- 50% is $\frac{1}{2}$ of a number, or $\frac{1}{2}$ times the #.
- 10% is $\frac{1}{10}$ of a number!
- 1% is $\frac{1}{100}$ of a number

Ex~10% of $380 = ?

p = n x w

Decimal point moves ___space to the _____

Ex~1% of $380 = ?

p = n x w

Decimal point moves ___space to the _____

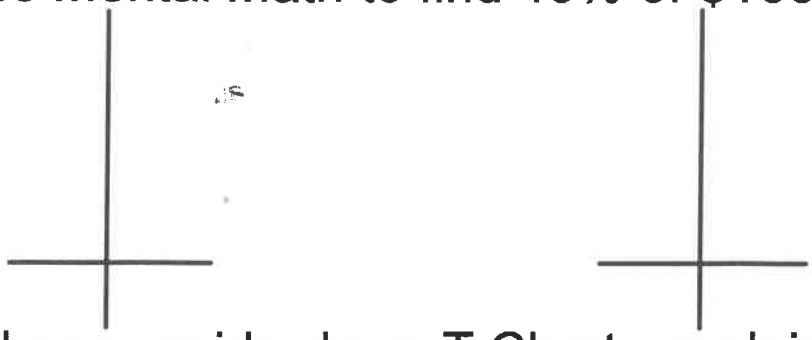
Ex~50% of $380 = ?

p = n x w

Taking 50% of a number is the same thing as

_____

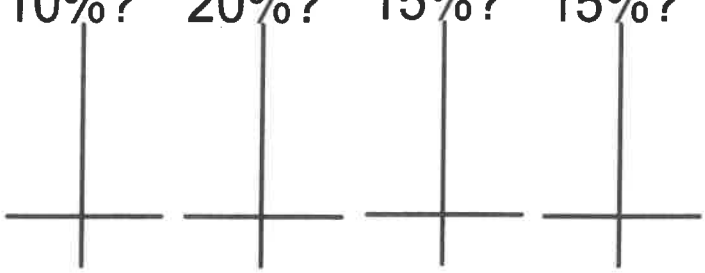
Use Mental Math to find 40% of $160?

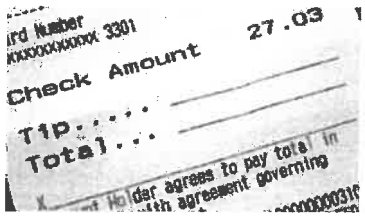


These upside-down T-Charts explain what your brain should be doing! Eventually you should not need them!

Use Mental Math to find tip on a bill of $27.03?

10%? 20%? 15%? 15%?



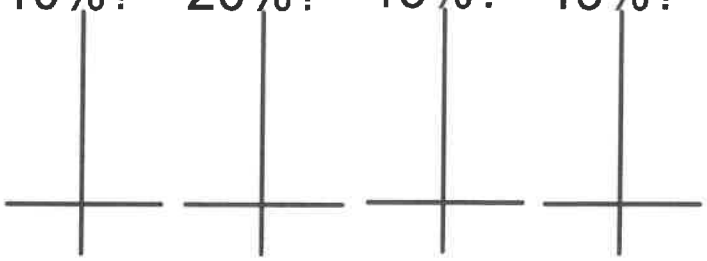


How can I get 5% Mentally?

These upside-down T-Charts explain what your brain should be doing! Eventually you should not need them!

You Try-Find tip on a bill of $19.43?

10%? 20%? 15%? 15%?



Finding a % mentally Key:

100% –

50% –

10% –

5% –

1% –

Find Percent of a Number Mentally

When working with common percents like 10%, 25%, 40%, and 50%, it may be helpful to use the fraction form of the percent.

