6th Grade Math

Module 1: Ratios and Rates

Math Parent Letter

This document is created to give parents and students a better understanding of the math concepts found in Eureka Math (© 2013 Common Core, Inc.) that is also posted as the Engage New York material which is taught in the classroom. Module 1 of Eureka Math (Engage New York) builds on ratios, rates, and unit rates and develop a fluidity in using multiple forms of ratio language and ratio notation.

Focus Area Topic C:

From Ratios to Rates

Words to Know:

Ratio - A pair of nonnegative numbers, A: B, where both are not zero, and that are used to indicate there is a relationship between two quantities such that when there are A units of one quantity, there are B units of the second quantity.

Rate - A rate indicates, for a proportional relationship between two quantities, how many units of
one quantity there are for every 1 unit of the second quantity. For a ratio of A:B between two
quantities, the rate is A/B units of the first quantity per unit of the second quantity.

Unit Rate - The numeric value of the rate, e.g., in the rate 2.5 mph, the unit rate is 2.5.

Value of a Ratio – The value of a ratio is ratio whose denominator is one. . The value of the ratio 9:3 is 3:1.

Ratio table – A table of values listing pairs of numbers that form equivalent ratios.

Hours	Miles
2	120
4	240
6	360
8	480
10	600

Rate Unit- Miles per hour; dollars per pound; words per minute

Focus Area Topic C:

From Ratios to Rates

Computing Unit Rate

The students recognize that they can associate a ratio of two quantities, such as 5 miles per 2 hours, to another quantity called the rate. Given a ratio, students precisely identify the associated rate. They identify the unit rate and the rate unit.

Example Problem and Answer

A publishing company is looking for new employees to type novels that will soon be published. The publishing company wants to find someone who can type at least 45 words per minute. Trent discovered he can type at a constant rate of 704 words in 16 minutes. Does Trent type at a fast enough rate to qualify for the job? Explain why or why not?

Answer:

Words	704	352	176	88	44
Time(minutes)	16	8	4	2	1

After completing the table, students conclude that Trent can only type 44 words per minute which is slower than the 45 words per minute required.

This problem could be extended to ask students:

A.   How many words would Trent have to type in 20 minutes to qualify for the job?

B.   What is the rate unit for this problem?

Answer and Solution:

A.   20 minutes x 45 words per minute = 900 words.

Trent would have to type 900 words in 20 minutes to qualify for the job with the publishing company.

B.   The **rate unit** is words per minute

Example Problem and Answer:

Brad can mow lawns at a constant rate of $\frac{3}{5}$ lawns/hour. What is the ratio of lawns to hours?

Answer and solution:
Ratio of lawns to hours is 3:5. Brad can mow 3 lawns in 5 hours.

Finding a Rate by Dividing Two Quantities

While there is no physical way to divide two different quantities like (5miles/2hours), students make use of the structure of division and ratios to model $\frac{5 miles}{2 hours}$ as a quantity 2.5 mph. Interpreting a rate as a division of two quantities (or better yet a fraction) is the first step towards converting measurement units .

Example Problem and Solution
Question:
At the Crystal Clean and Shine carwash, the average employee can wash 4 cars per hour. If the carwash wants to accommodate the large volume of customers that go through their business in a typical day, they must continue this rate for 8 hours. At this rate, how many cars can a typical employee wash is 8 hours?

Answer and Solution:

$4 \frac{cars}{hour}$ x 8 ~~hours~~ = 32 cars

Students should be answering these questions:
- At what <u>rate</u> does an average employee wash cars?
  - ❖ 4 cars an hour
- How long does the employee need to wash cars in order to keep up with the volume of customers on a typical day?
  - ❖ 8 hours

Then students multiply the rate (4 cars an hour) times the time (8 hours). 4 x 8 = 32
An average employee can wash 32 cars in 8 hours.

Students transfer this skill to convert measurements:

How many cups are in 5 quarts?

$\frac{5 \, quarts}{1}$ x $\frac{4 \, cups}{1 \, quart}$ = $\frac{5 \times 4 \, cups}{1 \times 1}$ = 20 cups

Percent as a Rate per 100

Students model percentages as a rate per hundred using 10 x 10 grids and write them as fractions over 100 or as a decimal. Students use the model to represent a percent; more importantly they begin to connect and recognize the other representations of the same number in the form of a fraction and decimal.

$\frac{17}{100}$; 17%; .17

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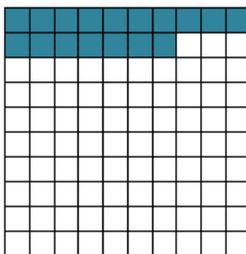
Students solve problems by analyzing different unit rates given in tables, equations and graphs.

Example Problem and Solution

Emilio wants to buy a new motorcycle. He wants to compare the gas efficiency for each motorcycle before he makes a purchase. The dealerships presented the data below.

Leisure Bikes

Gallons vs Miles
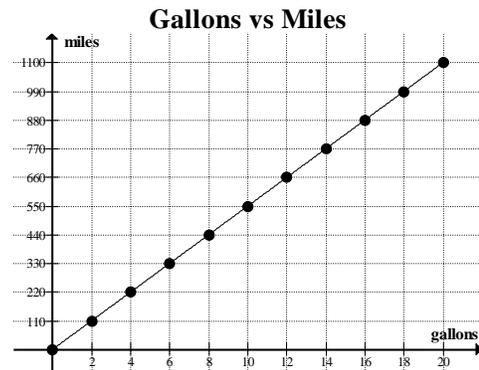
Sports Bikes

Gallons	5	10	15	20
Miles	287.5	575	862.5	1150

Which motorcycle dealership has the most gas efficient motorcycle? Use the graph and the table to make your decision.

Answer and Solution

At this point in the module students are proficient in finding the unit rate from a graph and a table. They are encouraged to use a calculator to divide the quantities. In the graph of Leisure Bikes, a bike travels 110 miles on 2 gallons of gas; therefore the unit rate is 55 miles per gallon. According to the values recorded in the table for Sports Bikes, their bike can travel 287.5 miles on 5 gallons of gas; therefore the bike from Sports Bikes can travel 57.5 miles on one gallon of gas.

Sports Bikes gets 2.5 miles more per gallon of gas therefore it is the most gas efficient.