Unit 10: Ratios & Proportional Relationships
Standards, Checklist and Circle Map

Georgia Standards of Excellence (GSE):

MGSE7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.*

MGSE7.RP.2: Recognize and represent proportional relationships between quantities.

MGSE7.RP.2a: Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

MGSE7.RP.2b: Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

MGSE7.RP.2c: Represent proportional relationships by equations. *For example, if total cost is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t=pn.*

MGSE7.RP.2d: Explain what a point (x,y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (O,O) and (l,r) where r is the unit rate.

MGSE7.G.1: Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

MGSE7.RP.3: Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

What Will I Need to Learn?? Mark a check next to each concept as you master them.

_____ I can compute unit rates with fractions

_____ I can write and solve proportions

_____ I can determine whether two quantities are proportional (using a table or graph)

_____ I can identify the constant (unit rate) in tables, graphs, equations, etc.

_____ I can represent proportions with equations (direct variation/direct proportion)

_____ I can explain points on a graph of a proportional relationship

_____ I can solve problems involving scale drawings

_____ I can solve real-world percent problems (tips, tax, discount, etc.)

_____ I can calculate percent change and error

Unit 10 Circle Map: On the next page, make a Circle Map of the standards listed above. Include at least 15 concepts.

A

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Standards, Checklist and Circle Map

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Vocabulary Review

Unit 10: Ratios & Proportional Relationships		
Vocabulary Term	**What does it mean? Definition**	**What does it look like? Picture/Example**
Complex Fraction	A fraction in which the numerator, denominator, or both contain a fraction	
Fraction	A number expressed in the form $\frac{a}{b}$, where b ≠ 0.	
Ratio	A comparison of two numbers.	
Proportion	An equation of equivalent ratios.	
Percent change	A rate of change expressed as a percent. This is found by dividing the change by the original amount.	
Direct proportion (direct variation)	The relationship between two quantities whose ratio remains constant. When one variable increases the other increases proportionally. This is written in the form y = kx, where k represents the constant of proportionality.	
Constant (of proportionality)	The constant value of the ratio between y and x. The constant also represents the unit rate.	
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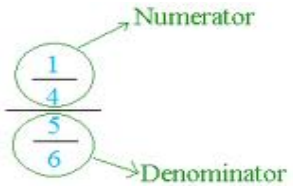
~ Unit Rates with Complex Fractions~

"**Complex fractions**" are not as scary as they sound! A complex fraction is just a fraction that has another _____ in its numerator or denominator (or both!). Complex fractions ***must be simplified***. To do this, simply remember that a fraction is just another way of writing a _____ problem! So, just _____ the numerator by the denominator to simplify a complex fraction.

For instance:



To simplify this, just work out $\frac{1}{4} \div \frac{5}{6}$

$$\frac{1}{4} x \frac{6}{5} = \frac{6}{20} = \frac{3}{10}$$

➔ *Now, let's examine familiar problems, this time using* ***division****!*

Example: *Ms. Walksalot walks ½ a mile per ¼ hour*. How far does she walk per 1 hour?

$$\frac{\frac{1}{2} mile}{\frac{1}{4} hour} = \frac{1}{2} \div \frac{1}{4} = \frac{1}{2} x \frac{4}{1} = \frac{4}{2} = \frac{2 miles}{1 hour}$$

So, Ms. Walksalot walks 2 miles per 1 hour!

The unit for our unit rate must be placed in the denominator of the fraction!!

Example 1: Andrew the butcher charges $2.50 per 1/5 pound of gourmet pork.
What is the unit rate (price per 1 pound)?

$$\frac{\$2.50}{\frac{1}{5} lb} = .2\overline{)2.50} = 2\overline{)25.0}^{\,12.5} = \$12.50$$

So, the gourmet pork is $12.50 per 1 pound.

Example 2: Mikayla runs 1 ½ miles in 2/10 of an hour. How far can she run in 1 hour?

$$\frac{1\frac{1}{2} miles}{\frac{2}{10} hour} = 1\frac{1}{2} \div \frac{2}{10} = \frac{3}{2} x \frac{10}{2} = \frac{30}{4} = 7\frac{1}{2} mph$$

So, Mikayla runs 7 ½ miles per 1 hour.

YOU Try!! Using **division**, find the unit rate to solve each problem below.

1) Joshua read 1/6 of his book in 1/3 hour. At this rate, how much of his book will he read in an entire hour?

2) Katy needs 1/8 cups of sugar to make 1/4 of her cookie recipe. How much sugar does she need to make the entire recipe?