Percent-Fraction Equivalents				
$25\% = \frac{1}{4}$	$10\% = \frac{1}{10}$	$20\% = \frac{1}{5}$	$12\frac{1}{2}\% = \frac{1}{8}$	$16\frac{2}{3}\% = \frac{1}{6}$
$50\% = \frac{1}{2}$	$30\% = \frac{3}{10}$	$40\% = \frac{2}{5}$	$37\frac{1}{2}\% = \frac{3}{8}$	$33\frac{1}{3}\% = \frac{1}{3}$
$75\% = \frac{3}{4}$	$70\% = \frac{7}{10}$	$60\% = \frac{3}{5}$	$62\frac{1}{2}\% = \frac{5}{8}$	$66\frac{2}{3}\% = \frac{2}{3}$
$100\% = 1$	$90\% = \frac{9}{10}$	$80\% = \frac{4}{5}$	$87\frac{1}{2}\% = \frac{7}{8}$	$83\frac{1}{3}\% = \frac{5}{6}$

Example 1 **Find 20% of 35 mentally.**

20% of $35 = \frac{1}{5}$ of 35 Think: $20\% = \frac{1}{5}$.

$= 7$ Think: $\frac{1}{5}$ of 35 is 7. So, 20% of 35 is 7.

When an exact answer is not needed, estimate by rounding and using mental math to compute the answer.

Example 2 **Estimate.**

a. 23% of 84

23% is about 25% or $\frac{1}{4}$.

$\frac{1}{4}$ of 84 is 21.

So, 23% of 84 is about 21.

b. $\frac{1}{2}$% of 490

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

490 is almost 500.

So, $\frac{1}{2}$% of 490 is about $\frac{1}{2} \times 5$ or 2.5.

Exercises

Find the percent of each number mentally.

1. 50% of 6
2. 25% of 100
3. 60% of 25
4. 75% of 28
5. $66\frac{2}{3}$% of 33
6. 150% of 2
7. 125% of 4
8. 175% of 4
9. 10% of 110

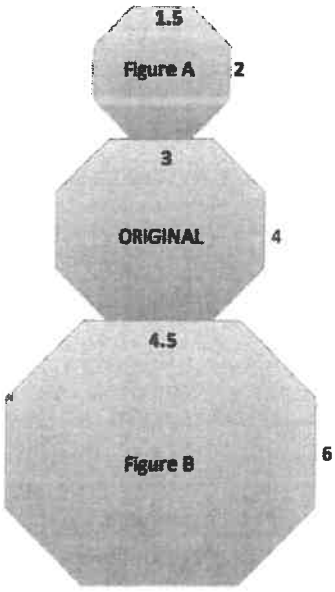
Estimate.

10. 19% of 20
11. 52% of 129
12. 8% of 35
13. $\frac{1}{2}$% of 390
14. 150% of 200
15. 33% of 33

Lesson 12: The Scale Factor as a Percent for a Scale Drawing

Opening

Compare the corresponding lengths of Figure A to the original octagon in the middle. This is an example of a particular type of *scale drawing* called a _____. Explain why it is called that.



Compare the corresponding lengths of Figure B to the original octagon in the middle. This is an example of a particular type of *scale drawing* called an _____. Explain why it is called that.

The *scale factor* is the quotient of any length in the scale drawing to its corresponding length in the actual drawing.

$$\text{Scale factor} = \frac{\text{scale drawing}}{\text{actual}}$$

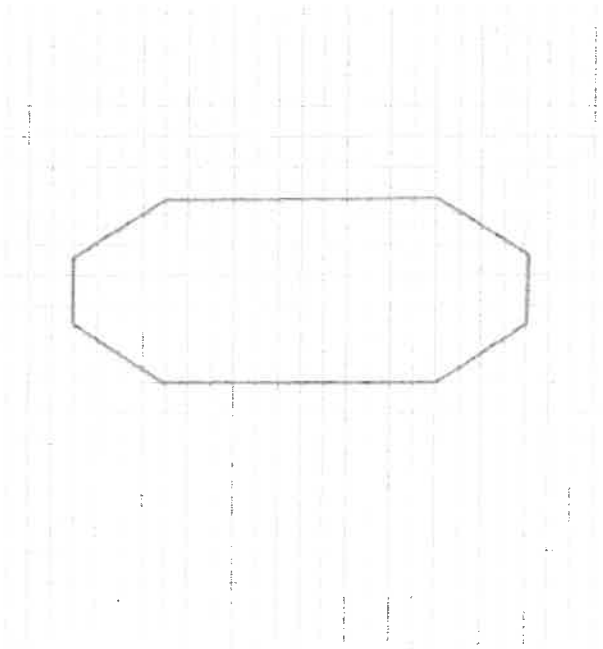
Use the diagram to complete the chart below to determine the horizontal and vertical scale factors. Write answers as a percent and as a concluding statement using the previously learned reduction and enlargement vocabulary.

