

UNIT 6 Ratios, Rates, Proportions and Measurement Conversions

CCM6+7+

Name _____

Teacher _____

Estimated Test Date _____

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Unit 7 Vocabulary

equivalent ratio	ratios that name the same comparison
rate	compares two quantities that have different units of measure
ratio	a comparison of two quantities using division
unit rate	a rate in which the second quantity in the comparison is one unit
tape diagram	a drawing that looks like a segment of tape, used to illustrate number relationships; also known as a strip diagram, bar model, fraction strip, or length model
cross product	the product of numbers on the diagonal when comparing two ratios
proportion	an equation stating two ratios are equivalent
proportional	term used when two ratios are equivalent



Comparing Ratios and Rates



The Fancy Fruit Juice Company makes grape juice and apple juice. A small barrel of grape juice is mixed using 12 parts grape concentrate and 30 parts water. A large barrel of apple juice is mixed using 16 parts apple concentrate and 36 parts water. Which barrel is fruitier?

Today's Main Ideas: Ratios and Rates

Big Idea	Definition	Example
Ratio		
Rate		
Unit Rate		

Dimensional Analysis...converting between units....set it up so the right things cancel!

Convert 10 mi/h to feet per min

$$\frac{10 \text{ miles}}{1 \text{ hour}} = \frac{\text{_____} \text{ feet}}{1 \text{ mile}} = \frac{1 \text{ hour}}{\text{_____} \text{ minutes}} = \text{feet per minute}$$

Convert 3.5 quarts/min to gal/h

$$\frac{3.5 \text{ quarts}}{1 \text{ min}} = \frac{\text{_____} \text{ min}}{\text{_____} \text{ hour}} = \frac{\text{_____} \text{ gal}}{\text{_____} \text{ quarts}} = \text{gal per hour}$$

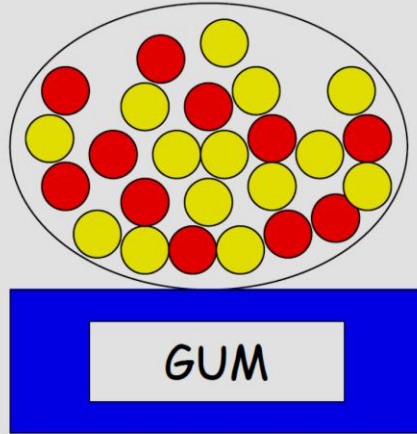
Convert 12 cm/s to m/h

$$\frac{12 \text{ cm}}{1 \text{ s}} =$$

Convert 8 in/s into ft/h

Gumball Machines Task #1

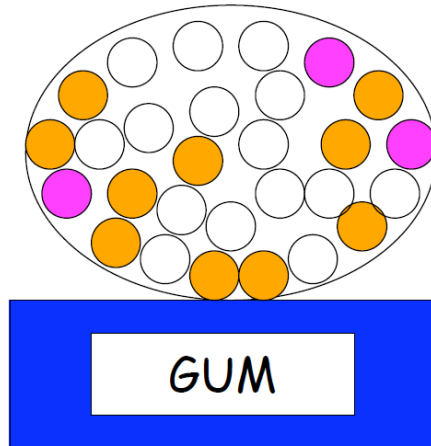
The Gumball Company fills machines so that for every three red gumballs there are four yellow gumballs.



The quality control manager noticed that this machine was not filled correctly. What should be done to correct this situation so that for every three red gumballs there are four yellow gumballs? Show your solutions and explain how you found these solutions.

Gumball Machine Task #2

The Gumball Company fills machines so that for every three orange (O) gumballs, there are one pink (P) and four white (W) gumballs in the machine.



This machine does not meet the standard required by the company. What can be done to this machine so that it will pass inspection by the company quality control manager? Explain how you solved the problem.

RATES and UNIT RATES

Key Word	Definition	Examples
<p style="text-align: center; font-size: 24pt; font-weight: bold;">Rate</p>	<p>A rate is a _____ comparing two things that are different _____.</p> <p>Rates have to be _____, too!</p> <p>_____ per _____: $\frac{\text{first is on top}}{\text{second is on bottom}} =$ $\text{first \#} \div \text{second \#}$</p>	<p>a) The car went 120 miles on 4 gallons.</p> <p>b) To make 24 cookies you need 2 eggs in the recipe.</p> <p>Why are these examples RATES not RATIOS?</p>
<p style="text-align: center; font-size: 24pt; font-weight: bold;">Unit Rate</p>	<p>A unit rate is a special kind of rate where you _____ to get a number of this unit per _____ of that unit.</p> <p>Unit Rates help you find the _____ at the grocery store.</p> <p>If your unit rate is a price, it is called a _____.</p> <p>This is the _____ per _____ of the items.</p> <p>Unit Price = _____ \div the # of items</p> <p style="text-align: center;">**Use a calculator to divide!**</p>	<p>a) Dear Aunt Sally drove 84 miles in 3 hours. What was her average speed in <u>miles per hour</u>?</p> <p>b) The grocery store is selling a 6-pack of Hershey bars for \$3.94. What is the <u>price per bar</u>?</p> <p>c) Usain Bolt’s world record run is 100 meters in 9.58 seconds. How many <u>meters per second</u> is this?</p> <p>d) Food Lion sells a dozen donuts for \$3.49. Currently they are half-price. What is the normal price per donut?</p> <p>What is the sale price per donut?</p>

