio of the area of  $A'B'C'D'$  to that of  $ABCD$ ?

Area of  $ABCD$  :

Area of  $A'B'C'D'$  :

- (d) If  $A''B''C''D''$  is the image of  $ABCD$  after a dilation by a scale factor of 5, determine the ratio of the area of  $A''B''C''D''$  to that of  $ABCD$ . Show your calculations. What do you notice?
- (e) Based on (d), if a rectangle was a dilation of  $ABCD$  by a scale factor of 10, what would its area be? Calculate by only using the scale factor.



## Areas of Dilated (Scaled) Figures

If a geometric image is the result of a dilation of a pre-image by a scale factor of  $k$ , then its **area** will be **scaled** by a factor of  $k^2$ .

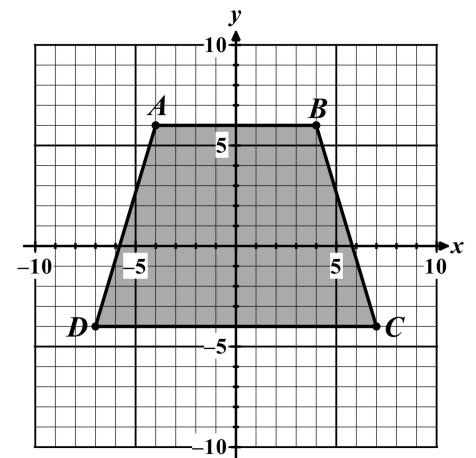
**Exercise #2:** A triangle has an area of 36 square inches. If the triangle is dilated with a scale factor of  $\frac{1}{2}$ , then what will be the area of its image? Show how you found your answer.

**Exercise #3:** A rectangular picture has both its length and width enlarged by 25%. If its original area was 45 square centimeters, answer the following:

- (a) What will be its area after being enlarged?                      (b) By what percent is its area increasing? Round to the nearest whole percent.

**Exercise #4:** Carmelo is designing a back deck in the shape of an isosceles trapezoid. He models its floorplan by using the coordinate grid with vertices at  $A(-4, 6)$ ,  $B(4, 6)$ ,  $C(7, -4)$ , and  $D(-7, -4)$ , where each grid unit represents one foot.

- (a) Find the area of  $ABCD$  either by decomposition or by using the **trapezoid area formula**.



- (b) Carmelo decides he wants to keep the overall shape of the back deck but wants its area to double. If he dilates  $ABCD$  with a center at the origin, what scaling factor, to the nearest hundredth, will he need?

- (c) If  $A'B'C'D'$  represents the image of  $ABCD$  after the dilation that doubles its area, what will be the coordinates of  $B'$ ? Round to the nearest hundredth.



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**AREAS OF SIMILAR FIGURES**  
**N-GEN MATH® GEOMETRY HOMEWORK**

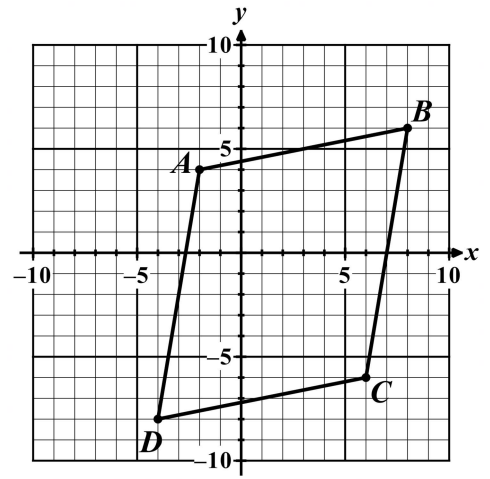
**FLUENCY**

1. It is known that  $\triangle EFG$  has an area of 12 square meters. If  $\triangle E'F'G'$  is the image of  $\triangle EFG$  after a dilation by a scale factor of 3, then  $\triangle E'F'G'$  has an area of:  
(1) 4 square meters  
(2) 36 square meters  
(3) 72 square meters  
(4) 108 square meters \_\_\_\_\_
  
2. Parallelogram  $HIJK$  has an area of 200 square centimeters. What will the area of its image be if it is dilated using a scale factor of  $\frac{1}{5}$ ?  
(1) 4 square centimeters  
(2) 8 square centimeters  
(3) 20 square centimeters  
(4) 40 square centimeters \_\_\_\_\_
  
3. A quadrilateral has an area of 48 square inches. After being dilated, its image has an area of 108 square inches. Which of the following is the value of the scaling constant for this dilation?  
(1)  $k = 0.67$   
(2)  $k = 1.25$   
(3)  $k = 1.5$   
(4)  $k = 2.25$  \_\_\_\_\_
  
4. Triangle  $EFG$  is dilated in the coordinate plane with a center at the origin. Its image,  $\triangle E'F'G'$ , has an area that is nine times greater than that of  $\triangle EFG$ . If point  $E$  is located at  $E(-4, 7)$ , then which of the following represents the coordinates of its image  $E'$ ?  
(1)  $(-12, 21)$   
(2)  $(-36, 63)$   
(3)  $(5, 16)$   
(4)  $(9, -3)$  \_\_\_\_\_
  
5. If a triangle is scaled such that its base and height are both increased by 15%, then which of the following is closest to the percent increase in its area?  
(1) 30%  
(2) 32%  
(3) 35%  
(4) 39% \_\_\_\_\_



6. Parallelogram  $ABCD$  has vertices at  $A(-2, 4)$ ,  $B(8, 6)$ ,  $C(6, -6)$ , and  $D(-4, -8)$ . It is dilated with a center at the origin to produce an image  $A'B'C'D'$  that has an area that is  $\frac{1}{4}$  of the area of  $ABCD$ .

(a) What is the scaling factor needed to produce  $A'B'C'D'$ ? Justify.

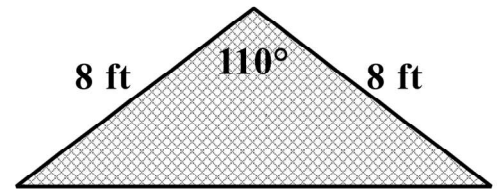


(b) Plot  $A'B'C'D'$ . Show the mapping of the vertices below.

### APPLICATIONS

7. A small flower garden is in the shape of an isosceles triangle with legs that measure 8 feet each and a vertex angle that measures  $110^\circ$ .

(a) What is the area of the garden to the nearest square foot?



(b) Park managers want to enlarge the garden so that its area is triple what it is in (a). They want to keep the shape of the garden the same. What scaling constant should they use to design the larger garden? Round to the nearest hundredth.

(c) Use your answer from (b) to determine the length of the legs of the new garden to the nearest hundredth?

### REASONING

8. The area of an equilateral triangle whose sides have a length of 1 cm is  $\frac{\sqrt{3}}{4}$   $\text{cm}^2$ . What is the area of an equilateral triangle whose sides have a length of 6 cm? Write in exact form.

