MDI -

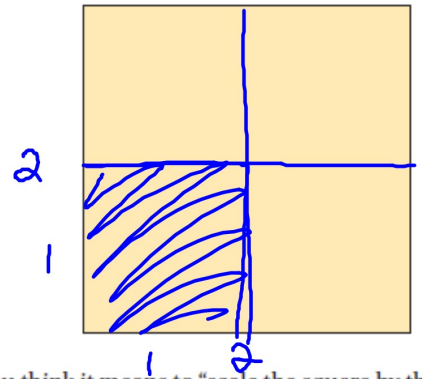
Change the following to a decimal and a percent

$\frac{3}{5}$ .6 60%

$\frac{2}{7}$ .29 29%

LAUNCH: In your notes

Each side of this square has length 2 inches.



1. What do you think it means to "scale the square by the factor $\frac{1}{2}$"? Draw a figure to show what you think it means. Can you think of more than one way to interpret the statement? If so, draw a separate figure for each meaning.

4.2 Scale Factors

Objective: Students will understand that a scale factor measures the change in linear dimensions when you scale a picture

Vocabulary:

A scale factor is a number that represents how much you reduce or enlarge a map, blueprint, or picture

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_____ as Tony _____ as Amy

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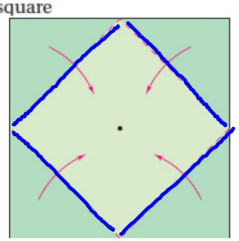
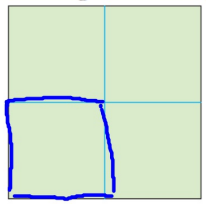
Tony and Amy have different meanings for scaling the square by the factor $\frac{1}{2}$. See if you agree with either of their explanations.

Tony To scale by $\frac{1}{2}$, I drew a square that is half the size of the first one. You know, half the area. The area of the original square is 2×2 or 4 square inches. I made a square with an area of 2 square inches. A neat way to do this is to fold all four corners of the square to the center.



Amy I think that scaling by half means we are supposed to draw the sides half as long. The first square has sides that are 2 inches long, so the scaled square should have sides that are 1 inch long. I drew a horizontal line and a vertical line on the square to divide the length and width in half. This gives me four squares, each scaled by the factor $\frac{1}{2}$.



Amy is correct!

* When you **scale a figure by r**, the sides are multiplied by r

r > 1 The figure gets bigger

r < 1 The figure gets smaller

r = 1 The figure stays the same

EXAMPLES:

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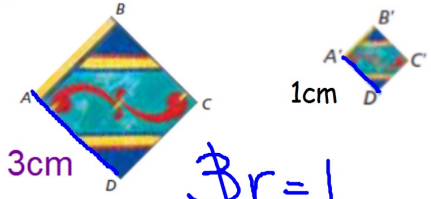
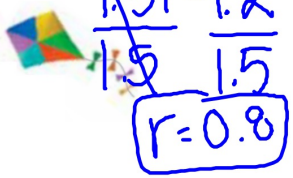
What scale factor transforms the picture on the left into the scaled picture on the right?

a)



$\frac{3r}{3} = \frac{1}{3}$ $r = \frac{1}{3}$

b)



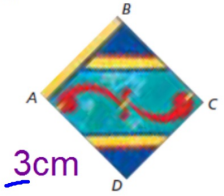
$\frac{1.5r}{1.5} = \frac{1.2}{1.5}$ $r = 0.8$

$\frac{4}{5}$

EXAMPLES:

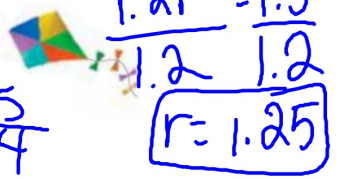
NOW.....what scale factor transforms the picture on the RIGHT into the scaled picture on the left?

a)



$\frac{1r}{1} = \frac{3}{1}$ $r = 3$

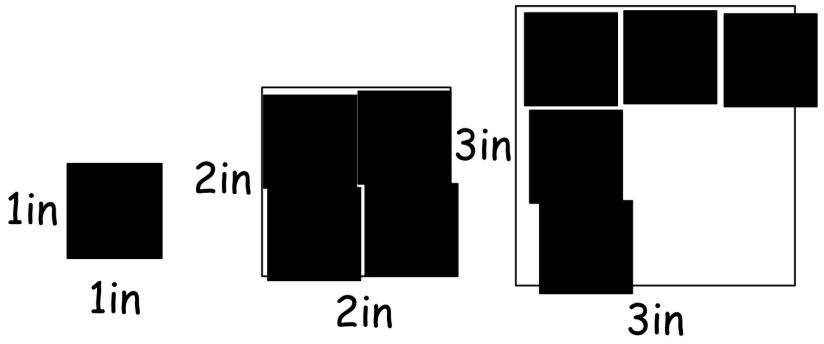
b)



$\frac{1.2r}{1.2} = \frac{1.5}{1.2}$ $r = 1.25$

$\frac{5}{4}$

How many 1in by 1in copies will fit in a new square if we scale by 2?
How many will fit if we scale by 3?



WHAT IS THE PATTERN?

For Discussion

5. If you scale a 1-inch square by a positive integer r, how many copies of the 1-inch square fit inside the scaled square?

