Grade Level/Course: Grade 6 Math

Lesson/Unit Plan Name: Ratios: Finding the Unit Rate

Rationale/Lesson Abstract: This lesson teaches a variety of methods for solving ratio problems by finding the unit rate.

Timeframe: One hour

Common Core Standard(s): 6.RP.2: Understand the concept of a unit rate a/b with b ≠ 0, and use rate language in the context of a ratio relationship.

Instructional Resources/Materials:

- Warm-up, pencil, paper (for each student)
- Document camera
- Chart paper, pens
- Painter's Tape
- Index cards

Prerequisites:

- The relationship between repeated addition and multiplication.
- The inverse relationship between multiplication and division.
- The use of ratio language to describe the relationship between two quantities.
- Moving between equivalent fractions and decimals.
- Simplifying fractions.
- Multiplying by "an equivalent form of one."
- Review of division rules.

Vocabulary:

Ratio: A comparison of two or more quantities.
Fraction: a comparison of two quantities using division.
Part to part: a relationship where the two terms, if added together, equal the whole.
Part to whole: a relationship with two terms, where the first term is a part of the second term.
Unit Rate: A special ratio in which the denominator or second term is a 1, and the terms have different units.
Additive: a relationship between values that involves addition.
Multiplicative: a relationship between values that involves multiplication.
Warm Up: Give students 10 minutes to complete the warm-up (attached below). Review the answers for each of the four problems.

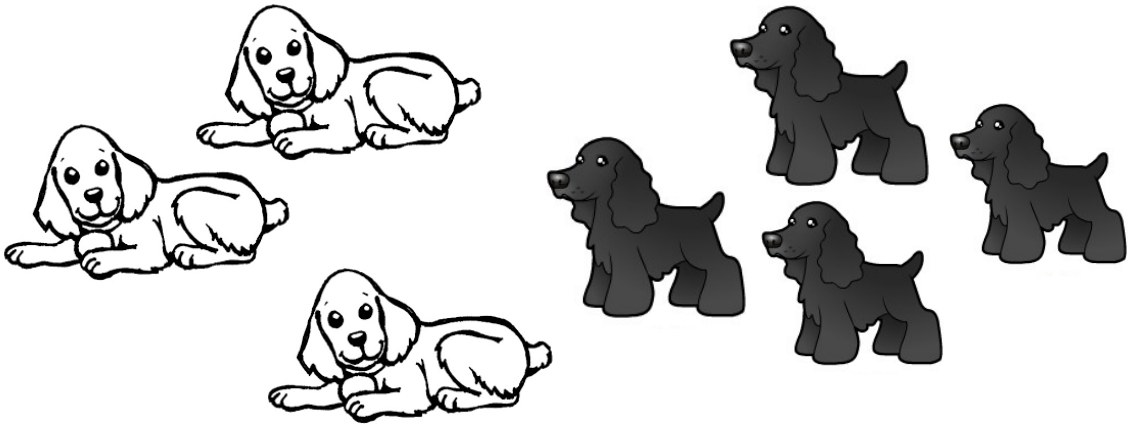
Activity One: <u>Materials:</u> Ratio/Fraction cards, T-chart worksheet, poster paper or white board.

- *Ratio/Fraction Cards will need to be cut out before the lesson (one set per group of 3).*

Introduce the vocabulary words "part-to-part" and "part-to-whole". Using a document camera, show the scenario below, and then give an example of each:

"*If we say, 'There are three white dogs for every four black dogs,' that would be **part-to-part**."*
*"If we say, 'There are four black dogs out of seven total dogs,' that would be **part-to-whole**."*

"*In groups, use this scenario to sort the eight ratio/fraction cards into **part-to-part** or **part-to-whole.** Every card is true for this group of puppies."*



When students are done, check their sorting, and ask them if they can make any observations about where the ratio cards are, and where the fraction cards are. Lead them to the conclusions, below:

<u>Conclusions:</u>

- **Ratios** can express either a part-to-part or a part-to-whole relationship.
- Understanding the context (word problem, picture, etc.) is the key to understanding a ratio relationship.
- **Fractions** always express a part-to-whole ratio.