Ratio Tables

1. My lemonade has a ratio of 2 lemons to 3 cups of water. If I want to have 20 cups of lemonade, how many lemons do I need?

Lemons	Total
2	5
?	20

Using the ratio table, I can see looking at the whole that $5 \times 4 = 20$, so to find how many lemons I need I would do $2 \times 4 = \underline{\quad}$. So I need lemons for 20 cups of lemonade.

2. The SPCA must keep a 2:5 ratio of cats to dogs. If they have 12 cats, how many dogs should they have?

Cats	Dogs
2	5
12	?

Answer: _____

3. The school band needs a 5:4 ratio of flutes to clarinets. If there are 27 students total who play the flute or clarinet, how many play the flute?

Flute	Total



Answer: _____

4. Megan charges \$28 for 3 hours of swimming lessons. How much does Megan charge for 2 hours of swimming lessons?

Hours	Cost

Answer: _____

RATIOS NOTES

Big Ideas	Notes	Examples
Ratio	A ratio is a comparison of two things in the same unit.	There are 2 peanut butter sandwiches for every 3 turkey sandwiches.
3 ways to write a ratio	1. as a _____ 2. with a _____ () 3. with the word "_____"	1. 2. 3.
part-to-part ratio	Each number is a _____ of the entire set. **Your final answer should be _____.	a) In a gumball machine there are only red and purple gumballs. If there are 20 gumballs in the machine and 12 are red, what is the ratio of purple to red? b) What is the ratio of white to dark gumballs?  Why are these part-to-part?
part-to-whole ratio	This is always a _____ compared to the entire set. **Your final answer should be _____.	 Super Flying Pets What is the ratio of cats to all animals? Why is this part-to-whole?

Ratios/Rates HW in textbook: pages 290-291 #17-45 odds only

MATHSCAPE BUYER BEWARE

Lesson 2: The Best Snack Bar Bargain

You can use a price graph to compare unit prices for different products. In this lesson you will use a price graph to determine the price at different quantities of a snack bar if you were paying by the ounce. Then you will construct a price graph to compare the prices of five different products.

Use a Price Graph to Find Unit Price

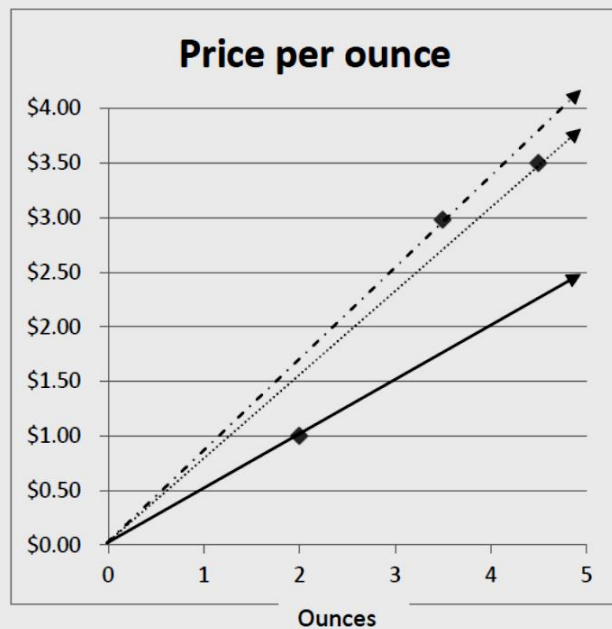
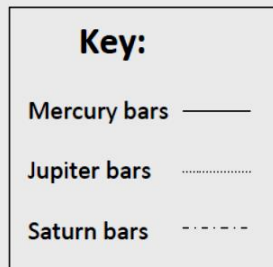
The graph below shows the prices for three different snack bars:

Mercury bars are \$1.00 for 2 oz.

Jupiter bars are \$2.98 for 3.5 oz.

Saturn bars are \$3.50 for 4.5 oz.

Each of the three dots on the graph shows the price and the number of ounces for one of the snack bars. Each line shows the price of different quantities of the snack bar at the same price per ounce.