	Horizontal Measurement in Scale Drawing	Vertical Measurement in Scale Drawing	Concluding Statement
Figure A			
Figure B			

Example 1

Create a snowman on the accompanying grid. Use the octagon given as the middle of the snowman with the following conditions:

a. Calculate the width, neck, and height, in units, for the figure to the right.



b. To create the head of the snowman, make a scale drawing of the middle of the snowman with a scale factor of 75%. Calculate the new lengths, in units, for the width, neck, and height.

c. To create the bottom of the snowman, make a scale drawing of the middle of the snowman with a scale factor of 125%. Calculate the new lengths, in units, for the width, waist, and height.

d. Is the head a reduction or enlargement of the middle?

e. Is the bottom a reduction or enlargement of the middle?

f. What is the significance of the scale factor as it relates to 100%? What happens when such scale factors are applied?

100% = _____

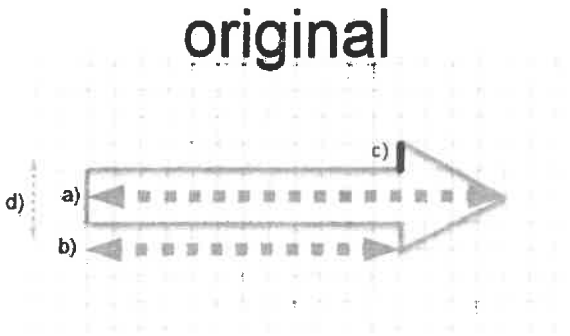
< 100% = _____ **> 100% = _____**

Use the dimensions you calculated in parts (b) and (c) to draw the complete snowman.

Example 2

Create a scale drawing of the arrow below using a ***scale factor of*** 150%.

REDUCTION or ENLARGEMENT?



Measurements:

a)

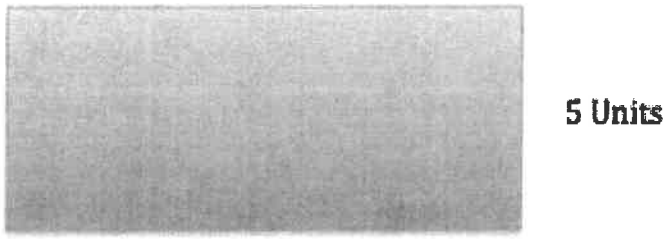
b)

c)

d)

Exercise 2

Chris is building a rectangular pen for his dog. The dimensions are 12 units long and 5 units wide.



Chris is building a second pen that is 60% the length and width of the original.

Is the second pen a reduction or enlargement of the original? _____

Determine the length and width of the second pen: Length = _____ Width = _____

Lesson 13: Changing Scales

Opening Exercise

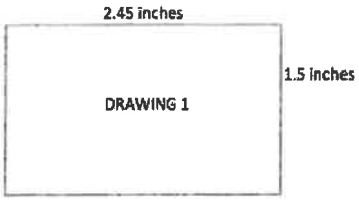
Scale factor: $\frac{\text{length in SCALE drawing}}{\text{Corresponding length in ORIGINAL drawing}}$

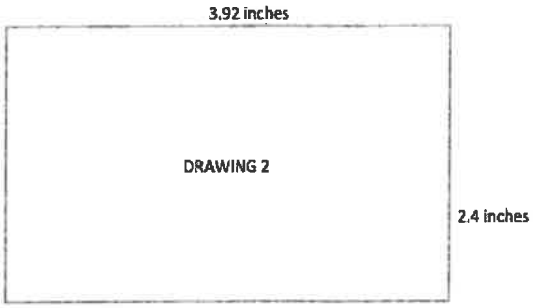
Describe, using percentages, the difference between a reduction and an enlargement.