Finding the Unit Rate Using Tables and Division

Activity 2: Natasha the Babysitter

Present this problem to the class:

> Natasha earned $42.50 while babysitting for 5 hours. At this rate, how much will she be paid to babysit for 7.5 hours?

Allow students 5 minutes to come up with a group solution to this problem. Then, allow students to come up and share their solutions, right or wrong, using the document camera. Discuss the correct answer (below), and show other methods for solving.

One way to solve this problem is to start by finding the **unit rate.**

**A unit rate is a special ratio in which the denominator or second term is 1.*

To find a unit rate, decide which term you would like to solve for. In this problem, we want to know how much money Natasha earns in one hour. Therefore, we should create a ratio with "hours" as the denominator, and divide.

$$\frac{money}{hours} = \frac{42.50}{5}$$

$$= \$8.50\ per\ hour, or\ \frac{8.5}{1}, or\ 8.5:1.$$

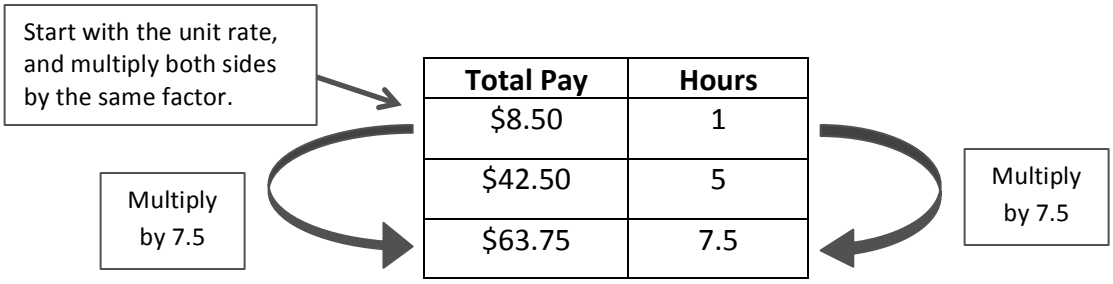
Notice that in a ***unit rate,*** the second term or denominator is a 1.

Once you have the unit rate, it is possible to find how much money Natasha will make in 7.5 hours, by making a table and using repeated addition:

	Total Pay	Hours	
	$8.50	1	
	$42.50	5	
+ 8.50	$51.00	6	+1
+ 8.50	$59.50	7	+1
+ 4.25	$63.75	7.5	+0.5

Therefore, Natasha makes $63.75 in 7.5 hours.

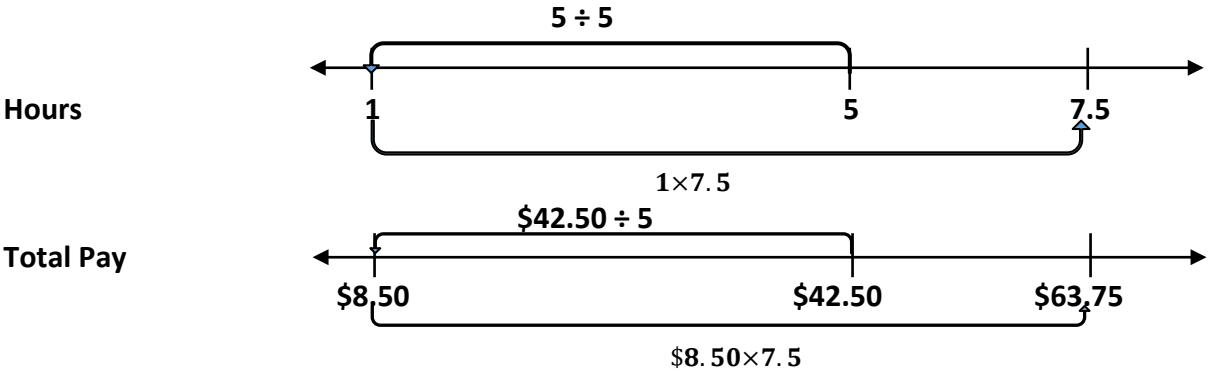
Another way to find the answer is to start with the unit rate, and multiply by the number of hours. A table can be used to keep the information organized.