1. What is the price of a 3-oz Mercury bar?
2. What is the price of a 0.5-oz Saturn bar?
3. Which snack bar has the lowest unit price? _____ Highest unit price? _____
How do you know this by just looking at the graph?

Relating Tables and Graphs

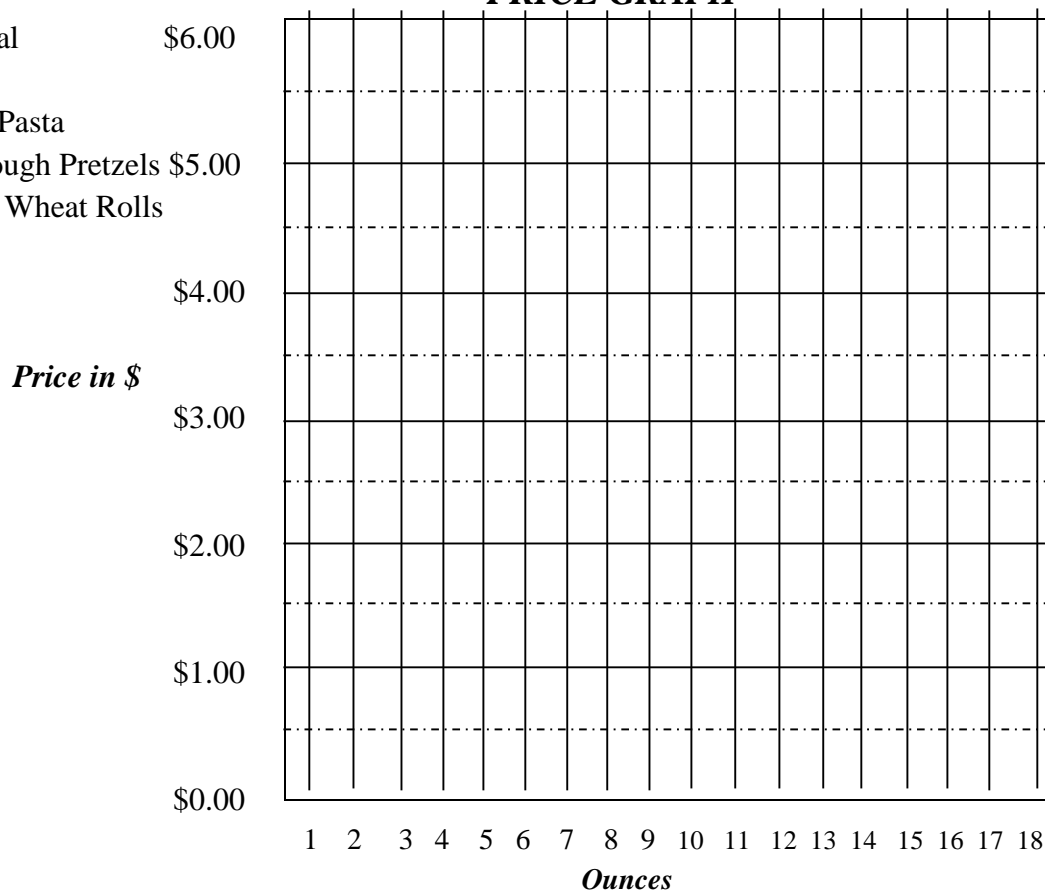
	Oatmeal	Tuna	Penne Pasta	Sourdough Pretzels	Whole Wheat Rolls
1 oz					
3 oz					
7.5 oz		\$2.00			
8 oz			\$1.00		
9 oz					\$1.60
12 oz				\$2.60	
14 oz	\$2.40				

Graph the information onto your own price graph. Use *different colors or styles* of lines for each item.

KEY:

- _____ = Oatmeal \$6.00
- _____ = Tuna
- _____ = Penne Pasta
- _____ = Sourdough Pretzels \$5.00
- _____ = Whole Wheat Rolls

PRICE GRAPH



- Graph the prices per ounces shown in the chart above. For each item, use a different color or style and connect the point created to the origin (0 oz, \$0).
- Using your graph, estimate the missing values above in the chart.
- The most expensive product per ounce is _____ because _____.
- The least expensive product per ounce is _____ because _____.