Scale factor	# of copies
1	1
2	4
3	9
r	r^2

On Your Own

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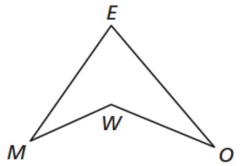
9. Many photocopy machines allow you to scale (reduce or enlarge) a picture. You enter the desired percent and press Copy.
   a. If you enter 80%, by what factor do you scale the picture?
   b. To scale a picture by the factor $\frac{3}{4}$, what percent should you enter?
10. Label the two scalings as *same* or *different*.
   a. scaling by 2 and scaling by $\frac{1}{2}$
   b. scaling by $\frac{1}{3}$ and scaling by 30%
   c. scaling by $\frac{3}{5}$ and scaling by 0.6
   d. scaling by 1 and scaling by 100%

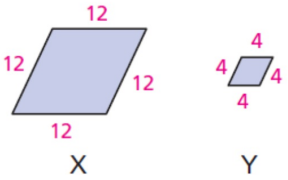


11. Give a scale factor that changes the quadrilateral *MEOW* as indicated.
   a. shrinks it
   b. enlarges it
   c. shrinks it very slightly
   d. keeps it the same size
12. A rectangle has width 12 inches and length 24 inches. You scale it using the following factors. In each case, what are the dimensions of the scaled rectangle?
   a. $\frac{1}{3}$ b. $\frac{1}{4}$ c. 0.3 d. 2.5 e. 0.25

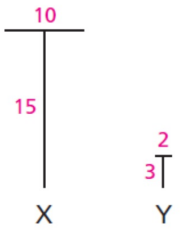
13. Examine each pair of figures below.

- What scale factor can you apply to figure X to get figure Y?
- What scale factor can you apply to figure Y to get figure X?
- How are the two scale factors you found related?

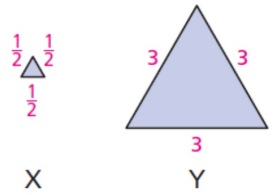
a.



b.



c.



4.2 Scale Factors DAY 2

Objective: Students will understand that a scale factor measures the change in linear dimensions when you scale a picture

Minds in Action: Episode 10

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_____ as Tony _____ as Derman

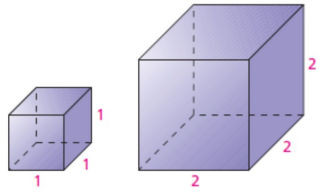
Minds in Action episode 10

Derman and Tony have just finished the In-Class Experiment and are trying to apply what they learned to the following problem.

A cube has edges of length 1 inch. You scale the cube by the factor 2. How long are the sides of the new cube? How many copies of the original cube fit inside the scaled cube?

Tony Well, if you scale the cube by the factor 2, then the new cube must be twice as big. Two cubes fit inside the scaled cube!

Derman That sounds right. The original cube has edges that are 1 inch long. The scaled cube must have edges that are 2 inches long.



Derman Wait! Look at the picture, Tony. Your answer can't be right! More than two of the original cubes are going to fit into the big cube.

Tony Nothing is ever that easy. So, how many 1-inch cubes fit into the scaled cube?

Derman The volume of the original cube is $1 \times 1 \times 1$, or 1 cubic inch. The volume of the scaled cube is $2 \times 2 \times 2$, or 8 cubic inches. Think of the larger cube as a box. You pack in four small cubes to fill the bottom. Then pack in one more layer of four small cubes to fill the box.

For Discussion

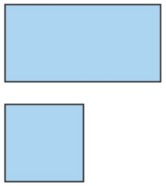
6. If you scale the original cube by the factor 3, how long are the sides of the new cube? How many copies of the original cube fit inside the scaled cube?
7. If you scale the original cube by a positive integer r, how many copies of the original cube fit inside the scaled cube?

Scale factor	# of copies

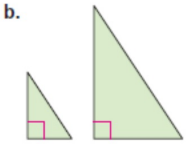
Check Your Understanding

1. What features of a square are invariant when you scale the square by the factor $\frac{1}{2}$?
2. You scale a figure by each given value of r. Will the new figure be smaller, larger, or the same size as the original figure?
   a. $r = \frac{3}{5}$ b. $r = 1$
   c. $r = 3$ d. $r = 0.77$
3. For each pair of figures, determine whether one figure was scaled by the factor $\frac{1}{2}$ to obtain the other figure. Explain.

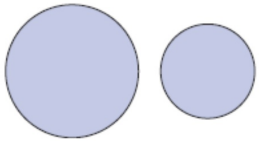
a.



b.



c.

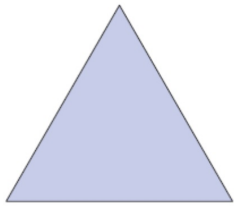


4. For each pair of figures, what scale factor transforms the picture on the left into the scaled picture on the right?

a.

b.

5. For each pair of figures in Exercise 4, what scale factor transforms the picture on the right into the scaled picture on the left?
6. Compare the scale factors you found for Exercises 4 and 5. How are they related?
7. This equilateral triangle has 2-inch sides.



   a. Draw a scaled version of the triangle. Use the factor $\frac{1}{2}$. How many of the scaled triangles fit inside the original triangle?
   b. Draw a scaled version of the triangle using the factor $\frac{1}{3}$. How many of the scaled triangles fit inside the original triangle?

8. Suppose you scale a 6 in.-by-6 in. square by each factor. How many 1-in. squares will fit inside each scaled square?
   a. $\frac{1}{3}$ b. 3 c. $\frac{2}{3}$

14. **Standardized Test Prep** Jamal scales a triangle by the factor 4. How many copies of the original triangle can he use to fill the scaled copy?
   A. 4 B. 8 C. 12 D. 16