Reduction: A scale drawing is a reduction of the original drawing when the lengths of the scale drawing are _____ than the original drawing. The scale factor is _____ than 1 and _____ than 100%.

Enlargement: A scale drawing is an enlargement of the original drawing when the lengths of the scale drawing are _____ than the original drawing. The scale factor is _____ than 1 and _____ than 100%.

Use the two drawings below to complete the chart. Calculate the first row (Drawing 1 to Drawing 2) only.





	Quotient of Corresponding Horizontal Distances	Quotient of Corresponding Vertical Distances	Scale Factor as a Percent	Reduction or Enlargement?
Drawing 1 to Drawing 2				
Drawing 2 to Drawing 1				

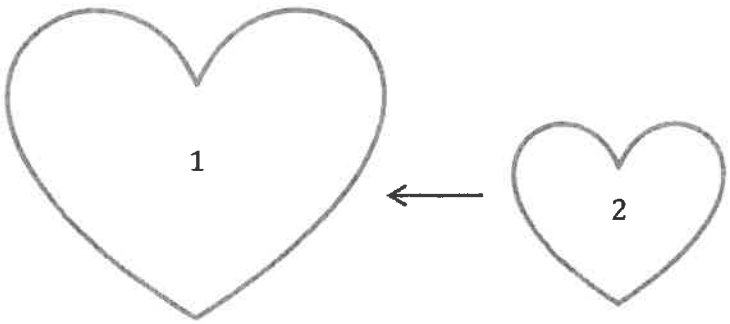
Compare Drawing 2 to Drawing 1. Using the completed work in the first row, make a conjecture (statement) about what the second row of the chart will be. Justify your conjecture without computing the second row.

Compute the second row of the chart. Was your conjecture proven true? Explain how you know.

Example 1

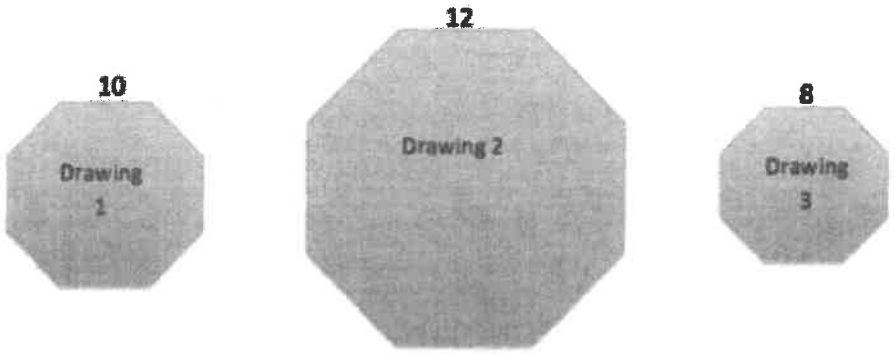
The scale factor from Drawing 1 to Drawing 2 is 60%.

Find the scale factor from Drawing 2 to Drawing 1. Explain your reasoning.



Example 2

A regular octagon is an eight-sided polygon with side lengths that are all equal. All three octagons are scale drawings of each other. Use the chart and the side lengths to compute each scale factor as a percent. How can we check our answers?