Total Pay	Hours
$8.50	1
$42.50	5
$63.75	7.5

$\therefore \$8.50 \times 7.5 \text{ hours} = \$63.75$

Finding the Unit Rate Using a Double Number Line ***Note: This shows the operations done to solve this problem. Depending on students exposure to a double number line you might want to include more equivalent ratios when creating the number line.**



*Double number lines can be useful ways of displaying the multiplicative relationship between two quantities. They are also a useful visual model when multiplying or dividing a ratio by an equivalent form of one to find an unknown, non-consecutive value. *Note the number line above has the minimal answers to solve the problem. Include more information at your discretion*

Activity 3: Lemonade to Raspberry Juice.

Materials: painter's tape, index cards with the numbers 3, 7, 9, 15, 21, 35.

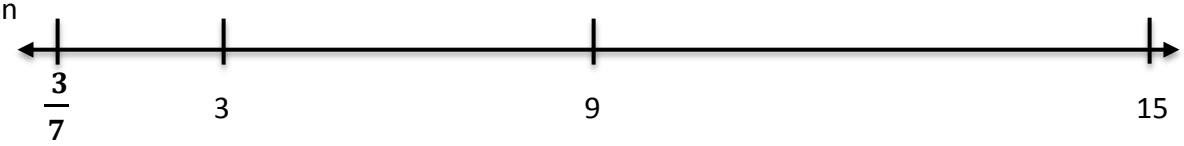
Using Painters tape lay down two number lines on the floor. Ask for student volunteers to model *three parts lemonade to seven parts raspberry juice.* Provide them with tape to mark off intervals and index cards with the numbers 3, 7, 9, 15, 21, 35, and copy paper to label the number lines. Ask the volunteers to speak aloud their thinking while they are deciding how to complete the task. Ask the rest of the class to observe and listen to the conversations and decisions the volunteers make and decide if they agree with those decisions.

When the task is finished. Here are some questions you can ask:

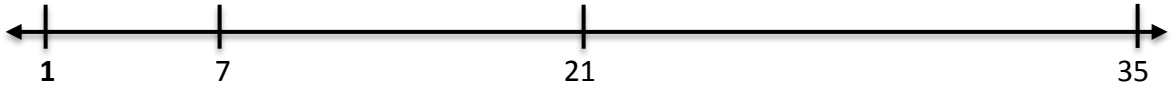
1. Describe what relationship is shown on the number lines. (Multiplicative relationship)
2. What comments can you share about the conversations you heard and the decisions they made? Do you agree or disagree with them and why?
3. Did anyone notice anything else or have a question?
4. Do you think multiplying both quantities by the same number is important?(Yes) Explain.

When you have finished the discussion ask your groups to find "What would the unit rate be for lemonade to raspberry juice?"