5. Besides looking at your price graph, what is another way you could have used the information in the table to fill in the missing values in the chart?
6. Using your price graph, about how much would you pay for 6 ounces of sourdough pretzels?
7. Using your price table, about how much would you pay for 5 ounces of whole wheat rolls?
(Hint: look at the price per one ounce and then use that to calculate the price per five ounces.)
8. Crabtree Middle School is holding a fundraiser dinner for 2,000 people. If the students need to cook 4 ounces of pasta per person, how much will it cost to buy enough penne pasta for the fundraiser?
Hint: First find the cost for 4 ounces....that's for one person....you need it for 2,000 people!
9. While shopping for oatmeal, Daphne's mom finds another brand of oatmeal on sale for \$2.65 for 16 ounces.
 - a. Which oatmeal is the better buy?
 - b. How much will she save buying the better buy instead of the other brand (for 16 ounces)?**SHOW YOUR WORK!**
10. Shamik's family is moving from Raleigh, NC, to Los Angeles, CA. They have to drive 2,520 miles. His dad says he knows he can drive 360 miles in 6 hours. If Shamik's family drives 8 hours per day, about how many days of driving will it take for them to drive from Raleigh to Los Angeles?
Hint: Find the unit rate (miles per hour)....then the amount of miles per day (unit rate x 8 hours)...then calculate the amount of days for 360 miles.

Finding the Better Buy

Use your calculator to find the unit price for each of the following. Round answers to the nearest cent.

1.	7 oz of crackers for \$1.19	\$ _____ per cracker
2.	14 oz of cottage cheese for \$1.19	\$ _____ per ounce
3.	16 boxes of raisins for \$5.60	\$ _____ per box

Find the better buy based on unit price.

4. A 35-oz. can of Best Brand Plum Tomatoes is on sale for \$0.69. A 4-lb can of Sun Ripe Plum Tomatoes is \$1.88.

5. A can of Favorite Dog Food holds 14 oz. Four cans are \$1.00. The price of **three cans** of Delight Beef Dog Food, **each containing 12 oz**, is \$0.58.

6. For each item in the chart below, calculate the unit price and circle the better buy.

	Item	Jefferson Auto Stores	Tom's Auto Parts
a.	oil	12 qt for \$10.99 \$ _____ per quart	6 qt for \$5.99 \$ _____ per quart
b.	anti-freeze	12 oz for \$3.79 \$ _____ per ounce	6 oz for \$1.79 \$ _____ per ounce
c.	auto wax	6 cans for \$14.29 \$ _____ per can	5 cans for \$12.98 \$ _____ per can

CHALLENGE

7. Six cans of fruit drink are on sale for \$1.95. Individually, the price of each can is \$0.35. How much does Tanya save buying 6 cans on sale?

8. Tubes of oil paint can be bought in sets of 5 for \$13.75 or bought separately for the unit price. What would be the price of two tubes of this oil paint?

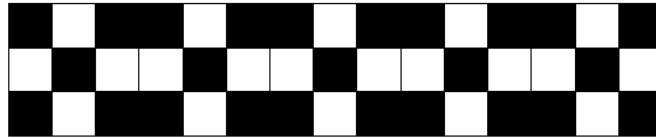
Double Number Line Diagrams for Ratios

MATHSCAPE BUYER BEWARE

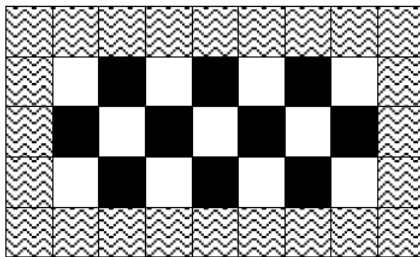
Lesson 5: Quilting Ratios

A ratio is a comparison of one number to another by division. In this lesson you will use ratios to describe a design.

Leticia is designing a quilt pattern that is made up of squares. One row of the quilt is shown below.



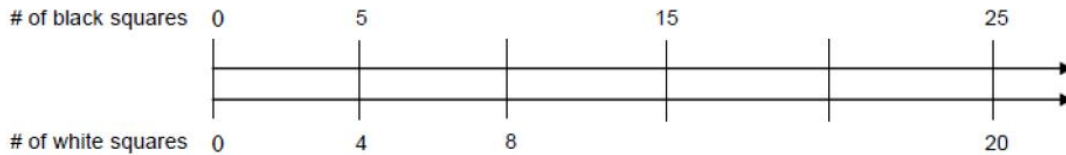
1. What is the ratio of black squares to white squares? _____
Is this a part-to-part or a part-to-whole ratio? _____
2. What is the ratio of black squares to all the squares in the row? _____
Is this a part-to-part or a part-to-whole ratio? _____
3. Gino is designing a quilted placemat shown below. Find two different ratios within the design. Describe them using words and numbers, and classify them as part-to-part or part-to-whole.



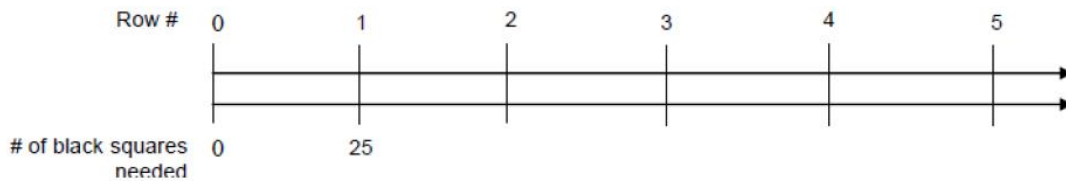
Understanding Ratios Using Double Number Lines

Use the information from *MathScape* Lesson 5: "Quilting Ratios" to help you complete the following questions.