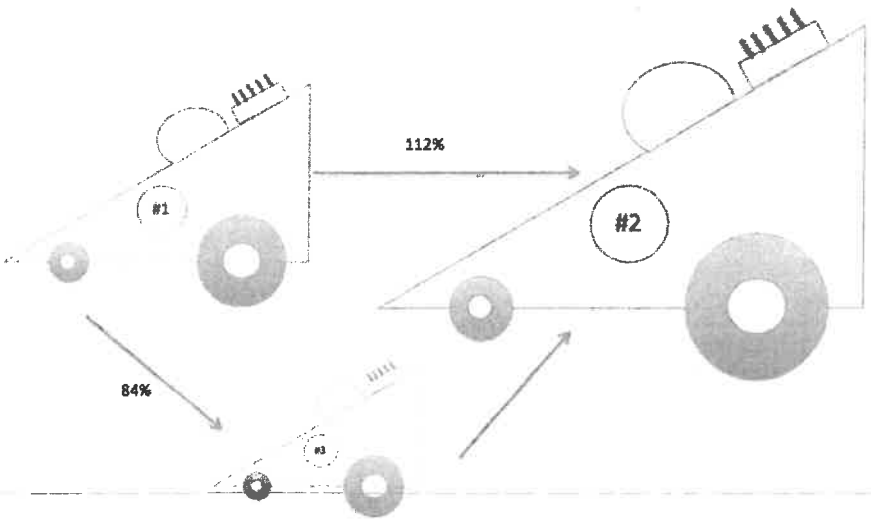


Actual Drawing to Scale Drawing	Scale Factor & R or E (reduction or enlargement?)	Equation to Illustrate Relationship
(original) (scale) Drawing 1 to Drawing 2		$12 = n(10)$
Drawing 1 to Drawing 3		
Drawing 2 to Drawing 1		
Drawing 2 to Drawing 3		
Drawing 3 to Drawing 1		
Drawing 3 to Drawing 2		

xxample 3

The scale factor from Drawing 1 to Drawing 2 is 112%, and the scale factor from Drawing 1 to Drawing 3 is 84%. Drawing 2 is also a scale drawing of Drawing 3.

Is Drawing 2 a **reduction** or an **enlargement** of Drawing 3? Justify your answer using the scale factor.



Drawing 2 is a

_____

of Drawing 3.

To prove it, let's find the scale factor from 3 to 2:

Is Drawing 3 a **reduction** or an **enlargement** of Drawing 2? Justify your answer using the scale factor.

Drawing 3 is a

_____

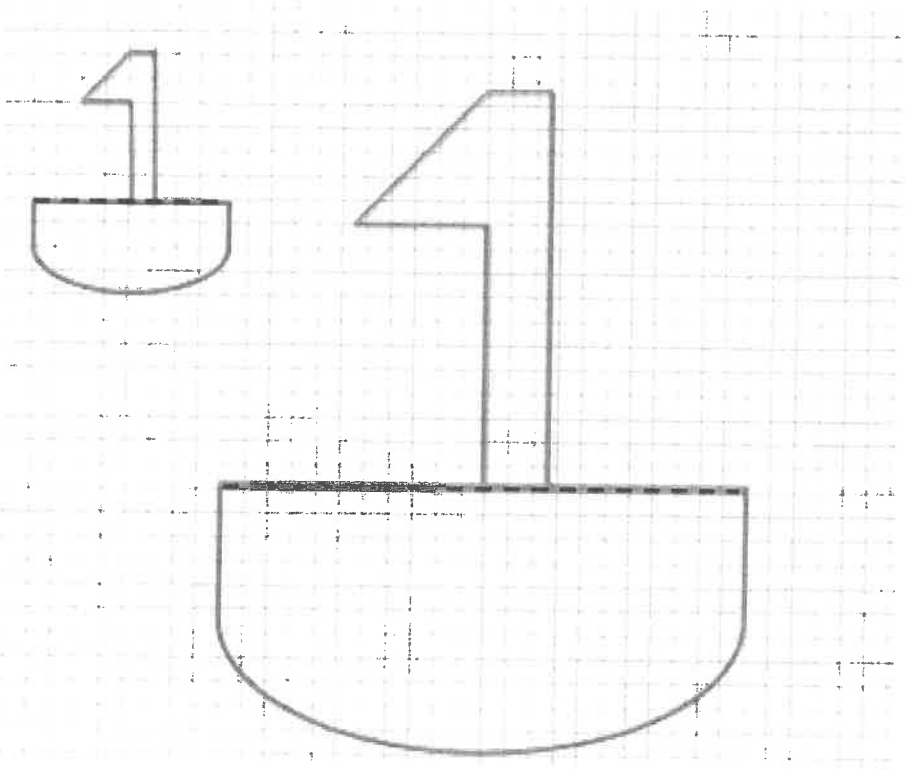
of Drawing 2.