3) **Challenge!!** Dino jogs ½ mile in 2/5 of an hour. At this rate, how far can he jog in 1 hour?

C

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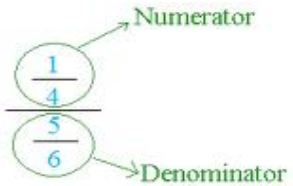

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C

Amazon Rainforest Survival Guide

Unit Rates & Speed

The top speed of a panther is 426 miles per 6 hours. What is the unit rate?

Write as a rate: $\frac{426 miles}{6 hours}$

Divide:

Solution: _____

The top speed of a jaguar is ¼ miles per 1/200 of an hour. What is the unit rate?

Write as a rate:

Divide:

Solution: _____

Unit Rates & Price

Epibatidine sells for $215 in the USA for 10 oz. What is the unit rate?

Solution: _____

Off Bug Repellant costs 3/16 of a dollar per ¼ oz. Cutter Repellant costs 1/3 of a dollar for every 5/12 of an oz. Which is the better buy?

"Off" Unit Rate: "Cutter" Unit Rate

The better deal is _____.

More Unit Rates

Since 2009, the Amazon Rainforest has been deforested on average of ½ miles^2 per 1/14 day. What is the unit rate?

A caiman can travel ¼ of a mile in ½ a minute. Anacondas can travel 1/12 of a mile in ¼ minute. A human can run 1/10 of a mile in 1/3 minute. Can a human running at this speed outrun either animal?

D

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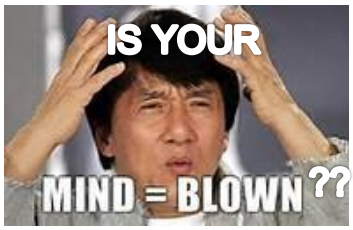
~ Representing Proportional Relationships with Equations ~

Proportional relationships can be expressed with tables, graphs, and **EQUATIONS**!!

These equations are in the form of $y = kx$, where **k represents** the **constant**, or **unit rate**.



Don't let this blow your mind! It's EASY-PEASY!!

Making an Equation (by finding the UNIT RATES)

From a Table

This table shows how much money, y, is earned when AJ works x hours.

X (hours)	0	1	5	20
Y (pay)	0	8	40	160

The constant, k, is 8. We know this because the unit rate is 8 (when x = 1, y = 8). We also know this because in every ratio, x is multiplied by 8 to get y.

So, our equation is **y = 8x**.

This means that y, or the pay, is calculated by multiplying 8 by x, the hours worked.

From a Graph

This graph shows how much money, y, is earned when Jeff works x hours.

The constant, k, is 20. We know this because of the point (1, 20). Also, each point on the graph shows that the product of x and 20 equals y.

So, our equation is **y = 20x**.

From 2 values

The values below give us a proportional relationship.

Grace makes $45 in 3 hours.

To get our equation, we need the unit rate.

$45 in 3 hours = $15 per 1 hour

So, our equation is **y = 15x**.

~ You Try! ~

***Hint*: The trick is to find the UNIT RATE!**

Determine the equations for each of the following proportional relationships.

1) Equation: _____

X (pounds)	2	3	12	15
Y (cost)	12	18	72	90

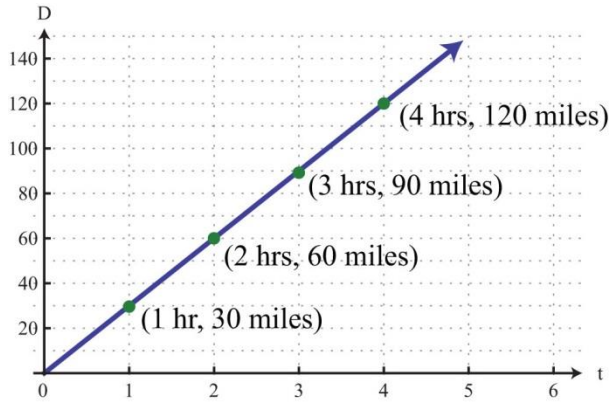
2) Equation: _____

The lumberjack averages 96 trees in 4 days.

3) Equation: _____

Creamsicle eats 10 pounds of food in 20 days.