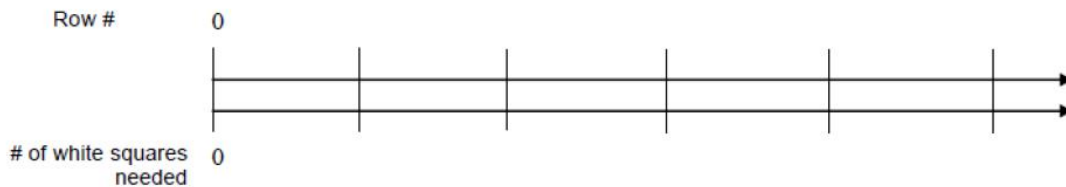
- Leticia used black and white squares for her quilt. Complete the following double number line diagram using the first row of her quilt.



- Leticia is planning out the rest of her quilt. She wants to use a double number line to figure out how many squares of each color she will need depending on the number of rows she plans on having.
 - Make a double number line diagram to help her plan how many black squares she will need if she wants up to 5 rows in her quilt.



- Make a double number line diagram to help her plan how many white squares she will need if she wants up to 5 rows in her quilt.

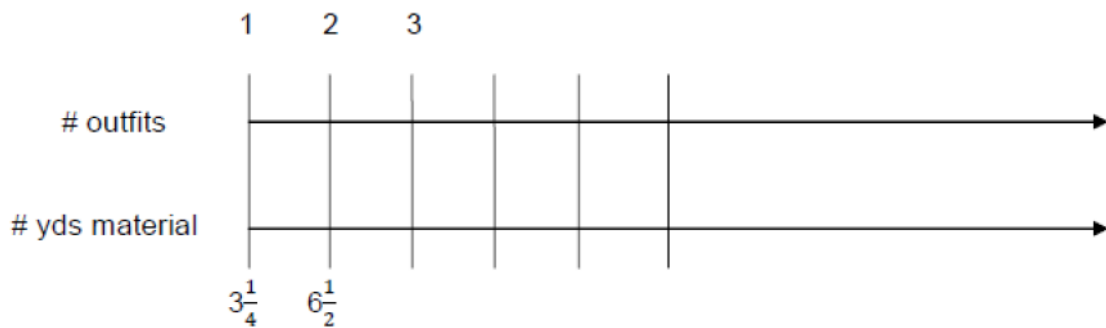


- How is unit rate shown on the double number line diagrams? What is the unit rate of black squares per row? White squares per row?

3. Compare Leticia's ratio of black squares to white squares and Gino's ratio of white squares to striped squares. Are they equivalent ratios? Use double number line diagrams to support your answer.

4. In Leticia's quilt, what is the unit rate of black squares per white square? How could we use this information to fill in her double number line in question 1 further?
 (Hint: what numbers could we add between 0 and 4 on the white squares line? What information goes with these numbers on the blue line?)

5. Carey and her friends want to make matching outfits for twin day at school. Her mom has 23 yards of cloth. If each outfit requires $3\frac{1}{4}$ yards of material, how many outfits can her mom make? Use a double number line to solve.

