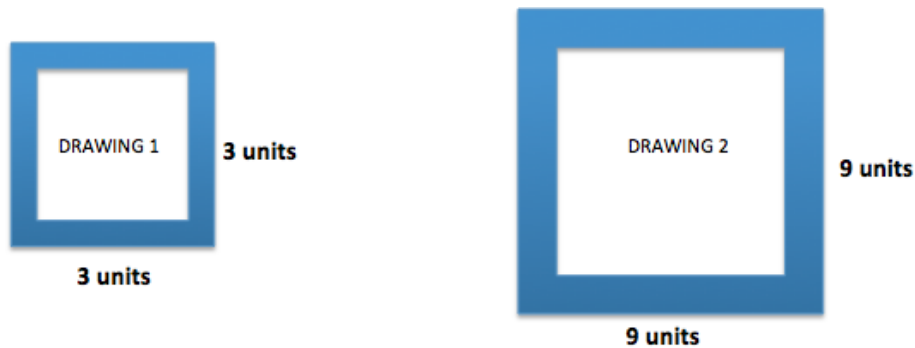# Lesson 15: Solving Area Problems Using Scale Drawings

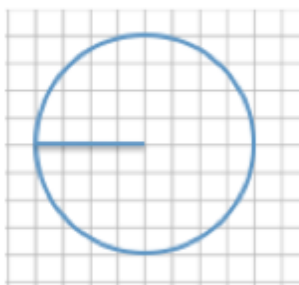## Classwork

Opening Exercise

For each diagram, Drawing 2 is a scale drawing of Drawing 1. Complete the accompanying charts. For each drawing, identify the side lengths, determine the area, and compute the scale factor. Convert each scale factor into a fraction and percent, examine the results, and write a conclusion relating scale factors to area.
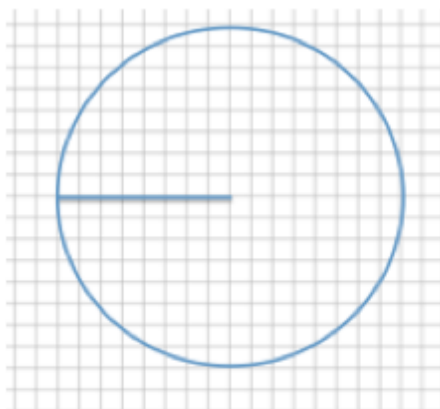
DRAWING 1   3 units

3 units

DRAWING 2   9 units

9 units

	Drawing 1	**Drawing 2**	**Scale Factor as a Fraction and Percent**
Side			
Area			

Scale Factor: _____   Quotient of Areas: _____

DRAWING 1

DRAWING 2

	Drawing 1	**Drawing 2**	**Scale Factor as a Fraction and Percent**
Radius			
Area			

Scale Factor: _____   Quotient of Areas: _____

The length of each side in Drawing 1 is 12 units, and the length of each side in Drawing 2 is 6 units.

Drawing 1

Drawing 2

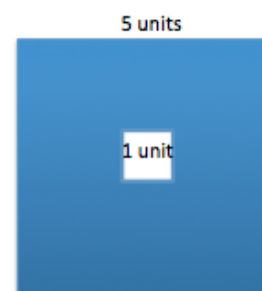|	Drawing 1	Drawing 2	Scale Factor as a Fraction and Percent
Side			
Area			

Scale Factor: _____   Quotient of Areas: _____
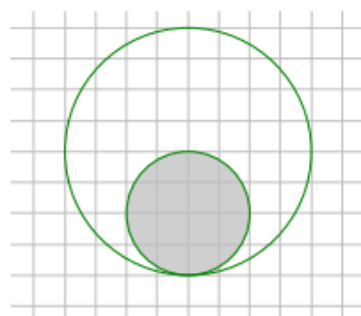
Conclusion:

Example 1

What percent of the area of the large square is the area of the small square?

5 units

1 unit

Example 2

What percent of the area of the large disk lies outside the smaller disk?

Example 3

If the area of the shaded region in the larger figure is approximately 21.5 square inches, write an equation that relates the areas using scale factor and explain what each quantity represents. Determine the area of the shaded region in the smaller scale drawing.
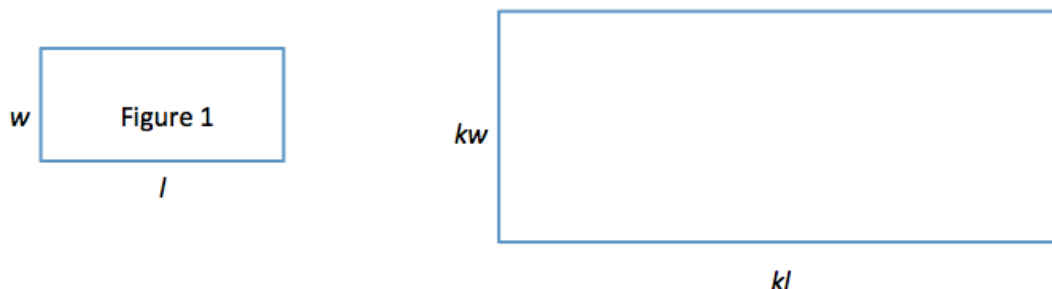
10 inches

6 inches

Example 4

Use Figure 1 below and the enlarged scale drawing to justify why the area of the scale drawing is k^2 times the area of the original figure.