To prove it, let's find the scale factor from 2 to 3:

Lesson 14: Computing Actual Lengths from a Scale Drawing

Example 1

The distance around the entire small boat is 28.4 units. The larger figure is a scale drawing of the smaller drawing of the boat. State the scale factor as a percent, and then use the scale factor to find the distance around the scale drawing.



Step 1: Compare a length in the original to a length in the scale drawing to find the scale factor.

Horizontal length original = _____

Horizontal length scale drawing = _____

Scale Factor = _____

scale drawing = (scale factor) x actual/original

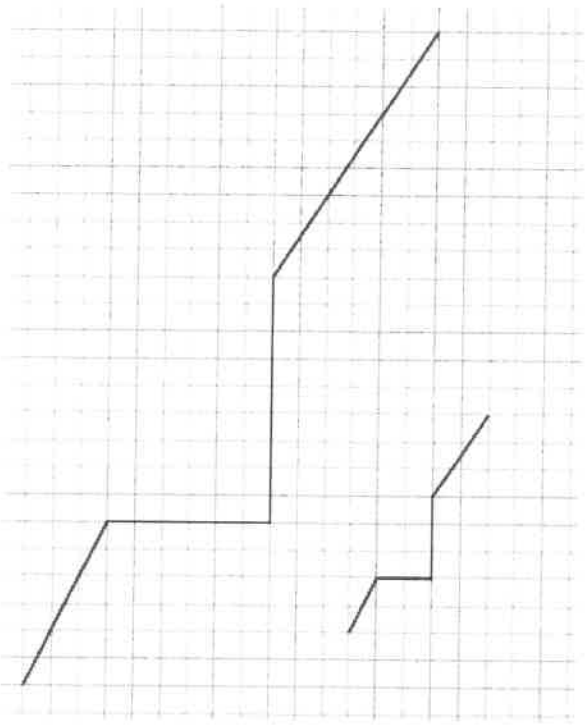
Step 2: Use the scale factor to find the distance around the larger boat (the scale drawing).

Distance around small boat = 28.4 units

Distance around large boat = _____

Exercise 1

The length of the longer path is 32.4 units. The shorter path is a scale drawing of the longer path. Find the length of the shorter path, and explain how you arrived at your answer.



Step 1: Compare a length in the original to a length in the scale drawing to find the scale factor.

Horizontal length original = _____

Horizontal length scale drawing = _____

Scale Factor = _____

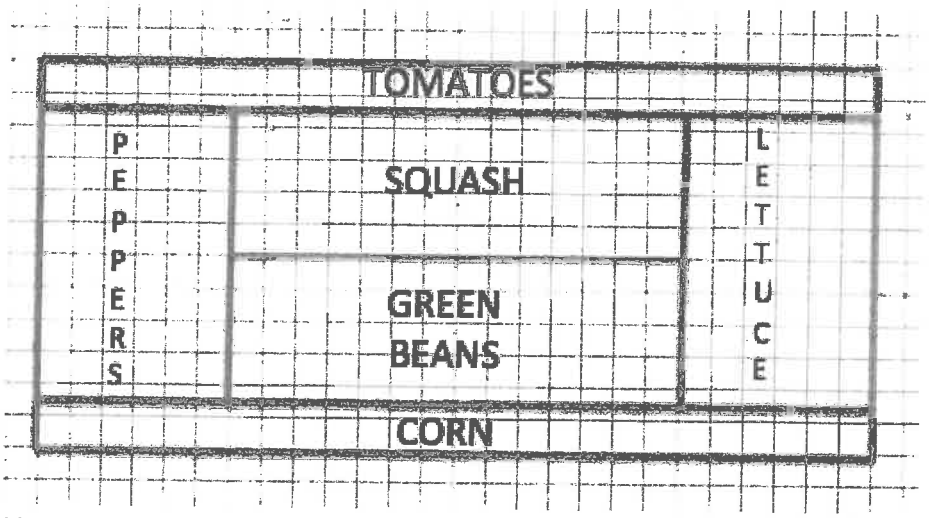
scale drawing = (scale factor) x actual/original

Step 2: Use the scale factor to find the length of the shorter path (the scale drawing).