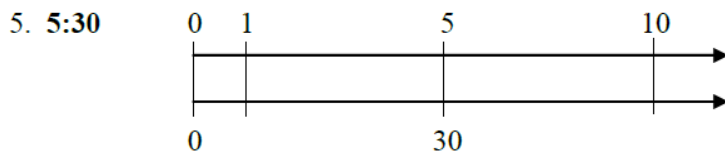


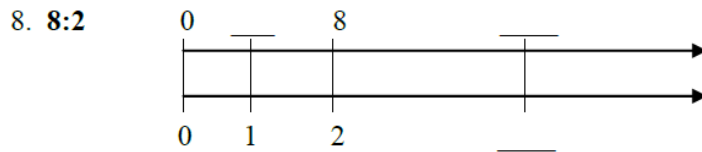
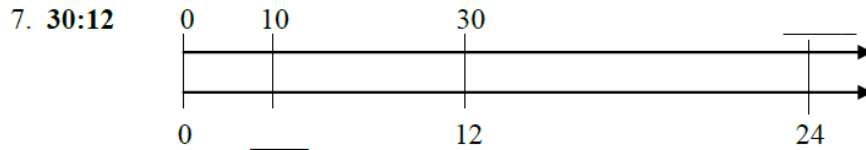
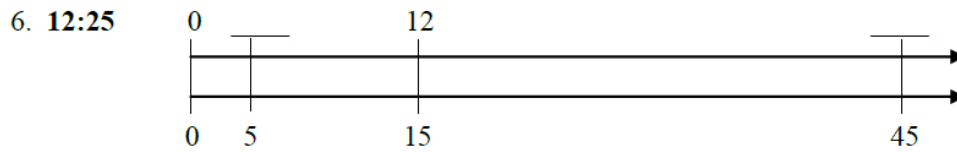
~~~~~REVIEW~~~~~

Write each ratio as a fraction in lowest terms.

1. 6 to 8
2. 8:44
3.  $\frac{60}{32}$
4. 20 to 30

Use double number lines to show equivalent ratios. Fill in the blanks then write the equivalent ratios.





The data table below shows how some students spent their time from 4p.m. to 5p.m. yesterday.

Decide if statements #9-12 are TRUE or FALSE.

| How Students Spent Their Time |               |
|-------------------------------|---------------|
|                               | # of Students |
| Homework                      | 10            |
| Sports Practice               | 5             |
| Music Practice                | 5             |

|               |   |
|---------------|---|
| Chores or Job | 6 |
| Other         | 4 |

9. One out of every three students did homework.

10. One out of every five students did chores.

11. The ratio of homework to music is 5 to 2.

12. The ratio of chores to music or sports is 2 to 3.

Do you like how double number line diagrams work? Explain your answer.

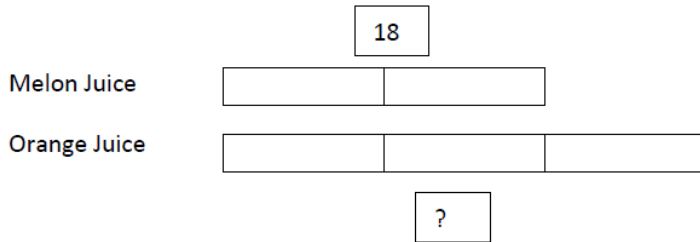
Are there other ways you know how do show this?

**Practice Solving Ratios Using Tape Diagrams**

*Directions: Draw a tape diagram for each problem to help answer the question. Be sure to label what each represents.*

**Example:**

Emily created a new drink by mixing 2 parts melon juice with 3 parts orange juice. If Emily used 18 ounces of melon juice, how many ounces of orange juice would be needed?



2 bars = 18 ounces, so 1 bar = 9 ounces. Orange juice has 3 bars so  $3 \cdot 9 = 27$  ounces

1. For every 5 calendars that Austin sold, Lara sold 4. Austin sold 45 calendars last month. How many calendars did Lara sell?
2. For every 3 cars that Kelly sells, Jane sells 4. Jane sold 32 cars last month. How many cars did Kelly sell?
3. The ratio of boys to girls who participated in the pie-eating contest was 7:2. There were 35 boys. How many girls participated?
4. The ratio of the length of Grace's string to the length of Peter's string is 5:6. Peter's string measures 60 inches. How long is Grace's string?
5. The ratio of blue marbles to yellow marbles is 5:6. If there are 42 yellow marbles how many blue marbles are there?
6. The ratio of trucks to minivans in the parking lot is 2:5. If there are 14 trucks, how many minivans are there?





Use tape diagrams, double number line diagrams, or ratio tables to solve and support your answers to the following problems.

1. An advertisement claims that dentists that recommended the new zigzag toothbrush outnumber the dentists that don't by a ratio of 5 to 3. If 264 dentists were interviewed, how many recommended the toothbrush?
2. A quart (32 ounces) container of yogurt contains 920 calories. About how many calories would there be in a 5-ounce serving?
3. The scale on a map is 3 inches equals 4 miles. How far is the actual distance between two towns that are 10.5 inches apart on the map?
4. Anya's class is selling wrapping paper. For every 5 rolls they sell, they make a profit of \$1.80. If her class has a goal of making a \$180 profit, how many rolls of wrapping paper do they need to sell?
5. Tammy wants to make one can of fruit punch. If the recipe calls for 2.5 cans of water and one can of concentrate, how much of each ingredient will she use? (Hint: what part of a can of water and what part of a can of concentrate will she need?)