lemon



raspberry juice



$\therefore$ The unit rate of lemonade to raspberry juice is $\frac{3}{7}$ to 1

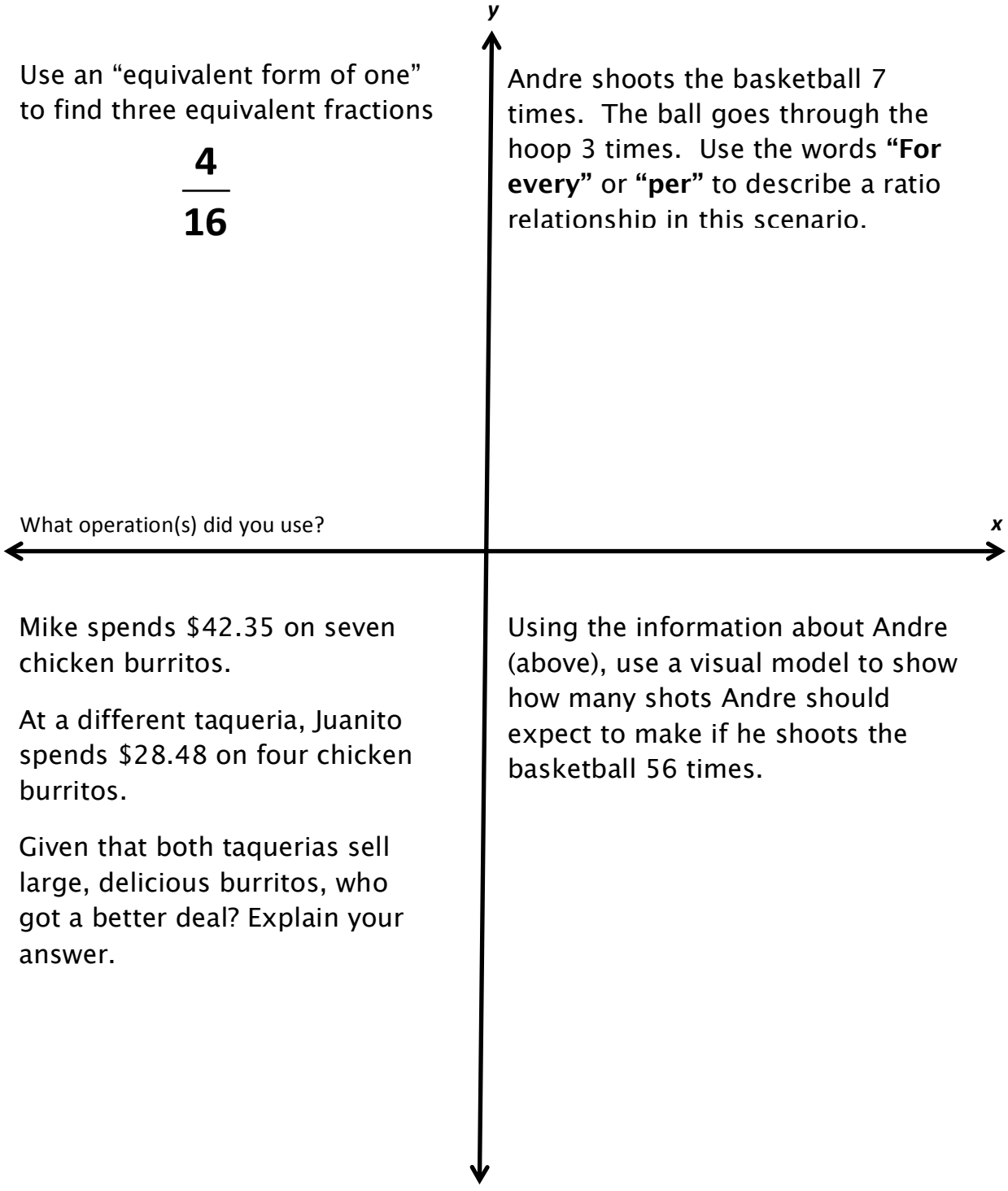
Warm-Up

Use an "equivalent form of one" to find three equivalent fractions

$$\frac{4}{16}$$

Andre shoots the basketball 7 times. The ball goes through the hoop 3 times. Use the words **"For every"** or **"per"** to describe a ratio relationship in this scenario.

What operation(s) did you use?



Mike spends $42.35 on seven chicken burritos.

At a different taqueria, Juanito spends $28.48 on four chicken burritos.

Given that both taquerias sell large, delicious burritos, who got a better deal? Explain your answer.

Using the information about Andre (above), use a visual model to show how many shots Andre should expect to make if he shoots the basketball 56 times.

Ratio/Fraction Cards

Ratio **3:4**	**Fraction** $\frac{4}{7}$
Ratio For every three white dogs, there are four black dogs.	**Fraction** $\frac{3}{7}$
Ratio **4:7**	**Ratio** There are four black puppies in a litter of seven total puppies.
Ratio **3:7**	**Ratio** $\frac{3}{4}$

Part-to-part	Part-to-whole

Group or partner work:

Unit Ratio Worksheet

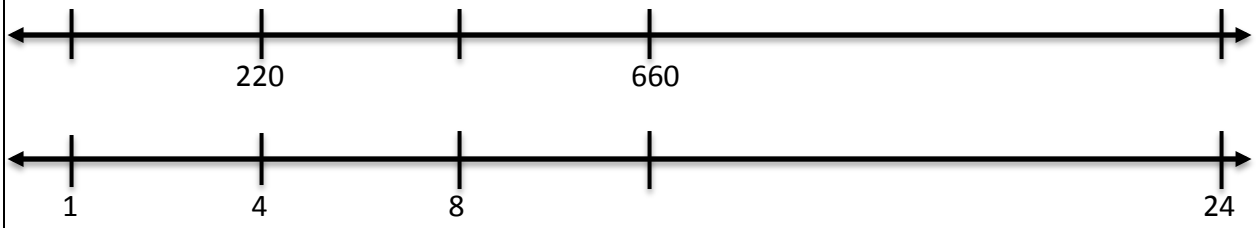
Directions: Make a table or a double number line, whichever is not present in each situation. Fill in the missing ratio on both the double number lines and the table. (Don't forget to label the rows or columns in your table or double number lines). Write two things that you noticed about each ratio situation.

1.)

Girls	Boys
	1
60	
	30
240	40
252	
300	

2.)

Miles travelled



Hours

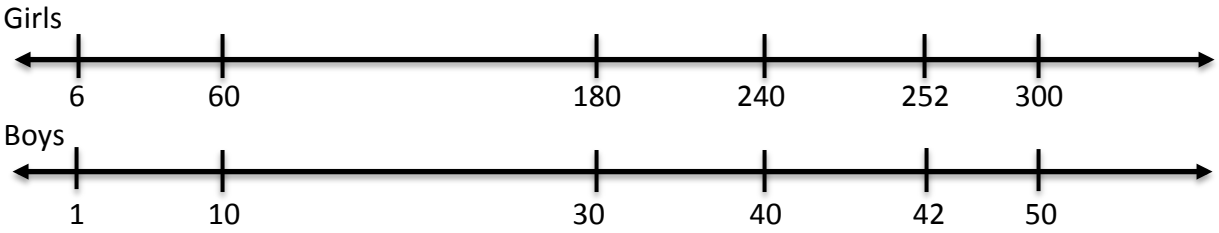
Group or partner work answers:

Unit Ratio Worksheet

Directions: Make a table or a double number line, whichever is not present in each situation. Fill in the missing ratio on both the double number lines and the table. (Don't forget to label the rows or columns in your table or double number lines). Write two things that you noticed about each ratio situation.

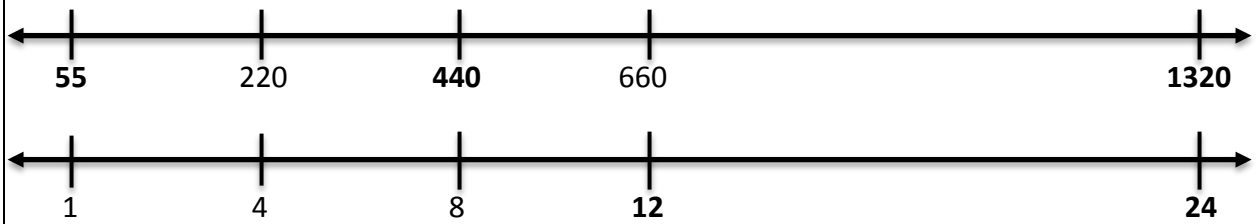
1.)

Girls	Boys
6	1
60	**10**
180	30
240	40
252	**42**
300	**50**



2.)

Miles travelled



Hours

Miles	**55**	**220**	**440**	**660**	**1320**
Hours	**1**	**4**	**8**	**12**	**24**

Homework

Name_____

Ratio Word Problems

Directions: Use tables and double number lines to find the unit rate for each situation and solve these problems.

1.) Gustavo runs 14 miles in 42 minutes. At this rate, how far will he travel in 1 hour? How many miles does he run in 1 minute?

2.) Daniela owns some clothing stores. If she owns 9 stores out of 225 total clothing stores in Los Angeles, what is Daniela's unit ratio of total stores to stores she owns?