4) Equation: _____



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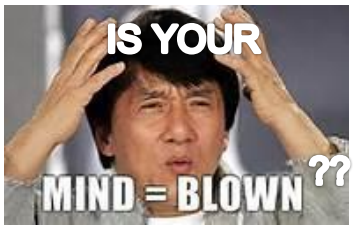

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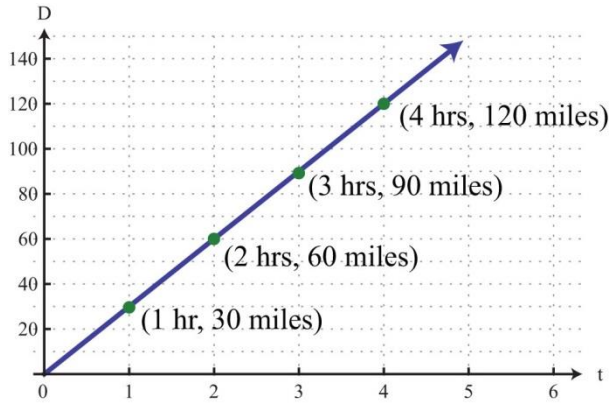
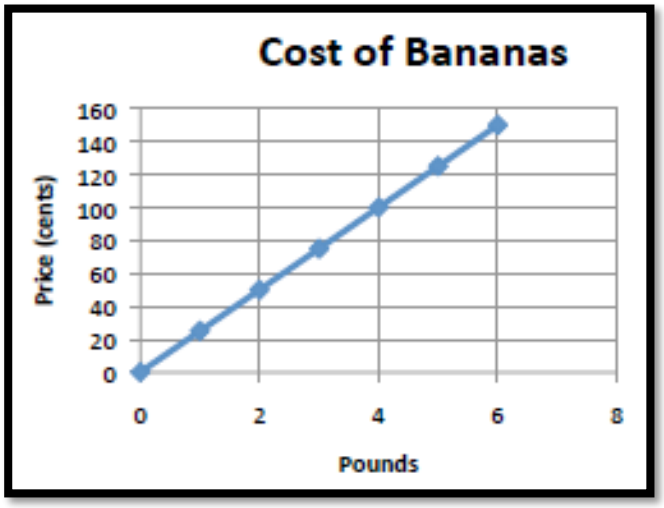


E

~ Explaining Points on a Graph ~

When you ***graph*** a ***proportional relationship*** (also known as *direct variation* or *direct proportion*), each point means something!

This graph shows how much bananas cost at my local grocery store!



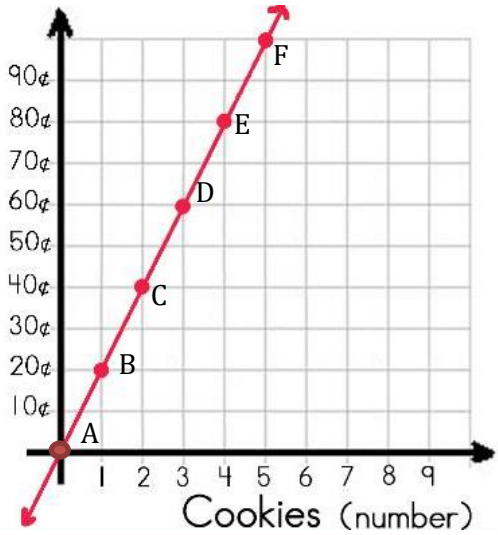
What does this graph tell us?

- We know the price (y) is *proportional* to the pounds (x) because the graph is a *straight line* and it *passes through (0,0).*
- We know the unit rate is 25¢ per 1 pound, because of the point (1,25). This means when x (the pounds) is 1, y (the price) is 25¢.
- We can also see:
  - 2 pounds cost 50¢
  - 3 pounds cost 75¢
  - 4 pounds cost $1
  - And so on….
- And of course, the point (0,0) means that 0 pounds cost $0. Makes sense, right?

~ Your Turn! ~

The graph below shows the cost of cookies on the planet Zoreo. Answer the questions!

Cost of Cookies



1) Name two characteristics that prove the graph shows a proportional relationship.

a._____

b._____

2) a. What is the constant? _____

b. What is the unit rate? _____ per 1 _____

3) What equation is represented by this graph? _____

4) Explain what Point E means in this situation._____

_____

5) Explain what Point A means in this situation. _____

_____

6) Zeke says that Point D represents "60 cookies cost 3 cents". Do you agree? Yes No