Explain why the expressions $(kl)(kw)$ and k^2lw are equivalent. How do the expressions reveal different information about this situation?

Exercise 1

The Lake Smith basketball team had a team picture taken of the players, the coaches, and the trophies from the season. The picture was 4 inches by 6 inches. The team decided to have the picture enlarged to a poster, and then enlarged again to a banner measuring 48 inches by 72 inches.

    a.   Sketch drawings to illustrate the original picture and enlargements.

b.   If the scale factor from the picture to the poster is 500%, determine the dimensions of the poster.

c.   What scale factor is used to create the banner from the picture?

d.   What percent of the area of the picture is the area of the poster? Justify your answer using the scale factor and by finding the actual areas.
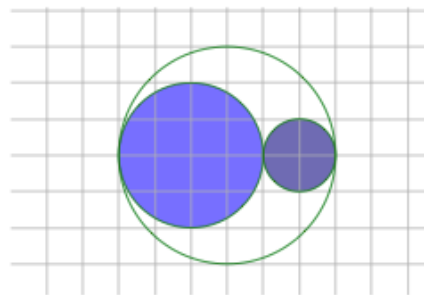
e. Write an equation involving the scale factor that relates the area of the poster to the area of the picture.

f. Assume you started with the banner and wanted to reduce it to the size of the poster. What would the scale factor as a percent be?

g. What scale factor would be used to reduce the poster to the size of the picture?
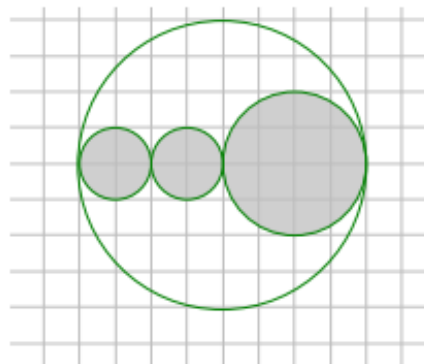
> **Lesson Summary**
>
> If the scale factor is represented by k, then the area of the scale drawing is k^2 times the corresponding area of the original drawing.
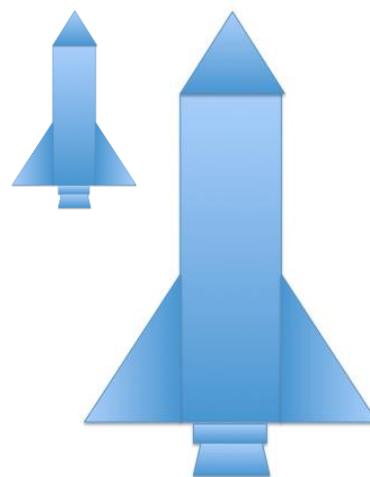
Problem Set

1. What percent of the area of the larger circle is shaded?

   a. Solve this problem using scale factors.

   b. Verify your work in part (a) by finding the actual areas.

2. The area of the large disk is 50.24 units^2.

   a. Find the area of the shaded region using scale factors. Use 3.14 as an estimate for π.

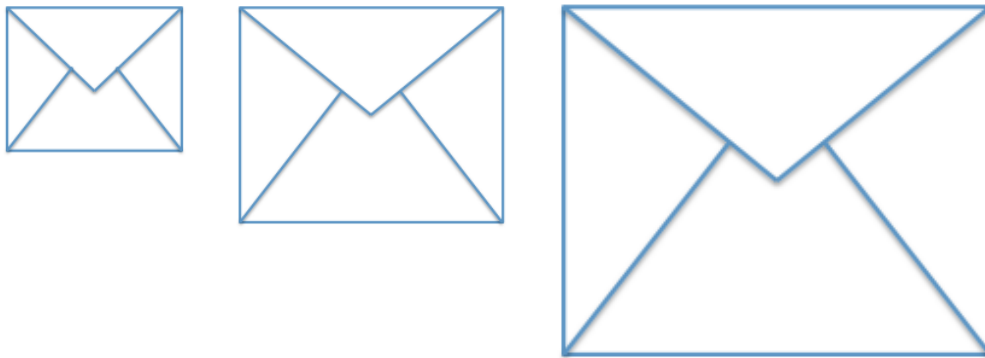   b. What percent of the large circular region is unshaded?

3. Ben cut the following rockets out of cardboard. The height from the base to the tip of the smaller rocket is 20 cm. The height from the base to the tip of the larger rocket is 120 cm. What percent of the area of the smaller rocket is the area of the larger rocket?

4. In the photo frame depicted below, three 5 inch by 5 inch squares are cut out for photographs. If these cut-out regions make up $\frac{3}{16}$ of the area of the entire photo frame, what are the dimensions of the photo frame?

5. Kelly was online shopping for envelopes for party invitations and saw these images on a website.

    The website listed the dimensions of the small envelope as 6 in. by 8 in. and the medium envelope as 10 in. by $13\frac{1}{3}$ in.

    a. Compare the dimensions of the small and medium envelopes. If the medium envelope is a scale drawing of the small envelope, what is the scale factor?

    b. If the large envelope was created based on the dimensions of the small envelope using a scale factor of 250%, find the dimensions of the large envelope.

    c. If the medium envelope was created based on the dimensions of the large envelope, what scale factor was used to create the medium envelope?

    d. What percent of the area of the larger envelope is the area of the medium envelope?