Name_____

3.) The local health food store's juice bar has 36 bottles of fruit juice. If the owner wants a ratio of 1:4; vegetable juice to fruit juice, how many bottles of vegetable juice will he need to add to his inventory? What if he adds 18 new fruit juices to his juice bar? Justify your answer with a table and a double line graph.

4.) Mariana counted 42 pairs of pants, and 126 tops in her closet. What is the ratio of tops to pants? She gave away 14 pairs of pants to charity, if she wants to keep the same ratio of pants to tops, how many tops will she need to give away to charity?

Homework answers

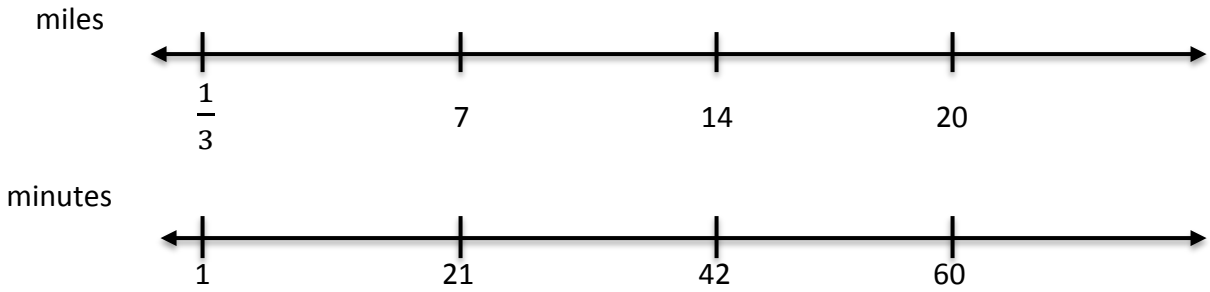
Ratio Word Problems

Directions: Use tables and double number lines to find the unit rate for each situation and solve these problems.

1.) Gustavo runs 14 miles in 42 minutes. At this rate, how far will he travel in 1 hour? How many miles does he run in 1 minute?

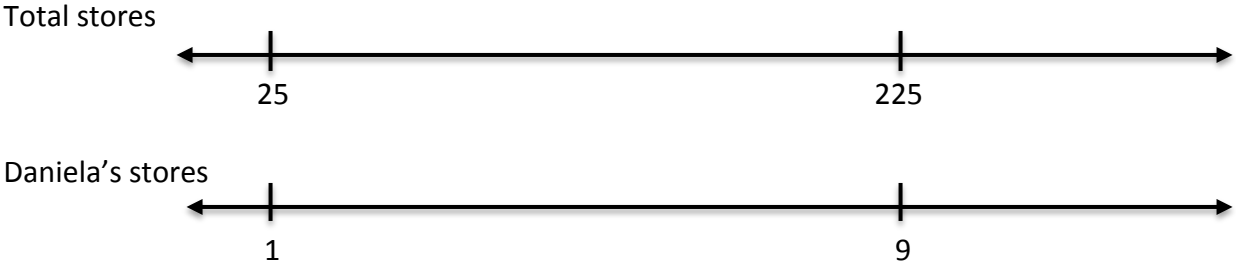
$14 = 2\times7 \quad 42 = 2\times3\times7 \therefore 14,42 \text{ have a } 1 \textit{ to } 3 \text{ ratio}$

miles	$\frac{1}{3}$	7	14	20
minutes	1	21	42	60



2.) Daniela owns some clothing stores. If she owns 9 stores out of 225 total clothing stores in Los Angeles, what is Daniela's unit ratio of total stores to stores she owns?

