"I know what we're going to do today."

Agenda:

1)   Bell Ringer: p. 121
2) Go over homework with 5: 00

3) Ratios and Proportions Lesson 12:
• How do you compute an area of a scaled drawing?

4)   Homework: Lesson 12 (1-5)

Sep 15-10:44 PM

Answer the following questions.

a.   Find the actual distance of the mall entrance and determine whether the set panels will fit.

b.   What is the scale factor? What does it tell us?

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Problem Set

1. A toy company is redesigning their packaging for model cars. The graphic design team needs to take the old image shown below and resize it so that $\frac{1}{2}$ inch on the old packaging represents $\frac{1}{3}$ inch on the new package. Find the length of the image on the new package.

    Car image length on old packaging measures 2 inches

2. The city of St. Louis is creating a welcome sign on a billboard for visitors to see as they enter the city. The following picture needs to be enlarged so that $\frac{1}{2}$ inch represents 7 feet on the actual billboard. Will it fit on a billboard that measures 14 feet in height?
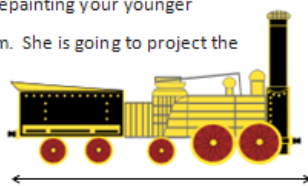
2

3. Your mom is repainting your younger brother's room. She is going to project the image shown below onto

his wall so that she can paint an enlarged version as a mural. How long wiil the mural be if the projector uses a scale where 1 inch of the image represents $4\frac{1}{2}$ feet on the wall?
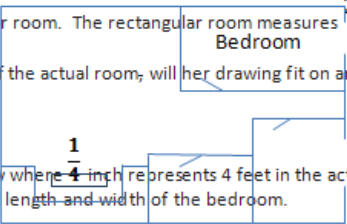
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4. A model of a skyscraper is made so that 1 inch represents 75 feet. What is the height of the actual building if the height if the model is $18\frac{3}{5}$ inches?

in	ft
1	75

$18\frac{3}{5} \rightarrow 75 \; 1395 \; ft$

5. The portrait company that takes little league baseball team photos is offering an option where a portrait of your baseball pose can be enlarged to be used as a wall decal (sticker). Your height in the portrait measures $3\frac{1}{2}$ inches. If the company uses a scale where 1 inch on the portrait represents 20 inches on the wall decal, find the height on the wall decal. Your actual height is 55 inches. If you stand next to the wall decal, will it be larger or smaller than you?

6. The sponsor of a 5K run/walk for charity wishes to create a stamp of its billboard to commemorate the event. If the sponsor uses a scale where 1 inch represents 4 feet and the billboard is a rectangle with a width of 14 feet and a length of 48 feet, what will be the shape and size of the stamp?

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3

7. Danielle is creating a scale drawing of her room. The rectangular room measures $20\frac{1}{2}$ feet by 25 ft. If her drawing uses the scale 1 inch represents 2 feet of the actual room, will her drawing fit on an $8\frac{1}{2}$ in. by 11 in. piece of paper?
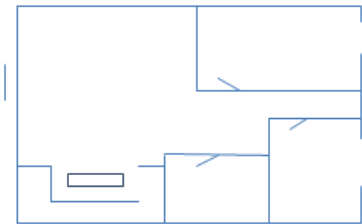
Bedroom

8. A model of an apartment is shown below where $\frac{1}{4}$ inch represents 4 feet in the actual apartment. Use a ruler to measure the drawing and find the actual length and width of the bedroom.

actual	drawing
2 ft	1 in
$20\frac{1}{2}$	$10\frac{1}{4}$ in
25	$12\frac{1}{2}$ in

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Bedroom

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Lesson 12: Computing Actual Areas from a Scale Drawing