Another way to find parts of equivalent ratios and rates, besides double number lines and tape diagrams is....

# PROPORTIONS!

**Proportions are two equal ratios or two equal rates.**

You can cross multiply to solve proportions....

$$\frac{x}{9} = \frac{4}{6}$$

Cross multiply:  $6x = 4 \cdot 9$

$$6x = 36$$

$$x = 6$$

Now check:  $6 \cdot 6 = 4 \cdot 9$

$$36 = 36 \checkmark$$

Spend time tonight reading textbook pages 294-295.

Proportion Applications...

Scale Drawings and Similar Figures are common proportional situations...

- a) A tree casts a shadow 8 ft long. A 6-ft man casts a shadow 4 ft long. The triangle formed by the tree and its shadow is similar to the triangle formed by the man and his shadow. How tall is the tree?
  
- b) Jacques has a scale drawing of his bedroom with a scale of 1 cm: 0.4 m. On the drawing, the front window is 3cm from the door. What is the actual distance from the window to the door in the room?
  
- c) The cities of Jackson, Mississippi, and Carson City, Nevada, are 1,750 miles apart. On a map these cities are 5 inches apart. What is the scale of the map?

Your homework is pages 296-298 #24-25, 28-31, 61-64, and packet page 20

**\*\*USE A CALCULATOR...but still show your work (the proportion).**

Kuta Software - Infinite Pre-Algebra

Name \_\_\_\_\_

### Similar Figure Word Problems

Date \_\_\_\_\_ Period \_\_\_\_\_

**Answer each question and round your answer to the nearest whole number.**

- 1) A 6 ft tall tent standing next to a cardboard box casts a 9 ft shadow. If the cardboard box casts a shadow that is 6 ft long then how tall is it?
- 2) A telephone booth that is 8 ft tall casts a shadow that is 4 ft long. Find the height of a lawn ornament that casts a 2 ft shadow.
- 3) A map has a scale of 3 cm : 18 km. If Riverside and Smithville are 54 km apart then they are how far apart on the map?
- 4) Find the distance between Riverside and Milton if they are 12 cm apart on a map with a scale of 4 cm : 21 km.
- 5) A model house is 12 cm wide. If it was built with a scale of 3 cm : 4 m then how wide is the real house?
- 6) Oak Grove and Salem are 87 mi from each other. How far apart would the cities be on a map that has a scale of 5 in : 29 mi?
- 7) A map has a scale of 2 in : 6 mi. If Clayton and Centerville are 10 in apart on the map then how far apart are the real cities?
- 8) A statue that is 12 ft tall casts a shadow that is 15 ft long. Find the length of the shadow that a 8 ft cardboard box casts.

**Answer each question and round your answer to the nearest tenth.**

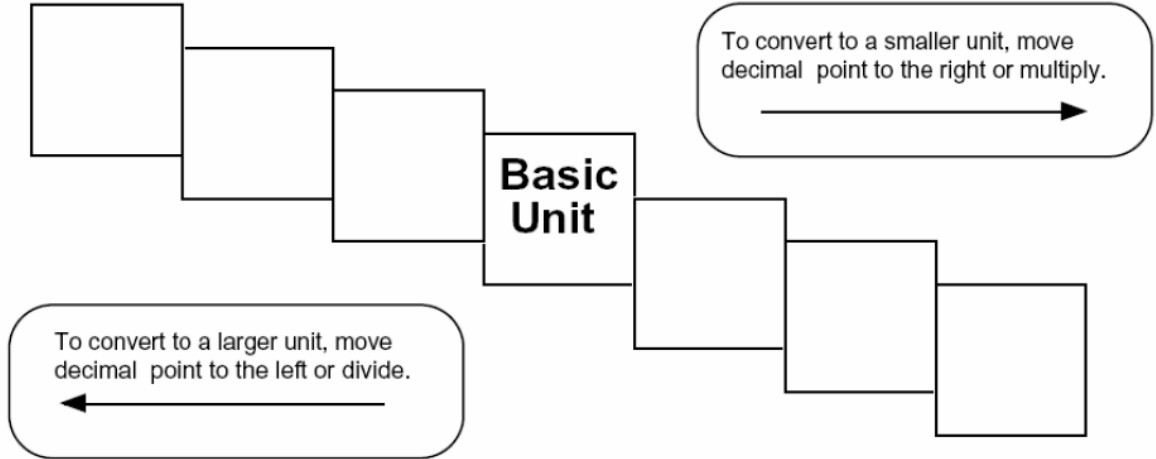
- 9) A model house has a scale of 1 in : 2 ft. If the real house is 26 ft wide then how wide is the model house?
- 10) A 6.5 ft tall car standing next to an adult elephant casts a 33.2 ft shadow. If the adult elephant casts a shadow that is 51.5 ft long then how tall is it?
- 11) If a 42.9 ft tall flagpole casts a 253.1 ft long shadow then how long is the shadow that a 6.2 ft tall woman casts?
- 12) Georgetown and Franklin are 9.7 in apart on a map that has a scale of 1.1 in : 15 mi. How far apart are the real cities?

# Metric Mania

Name \_\_\_\_\_

## Metric Conversions

Fill in the boxes in the stair step diagram.



Try these conversions, using the ladder method.

$1000 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

$1 \text{ L} = \underline{\hspace{2cm}} \text{ mL}$

$160 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$

$14 \text{ km} = \underline{\hspace{2cm}} \text{ m}$

$109 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

$250 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