Length of longer path = **32.4 units**

Length of shorter path = _____

Example 2: Time to Garden



Sherry designed her garden as shown in the diagram above. The distance between any two consecutive vertical grid lines is 1 foot, and the distance between any two consecutive horizontal grid lines is also 1 foot. Therefore, each grid square has an area of one square foot. After designing the garden, Sherry decided to actually build the garden 75% of the size represented in the diagram.

a. What are the outside dimensions shown in the blueprint?

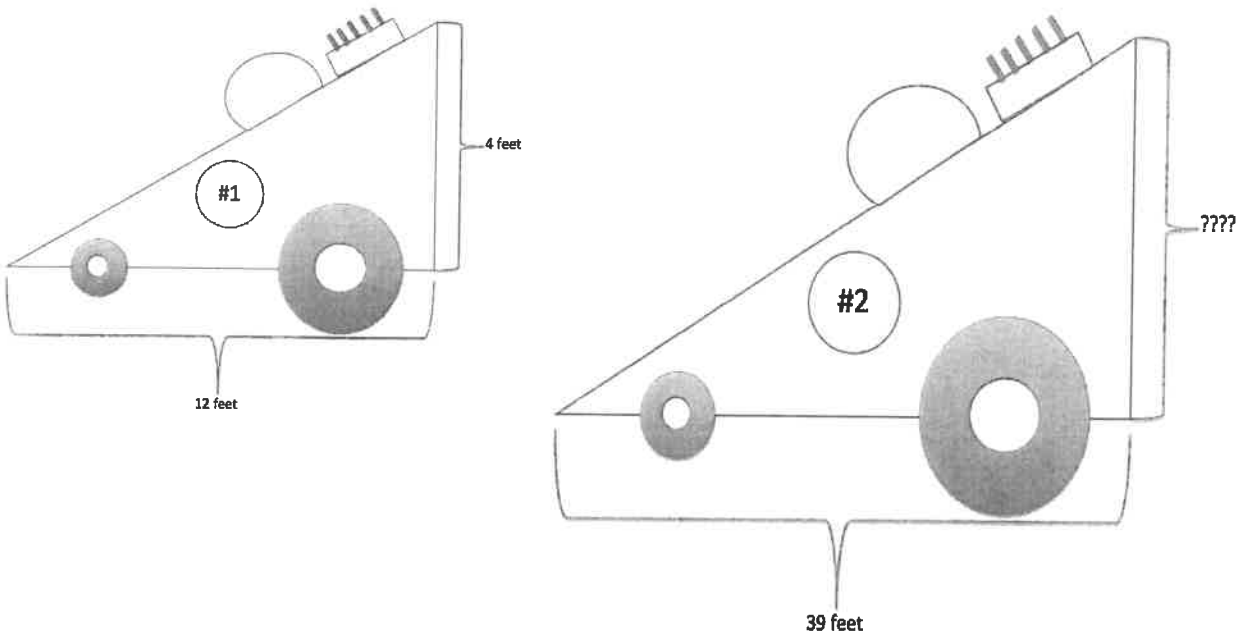
b. What will the outside dimensions be in the actual garden? Write an equation to find the dimensions. How does the problem relate to the scale factor?

c. If Sherry plans to use a wire fence around the outside of the garden, how much fence does she need?

d. If the fence costs $3.25 per foot plus 7% sales tax, how much would the fence cost in total?

Example 3

Race Car #2 is a scale drawing of Race Car #1. The measurement from the front of Race Car #1 to the back of Race Car #1 is 12 feet, while the measurement from the front of Race Car #2 to the back of Race Car #2 is 39 feet. If the height of Race Car #1 is 4 feet, find the scale factor, and write an equation to find the height of Race Car #2. Explain what each part of the equation represents in the situation.