Perimeter

6
$4\ \square\ 4$ 3
$2\ \square\ 2$
6   3

$P = 20\,u$ $P = 10\,u$

$Scale = \dfrac{1}{2}$

Area

$6 \cdot \dfrac{1}{2}$ 3
$4 \cdot\ \boxed{\dfrac{1}{2}}$ $2\ \square$

$a = 24\,u^2$ $a = 6\,u^2$

$Scale = \dfrac{1}{2}$ $\dfrac{1}{2} \cdot \dfrac{1}{2} = \dfrac{1}{4}$
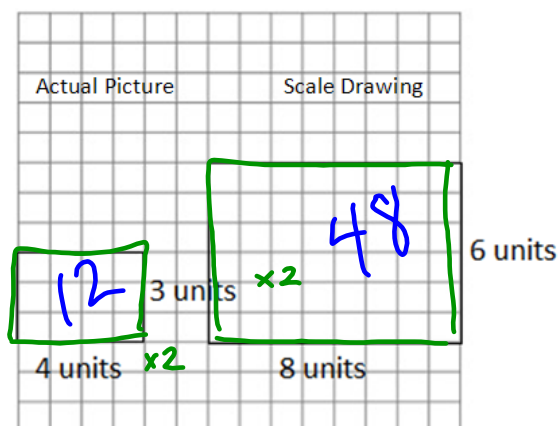
$\left(\dfrac{1}{2}\right)^2$
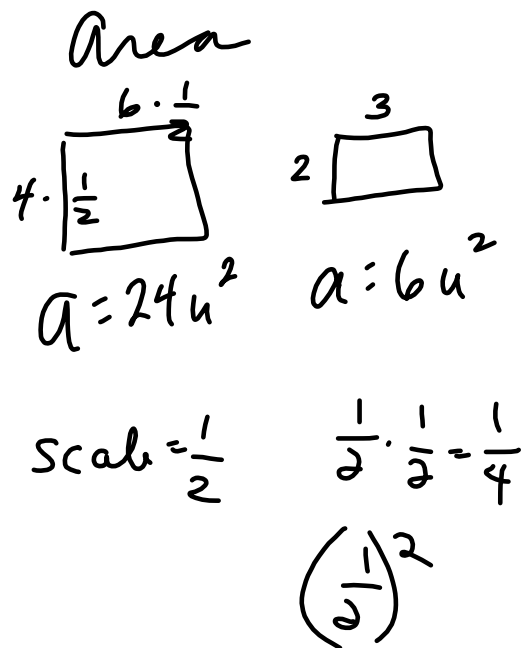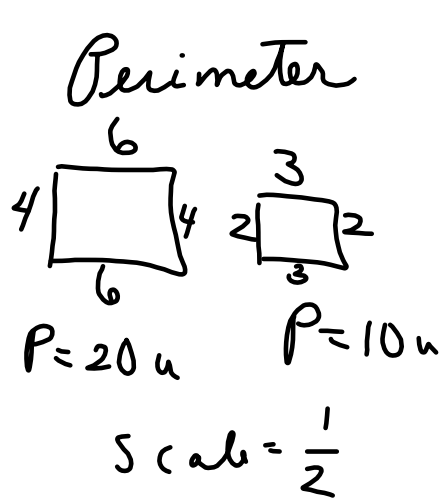
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Classwork

Examples 1–3: Exploring Area Relationships

Use the diagrams below to find the scale factor and then find the area of each figure.

Example 1

Actual Picture   Scale Drawing

12   3 units   ×2   48   6 units

4 units ×2   8 units

Scale factor: ___2___

Actual Area = __$4 \times 3 = 12\ um^2$__

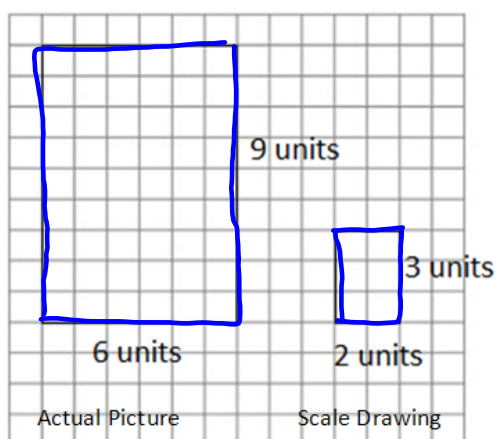Scale Drawing Area = __$8 \times 6 = 48\ um^2$__