Compare using  $<$ ,  $>$ , or  $=$ .

$56 \text{ cm} \bigcirc 6 \text{ m}$

$7 \text{ g} \bigcirc 698 \text{ mg}$

WATCH NBCLearn VIDEO about USA and Metric System...



[http://static.nbclearn.com/files/icue/govt\\_politics/constitutional\\_underpinnings/interactive\\_constitution/141589\\_130x100.jpg](http://static.nbclearn.com/files/icue/govt_politics/constitutional_underpinnings/interactive_constitution/141589_130x100.jpg)

# Metric Mania

Name \_\_\_\_\_

## Metric Conversions

Write the correct abbreviation for each metric unit.

1) Kilogram \_\_\_\_\_

4) Milliliter \_\_\_\_\_

7) Kilometer \_\_\_\_\_

2) Meter \_\_\_\_\_

5) Millimeter \_\_\_\_\_

8) Centimeter \_\_\_\_\_

3) Gram \_\_\_\_\_

6) Liter \_\_\_\_\_

9) Milligram \_\_\_\_\_

Try these conversions, using the ladder method.

10) 2000 mg = \_\_\_\_\_ g

15) 5 L = \_\_\_\_\_ mL

20) 16 cm = \_\_\_\_\_ mm

11) 104 km = \_\_\_\_\_ m

16) 198 g = \_\_\_\_\_ kg

21) 2500 m = \_\_\_\_\_ km

12) 480 cm = \_\_\_\_\_ m

17) 75 mL = \_\_\_\_\_ L

22) 65 g = \_\_\_\_\_ mg

13) 5.6 kg = \_\_\_\_\_ g

18) 50 cm = \_\_\_\_\_ m

23) 6.3 cm = \_\_\_\_\_ mm

14) 8 mm = \_\_\_\_\_ cm

19) 5.6 m = \_\_\_\_\_ cm

24) 120 mg = \_\_\_\_\_ g

Compare using <, >, or =.

25) 63 cm ○ 6 m

27) 5 g ○ 508 mg

29) 1,500 mL ○ 1.5 L

26) 536 cm ○ 53.6 dm

28) 43 mg ○ 5 g

30) 3.6 m ○ 36 cm

Other conversions...remember dimensional analysis?

31) 8 gal to \_\_\_\_\_ pints

32) 7500 pounds to \_\_\_\_\_ tons

33) 3 mi/gal to \_\_\_\_\_ ft/qt

34) 8 ft/min to \_\_\_\_\_ in/s

Converting between systems...Use the CHARTS! Don't memorize them!

# Converting between Metric and Customary

Set up two equal ratios and find the missing piece. Use the conversion charts below.

### METRIC to CUSTOMARY:

| Metric Units | Customary Units                |
|--------------|--------------------------------|
| 1 centimeter | 0.394 inch                     |
| 1 meter      | 3.281 feet<br>or 1.093 yards   |
| 1 kilometer  | 0.621 mile                     |
| 1 gram       | 0.035 ounce                    |
| 1 kilogram   | 2.205 pounds                   |
| 1 milliliter | 0.034 fluid ounce              |
| 1 liter      | 1.057 quart<br>or 0.264 gallon |

### CUSTOMARY to METRIC:

| Customary Units | Metric Units                         |
|-----------------|--------------------------------------|
| 1 inch          | 2.54 centimeters                     |
| 1 foot          | 30.48 centimeters<br>or 0.3048 meter |
| 1 yard          | 0.914 meter                          |
| 1 mile          | 1.609 kilometers                     |
| 1 ounce         | 28.350 grams                         |
| 1 pound         | 454 grams<br>or 0.454 kilogram       |
| 1 fluid ounce   | 29.574 milliliters                   |
| 1 quart         | 0.946 liter                          |
| 1 gallon        | 3.785 liters                         |

Now, let's try some:

- a) 5 inches = \_\_\_\_\_ cm \*We are converting from inches to cm so use the chart on the \_\_\_\_\_.

$$\frac{1 \text{ inch}}{2.54 \text{ cm}} = \frac{5 \text{ inches}}{x}$$

- b) 8 km = \_\_\_\_\_ mi \*We are converting from km to mi so use the chart on the \_\_\_\_\_.

$$\frac{1 \text{ km}}{0.621 \text{ mi}} = \frac{8 \text{ km}}{x}$$

- c) 18 g = \_\_\_\_\_ oz \*Use the chart to the \_\_\_\_\_.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

- d) 3.5 qt = \_\_\_\_\_ L \*Use the chart to the \_\_\_\_\_.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

READ Textbook pages 292-293 and DO problems 1-19 ODDS on page 293









**\*\*\*AND Textbook page 342 #1-14\*\*\***