Let's try to organize our data with this table. Fill in what we know and we'll use scale factor and the percent equation to find the part we don't know.

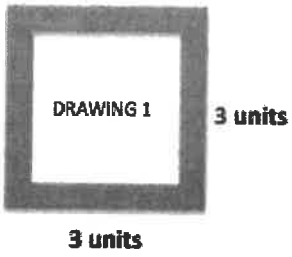
	Race Car #1	Race Car #2
Front to Back		
Height		

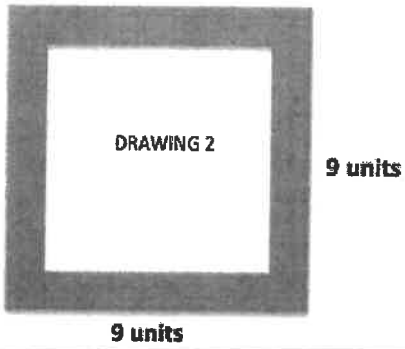
scale drawing = (scale factor) x actual/original

Lesson 15: Solving Area Problems Using Scale Drawings

Classwork

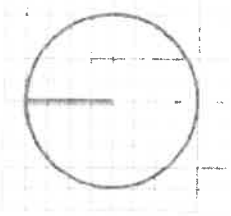
For each diagram, Drawing 2 is a scale drawing of Drawing 1. Complete the accompanying charts. For each drawing, identify the side lengths, determine the area, and compute the scale factor. Convert each scale factor into a fraction and percent, examine the results, and write a conclusion relating scale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



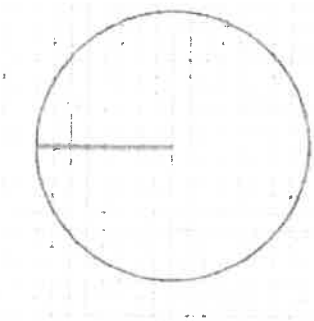


	Drawing 1 (original)	Drawing 2 (scale)	Scale Factor as a Fraction and Percent
Side			
Area (sq. units)			

Scale Factor: _____ Quotient of Areas: _____



DRAWING 1



DRAWING 2

	Drawing 1	Drawing 2	Scale Factor as a Fraction and Percent
Radius			
Area (sq. units) *in terms of pi			

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 (sq. units)			

Scale Factor: _____ Quotient of Areas: _____

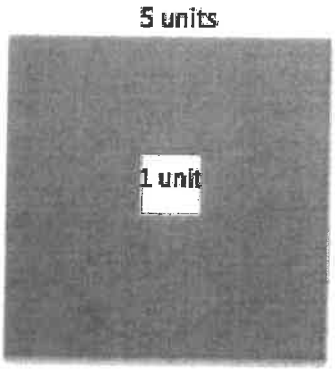
Conclusion:

Example 1

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

Area of large =

Area of small =

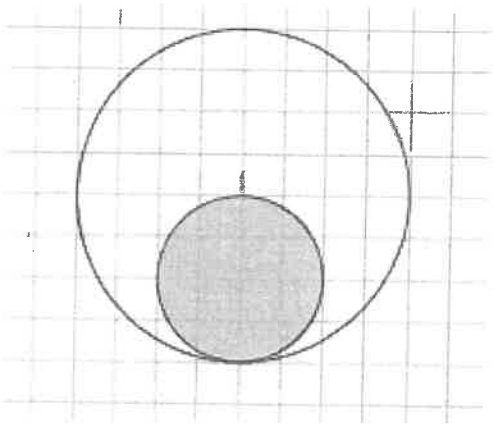


Example 2

What percent of the area of the large disk lies outside the shaded disk? **CIRCLES!!!!** $A = \pi r^2$

Area of large disk =

Area of small disk =



Small disk covers *what percent* **of large disk**?

So what percent of large disk area lies outside of small disk?

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.

PICTURE ***BANNER*** ***POSTER***

b. If the scale factor from the picture to the poster is 500%, determine the dimensions of the poster. *(picture = original, poster = scale)*

c. What scale factor is used to create the banner from the picture?
(picture = original, banner = scale)