F

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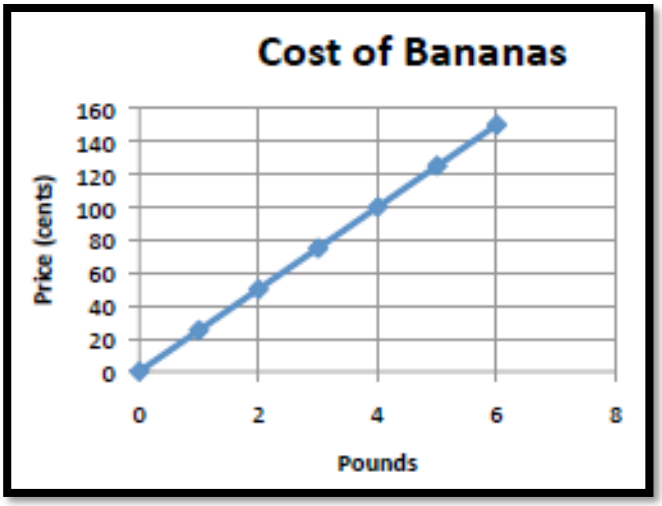

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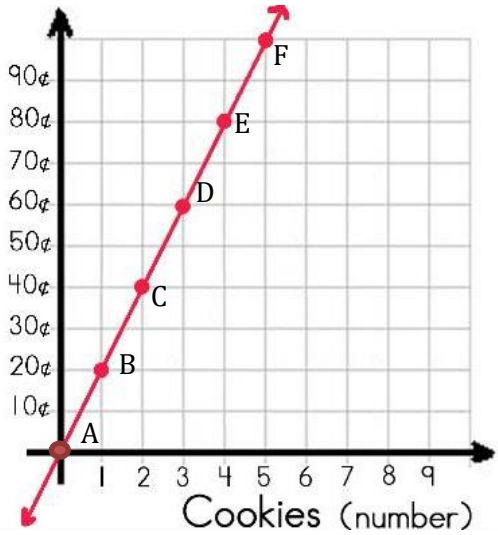

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F

Scale Drawings

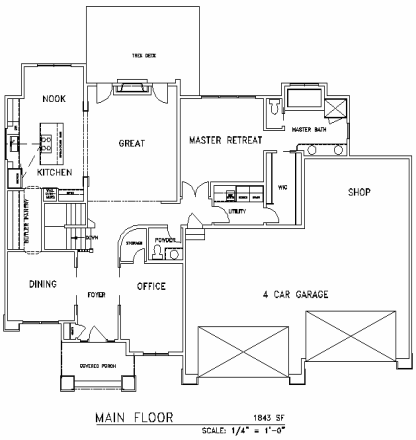
* What is scale factor? _____

* In a scale drawing, the scale factor is the ratio of the measurement on the _____ to the measurement of the actual _____.

* The scale on the blueprint says that ¼" = 1'. What does that mean?

  _____

  _____



* Scale drawings are _____ to the objects they represent.

* What are some common examples or uses of scale drawings?

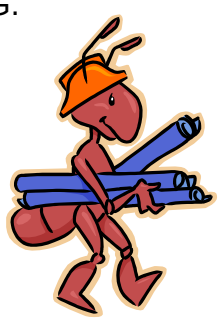
  _____

* **Example**: Finding Actual Distances: The scale on a map is 4 in = 1 mi. On the map, the distance between two towns is 20 inches. What is the actual distance? Show all work below.

Work to solve the problem:	Explanation:
$\frac{4in}{1mi} = \frac{20in}{x}$	

Lesson Review: Try These! ☺

On a map of the Great Lakes area, 2 cm = 45 km. For problem #s 1-4, copy down their distances on the map. Then, determine their actual distances. Show work on the left page of your MSG.



1. Detroit to Cleveland is _____ cm on the map, and _____ km in real life.
2. Duluth to Nipigon is _____ cm on the map, and _____ km in real life.
3. Buffalo to Syracuse is _____ cm on the map, and _____ km in real life.
4. Sault Ste. Marie to Toronto is _____ cm on the map, and _____ km in real life.
5. Distance from Detroit to State Park is _____ km in real life, and _____ cm on the map.