Ratio of Scale Drawing Area to Actual Area: ___4___
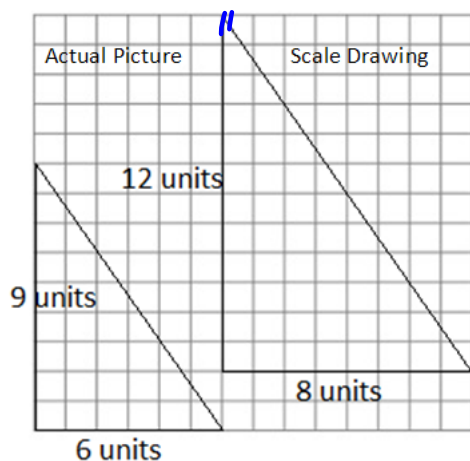
$48 \div 12 =$

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Example 2

9 units
3 units
6 units
2 units
Actual Picture   Scale Drawing

$$\frac{Act.|SD.}{6 \quad 2}$$
$$9 \quad 3$$

$$\frac{2}{6} = \frac{1}{3} \qquad \frac{3}{9} = \frac{1}{3}$$

Scale factor: $\frac{1}{3}$

Actual Area = $54 \, un^2$

Scale Drawing Area = $6 \, un^2$

Ratio of Scale Drawing Area to Actual Area: $\frac{1}{9}$

$$\frac{6}{54} = \frac{1}{9} \qquad \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{9}$$

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Example 3

Actual Picture   Scale Drawing
12 units
9 units
8 units
6 units

$$\frac{orig | S.D.}{9 \quad 12}$$
$$6 \quad 8$$

$$\frac{12 \div 3}{9 \div 3} = \frac{4}{3}$$

$$\frac{8 \div 2}{6 \div 2} = \frac{4}{3}$$

Scale factor: $4/3$

Actual Area = $\frac{9 \times 6}{2} = \frac{54}{2} = 27 \, un^2$

Scale Drawing Area = $\frac{12 \times 8}{2} = \frac{96}{2} = 48 \, un^2$

Ratio of Scale Drawing Area to Actual Area: $\frac{16}{9}$

$$\frac{48 \div 3}{27 \div 3} \qquad \frac{16}{9}$$

$$\frac{4}{3} \cdot \frac{4}{3} = \frac{16}{9}$$

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Results: What do you notice about the ratio of the areas in Examples 1-3? Complete the statements below.

When the scale factor of the sides was 2, then the ratio of area was _____4_____.

When the scale factor of the sides was $\frac{1}{3}$, then the ratio of area was _____$\frac{1}{9}$_____.

When the scale factor of the sides was $\frac{4}{3}$, then the ratio of area was _____$\frac{16}{9}$_____.

Based on these observations, what conclusion can you draw about scale factor and area?

$$\left(\text{scale factor}\right)^2 = \text{ratio of areas}$$

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If the scale factor of the sides is r, then the ratio of area will be _____r^2_____.

$$r \times r$$

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Example 4: They Said Yes!

The Student Government liked your half-court basketball plan. They have asked you to calculate the actual area of the court so that they can estimate the cost of the project.

Based on your drawing below, what is the area of the planned half-court going to be?

area of actual = $25 \times 30 = 750 \ ft^2$

scale

Scale Drawing: 1 inch on drawing corresponds to 15 feet of actual length

$1 \frac{2}{3}$ inches

25 ft

2 inches

30 ft
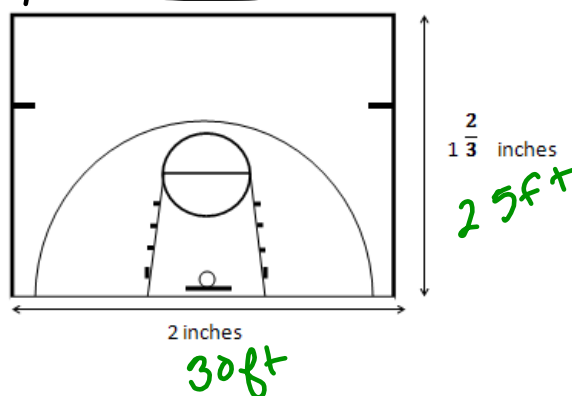
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Does the actual area you found reflect the results we found from Examples 1–3? Explain how you know.

actual area = $750 \ ft^2$

SD Scaled area = $2 \times 1\frac{2}{3} = 3\frac{1}{3}$

Is it true?