Total stores	25	225
Claudia's stores	1	9



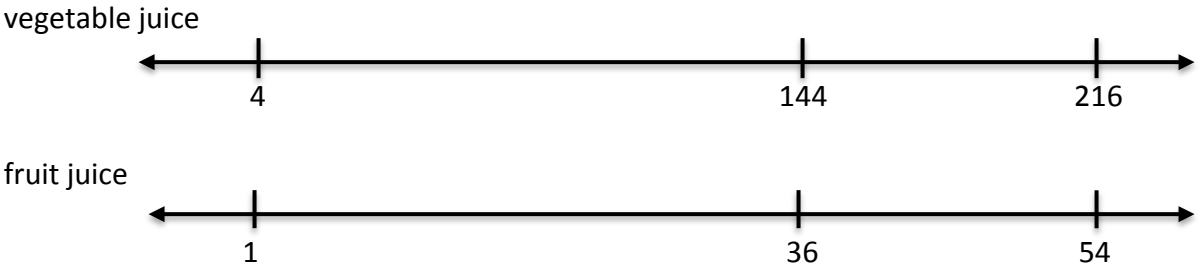
Homework answers

3.) The local health food store's juice bar has 36 bottles of fruit juice. If the owner wants a ratio of 4:1; vegetable juice to fruit juice, how many vegetable juices will he need to add to his inventory? What if he adds 18 new fruit juices to his juice bar? Justify your answer with a table and a double line graph.

Vegetable juice	4	144	216
Fruit juice	1	36	54

The owner will need to add 144 bottles of fruit juice to his inventory.

$4(36 + 18)$
$= 4(54)$
$= 216$ bottles of vegetable juice will be needed if he adds 18 more bottles of fruit juice.



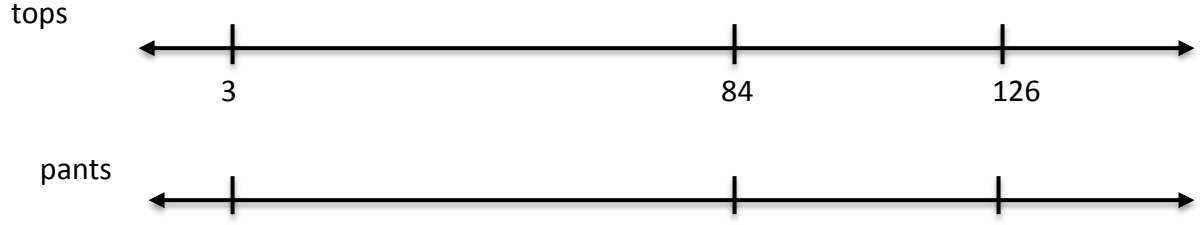
4.) Mariana counted 42 pairs of pants, and 126 tops in her closet. What is the ratio of tops to pants? She gave away 14 pairs of pants to charity, if she wants to keep the same ratio of pants to tops, how many tops will she need to give away to charity?

$126 = 2\times3\times3\times7 \quad 42 = 2\times3\times7 \quad \frac{126\div42}{42\div42} = \frac{3}{1}$

∴ Mariana has three times as many tops as she has pants.

tops	3	84	126
pants	1	28	42

$42 - 14 = 28$ pants and $28\times3 = 84$ tops
$126 - 84 = 42$
∴ Mariana gives away 42 tops to keep the same ratio.



1 28 42

Assessment: Exit ticket.

Exit Ticket

Unit Ratios

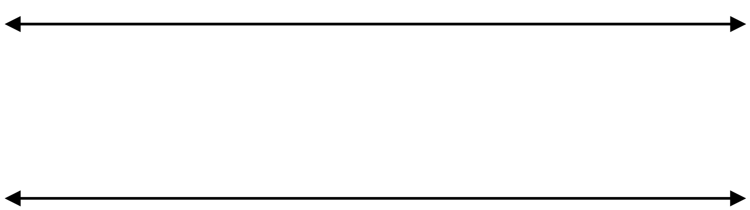
Stick A

30 cm.

Stick B

45 cm.

If you kept the same ratio for Stick A to Stick B, and Stick B was 1 cm. how long would Stick A be? Make a table and then fill in the double number lines provided.



Exit Ticket

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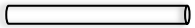
Exit Ticket

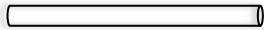
Unit Ratios

Stick A



30 cm.

Stick B



45 cm.

If you kept the same ratio for Stick A to Stick B, and Stick B was 1 cm. how long would Stick A be? Make a table and then fill in the double number lines provided.

Stick A	$\frac{2}{3}$ cm	2 cm	10 cm	30 cm
Stick B	1 cm	3 cm	15 cm	45 cm

Stick A

Stick B