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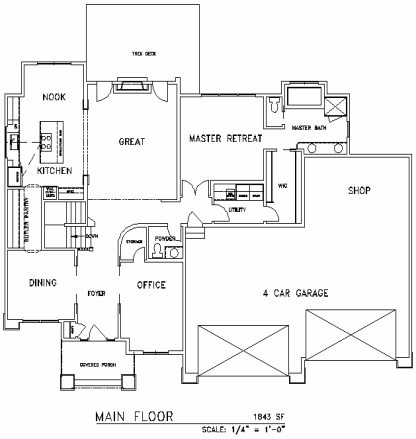

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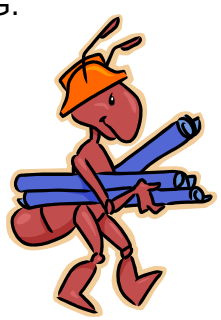

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G

Exercises in Scale

The scale of a drawing is ¼ in = 15 ft. Find the actual measurements for:

1. 9 in	2. 12 in	3. 14 in	4. 15 in

The scale is 2 cm = 25 m. Find the length each measurement would be on a scale drawing:

5. 150 m	6. 475 m	7. 350 m	8. 500 m

Tell whether each scale reduces, enlarges, or preserves the size of an actual object for:

9. 1 m = 25 cm	10. 8 in = 1 ft	11. 12 in = 1 ft	

12. On a map, the distance between Atlanta, Ga., and Nashville, Tenn., is 12.5 inches. The actual distance between the cities is 250 miles. What is the scale?

13. Blueprints of a house are drawn to the scale of ¼ in = 1 ft. Its kitchen measures 3.5 inches by 5 inches on the blueprints. What is the actual size of the kitchen?

H

Exercises in Scale

The scale of a drawing is ¼ in = 15 ft. Find the actual measurements for:

1. 9 in	2. 12 in	3. 14 in	4. 15 in

The scale is 2 cm = 25 m. Find the length each measurement would be on a scale drawing:

5. 150 m	6. 475 m	7. 350 m	8. 500 m

Tell whether each scale reduces, enlarges, or preserves the size of an actual object for:

9. 1 m = 25 cm	10. 8 in = 1 ft	11. 12 in = 1 ft	

12. On a map, the distance between Atlanta, Ga., and Nashville, Tenn., is 12.5 inches. The actual distance between the cities is 250 miles. What is the scale?

13. Blueprints of a house are drawn to the scale of ¼ in = 1 ft. Its kitchen measures 3.5 inches by 5 inches on the blueprints. What is the actual size of the kitchen?

H

Percent Notes

$$\frac{\text{is}}{\text{of}} = \frac{\%}{100} \quad \text{or} \quad \frac{\text{part}}{\text{whole}} = \frac{\%}{100}$$

Finding a percent (part) of a number (whole):

Example: What is 20% of 240?

First, set up your proportion:

$$\frac{x}{240} = \frac{20}{100}$$

Then, solve!

$$\frac{x}{240} = \frac{20}{100}$$

100x = 20 • 240

÷100 ÷ 100

x = 48

48 *is 20% of 240*

Finding the whole given the percent (part):

Ex: 60 is 75% of what number?

First, set up your proportion:

$$\frac{60}{x} = \frac{75}{100}$$

Then, solve!

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75x = 60 •100

÷ 75 ÷ 75

x=80

60 is 75% of ***80***

Finding the percent, given the part and whole:

Example: What % of 128 is 32?

First, set up your proportion:

$$\frac{32}{128} = \frac{\%}{100}$$

Then, solve!

$$\frac{32}{128} = \frac{\%}{100}$$

32 • 100 = 128x

÷ 128 ÷ 128

25 = x

32 is ***25%*** *of 132*

Real-World Applications of Percents:

Tips and Commission: These are earned for sales or service. These will be **ADDED** to the original amt.

Taxes: These are applied by the government to items that we buy, in order to pay for public servants, community projects, etc. These will be **ADDED**.

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Percent Problems

"Percent" means "out of 100."

$$\frac{\text{Percent}}{100} = \frac{\text{Part (is)}}{\text{Whole (of)}}$$

The variable can be placed in the Part, Whole, or Percent.

1) What is 30% of 250?	**2)** 21 is 35% of what number?
3) 84 is 75% of what number?	**4)** What percent of 30 is 12?
5) What percent of 98 is 147?	**6)** What is 16% of 15?
7) Helena got 90% of the questions correct on a test with 60 questions. How many questions did she get correct?	**8)** Hunter wants to go on a cruise that costs $499 per person. If the tax costs 15%, what will be the total cost for 3 people?
9) Josh bought a video game on sale for 40% off. If the original price was $39.50, what was the sale price?	**10)** Mrs. Bothers' bill at Waffle House was $32.90. If she left a 20% tip for her server, how much did she pay in all?
11) Silas the Salesman makes 6% commission off of each used car he sells. If he sold a car for $12,904, how much commission did he make?	**12)** Evan bought a smoothie for $3.40, but he had a 25%-off coupon. What did he pay after using the coupon AND applying 5% tax?