$\frac{750}{3\frac{1}{3}} = 225$

yes

scale factor (r) = 15
ratio of areas (r²) = 225

$750 \div 3\frac{1}{3}$

$750 \div \frac{10}{3} = \overset{75}{\cancel{750}} \times \frac{3}{\cancel{10}} = 225$

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Exercises

1. The triangle depicted by the drawing has an ~~actual area of 36 square units.~~ What is the scale of the drawing? (Note: each square on grid has a length of 1 unit)

Scale drawing
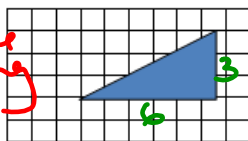
$$SD\ area = \frac{6 \times 3}{2} = 9$$

$$\frac{9 \div 9}{36 \div 9} = \frac{1}{4}$$

$$r^2 = \frac{1}{4}$$

actual area   SD area

$$36 \quad \longrightarrow \quad 9$$
$$\frac{1}{4}$$

$$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$$

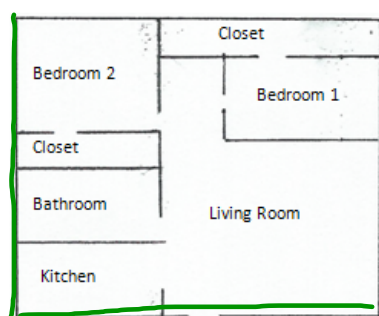(Scale) $r = \frac{1}{2}$

Sq. Root $\sqrt{\frac{1}{4}} = \frac{1}{2}$

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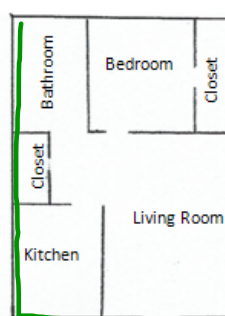2. Use the scale drawings of two different apartments to answer the questions. Use a ruler to measure.

Suburban Apartment   **City Apartment**

Bedroom 2 | Closet
Bedroom 1
Closet
Bathroom | Living Room
Kitchen

Bathroom | Bedroom | Closet
Closet
Kitchen | Living Room

Scale: 1 inch on scale drawing corresponds to 12 feet in the actual apartment

Scale: 1 inch on scale drawing corresponds to 16 feet in the actual city apartment

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a. Find the scale drawing area for both apartments, and then use it to find the actual area of both apartments.

area #1   area #2

720 ft^2 768 ft^2

b. Which apartment has the closet floor with more square footage? Justify your thinking.

$$\frac{\#1}{90 \text{ ft}^2} \qquad \frac{\#2}{80 \text{ ft}^2}$$

c. Which apartment has the largest bathroom? Justify your thinking.

$$\frac{\#1}{72 \text{ ft}^2} \qquad \frac{\#2}{96 \text{ ft}^2}$$

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d. A one-year lease for the suburban apartment costs $750 per month. A one-year lease for the city apartment costs $925. Which apartment offers the greater value in terms of the cost per square foot?

$$\frac{\#1}{} \qquad\qquad \frac{\#2}{}$$

$$\frac{750}{720} = 1.04 \qquad\qquad \frac{925}{768} = 1.20$$

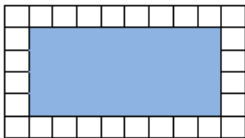Dec 13-1:32 PM

Lesson Summary:

Given the scale factor r representing the relationship between scale drawing length and actual length, the square of this scale factor, r^2, represents the relationship between scale drawing area and actual area.

For example, if 1 inch on the scale drawing represents 4 inches of actual length, then the scale factor, r, is $\frac{1}{4}$. On this
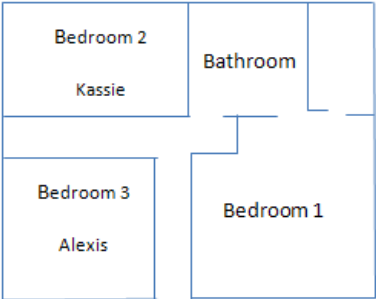
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Problem Set

1. The shaded rectangle shown below is a scale drawing of a rectangle whose area is 288 square feet. What is the scale factor of the drawing? (Note: each square on grid has a length of 1 unit)
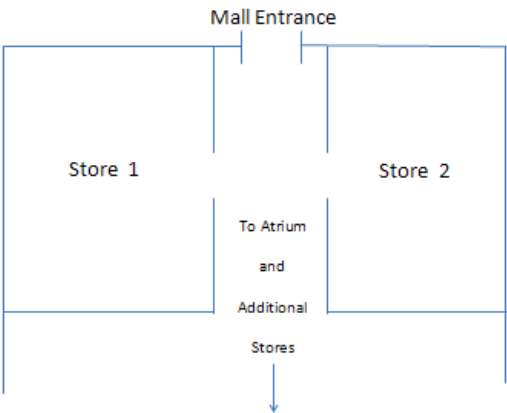
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2. A floor plan for a home is shown below where $\dfrac{1}{2}$ inch corresponds to 6 feet of the actual home. Bedroom 2 belongs to 13-year old Kassie, and bedroom 3 belongs to 9-year old Alexis. Kassie claims that her younger sister, Alexis, got the bigger bedroom, is she right? Explain.
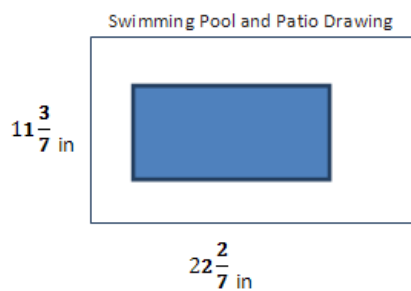
```
┌──────────────┬──────────┬───┐
│  Bedroom 2   │          │   │
│              │ Bathroom │   │
│   Kassie     │          │   │
├──────────────┤          └───┤
│              │              │
│  Bedroom 3   │  Bedroom 1   │
│              │              │
│   Alexis     │              │
└──────────────┴──────────────┘
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3. On the mall floor plan, $\overline{4}$ inch represents 3 feet in the actual store.

   a. Find the actual area of Store 1 and Store 2.

   b. In the center of the atrium, there is a large circular water feature that has an area of $\left(\dfrac{9}{64}\right)\pi$ square inches on the drawing. Find the actual area in square feet.

Mall Entrance

```
┌──────────┐ ┌──────────┐
│          │ │          │
│  Store 1 │ │  Store 2 │
│          │ │          │
│       To Atrium       │
│         and           │
│       Additional      │
│         Stores        │
│          ↓            │
```

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4. The greenhouse club is purchasing seed for the lawn in the school courtyard. They need to determine how much to buy. Unfortunately, the club meets after school, and students are unable to find a custodian to unlock the door. Anthony suggests they just use his school map to calculate the amount of area that will need to be covered in seed. He measures the rectangular area on the map and finds the length to be 10 inches and the width to be 6 inches. The map notes the scale of 1 inch representing 7 feet in the actual courtyard. What is the actual area in square feet?

5. The company installing the new in-ground pool in your back yard has provided you with the scale drawing shown below. If the drawing uses a scale of 1 inch to $1\frac{3}{4}$ feet, calculate the total amount of two-dimensional space needed for the pool and it's surrounding patio.

Swimming Pool and Patio Drawing

$11\frac{3}{7}$ in

$22\frac{2}{7}$ in