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J

% Percent Change %

When an amount changes, it is sometimes helpful to find the ***"percent change".***
This can be a ***"percent increase"*** if the amount went up, or a ***"percent decrease"*** if the amount went down. Both are calculated the same way:

$$\text{percent of change} = \frac{\text{amount of change}}{\text{original amount}}$$

Example 1: A year's tuition to Duke University is about $40,000. It is expected to be $48,000 by the time Nick goes to college. What is the percent change?

$$\frac{48,000-40,000}{40,000} = \frac{8,000}{40,000} = \frac{8}{40} = 40\overline{)8.0}^{.2} = 20\%$$

Since the tuition is going up, we'd say this is a **20% increase**.

Example 2: A year's tuition to UGA is about $22,000. Ridhi's scholarship is going to bring this down to $11,000. What is the percent change?

$$\frac{22,000-11,000}{22,000} = \frac{11,000}{22,000} = \frac{11}{22} = 22\overline{)11.0}^{.5} = 50\%$$

Since the tuition is going down, we'd say this is a **50% decrease**.
(Which makes sense, right? She's only paying ½ of the original amount!)

Example 3: A year's tuition to KSU is about $5,600. Owletta mistakenly thought that the tuition was $7,000. What was her percent error?

Note: "Percent error" is calculated in exactly the same way as percent change!

$$\frac{7,000-5,600}{5,600} = \frac{1,400}{5,600} = \frac{14}{56} = 56\overline{)14.00}^{.25} = 25\%$$

Owletta was off by 25%. So, this was a **25% error**.

YOU TRY! Find the percent change for each problem below.

1) A pennant did cost $8.00, but it's on sale for $6.40. What is the percent decrease?	2) Bowl game tickets were purchased for $250. Now they are selling for $350. What is the percent increase?	3) Muhammad thought the distance from Marietta to Georgia Tech is 24 miles, but it is actually 15 miles. What is the percent error?	4) Lauren spent $150 on college textbooks last semester, and $195 this semester. What is the percent increase?

K

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K

Candy Capers

Part 1

Record your results in the table below. Then answer the questions about the activity.

Vial #	Estimate	Actual	Was your estimate under or over the actual amount?	Difference between estimate and actual	Percent off the actual amount
1					
2					
3					
4					
5					

1. How can you determine how close you guessed to the actual number? _____

   _____

2. Suppose you guessed 30 candies but there were only 25. You were _____ over.

   On a second vial, you guessed 50 but there were 59, so you were _____ under. How could you find your average error in this situation? _____

   _____

3. The mean percent I was off is _____. Explain how you determined this average. _____

   _____

4. If the actual number of candies in a vial was 38, how many candies do you predict you would have estimated?

   _____ Explain how you determined this prediction. _____

   _____

L

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L

A Week in the Life of _____*
(Name)

Directions: Spin each spinner once. Record the values in the boxes below. Then use these values as you work through the activity. Then determine who in your group has the most money left at the end of the week.

Spinner 1	Spinner 2	Spinner 3

1. You work 40 hours per week at a rate of $_____ per hour. Your boss gives you a _____% raise.
   Spinner 1 Spinner 2

   Determine how much you now make per hour: _____
   How much do you make now per week? [ ]

2. On Monday, you buy dinner that costs $_____. You leave a 15% gratuity for the waiter.
   Spinner 3

   Determine how much gratuity you leave. _____
   How much do you leave in all? [ ]

3. On Tuesday, you buy 2 magazines that cost $_____ each. You must also pay an 8% sales tax.
   Spinner 1

   How much do 2 magazines cost? _____
   How much is the tax on 2 magazines? _____
   How much do you pay in all? [ ]

4. On Thursday, you buy a new shirt that normally costs $_____. There is a sign that says the shirt is on sale for
   Spinner 3
   20% off. However, you must also pay an 8% sales tax on the discounted price.

   What is the sale price of the shirt? _____
   How much tax do you pay on the sale price? _____
   How much do you pay in all? [ ]

5. On Saturday, you decide to reward yourself by attending the carnival. The normal price of the carnival tickets is

   $_____ but because it is opening day the tickets are on sale for 15% off. How much did you spend on a
   Spinner 2
   carnival ticket? [ ]

6. What a busy week! Use your new salary to determine how much money you have left at the end of the week to deposit into your savings account.

   Use the boxed answers above to determine how much money is left at the end of the week._____

Who in your group had the most money left at the end of the week? _____

M

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