Name: _____ Date: _____

PROPORTIONAL RELATIONSHIPS
COMMON CORE ALGEBRA I

You've studied proportional relationships in previous courses, but they are the basis of all **linear functions**, so we will take a lesson to recall their particulars.

PROPORTIONAL RELATIONSHIPS

Two variables have a **proportional relationship** if their respective values are always in the same ratio (they have the same relative size to one another). In equation form, if the two variables are x and y then:

$$\frac{y}{x} = \text{ constant}$$

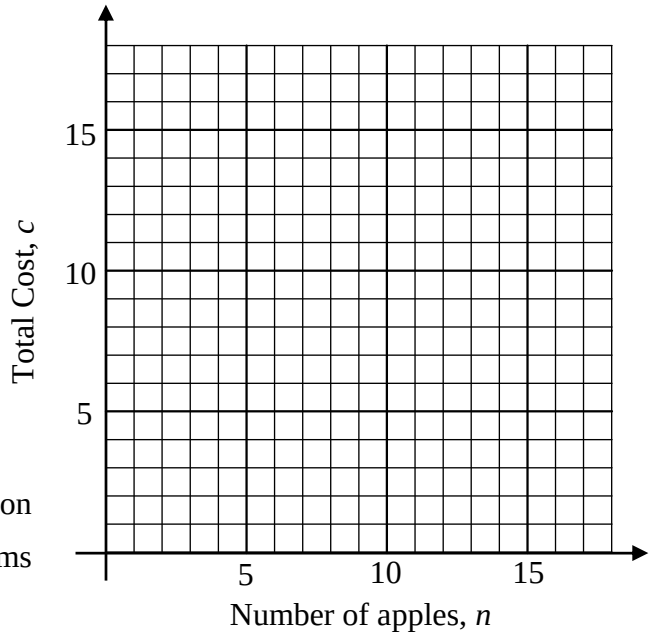
***Exercise* #1:** At a local farm stand, six apples can be bought for four dollars. Determine how much it would cost to buy the following amounts of apples. Round to the nearest cent, when necessary.

(a) a dozen apples

(b) 20 apples

(c) If c is the total cost of apples and n is the number of apples bought, write a proportional relationship between c and n. Solve this equation for the variable c.

(d) Graph the relationship below.



(e) According to the graph, $c(15) = 10$. Illustrate this on your graph. How do you interpret $c(15) = 10$ in terms of apples and money spent?

***Exercise* #2:** If Jenny can run 5 meters in 2 seconds, then which of the following gives the distance, *d*, she can run over a span of *t*-seconds going at the same constant rate? Show the work that leads to your answer.

(1) $d = \frac{2}{5}t$ (3) $d = 2t + 5$

(2) $d = 5t + 2$ (4) $d = \frac{5}{2}t$

Exercise #2 illustrates one of the most important proportional relationships, that of distance traveled compared to time traveled at a constant rate. Let's work some more with this.

***Exercise* #3:** Erika is driving at a constant rate. She travels 120 miles in the span of 2 hours.

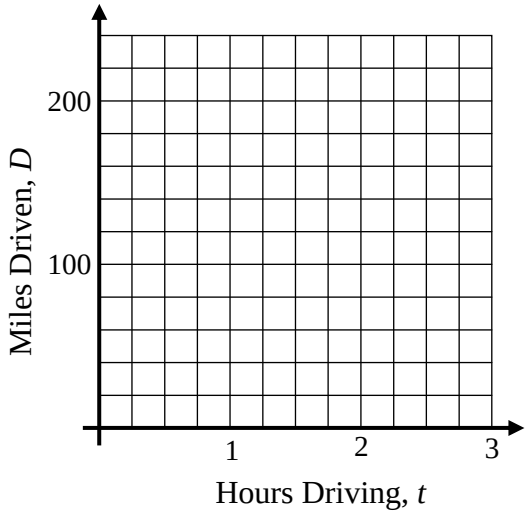
(a) If Erika travels at the same **rate**, how far will she travel in 3 hours?

(b) Write a proportional relationship between the distance *D* that Erika will drive over the time *t* that she travels, assuming she continues at this same rate. Solve the proportion for *D* as a function of *t*.

(c) What is the value of the proportionality constant? What are its units?

(d) How much time will it take for Erika to travel 150 miles.

(e) Graph *D* as a function of *t* on the axes at the right.



(f) What does the constant of proportionality, from (c) represent about this graph? Explain your thinking.

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PROPORTIONAL RELATIONSHIPS
COMMON CORE ALGEBRA I HOMEWORK

APPLICATIONS

1. A nutrition company is marketing a low-calorie snack brownie. A serving size of the snack is 3 brownies and has a total of 50 calories.

   (a) Determine how many calories 6 brownies would have.

   (b) Determine how many calories 21 brownies would have.

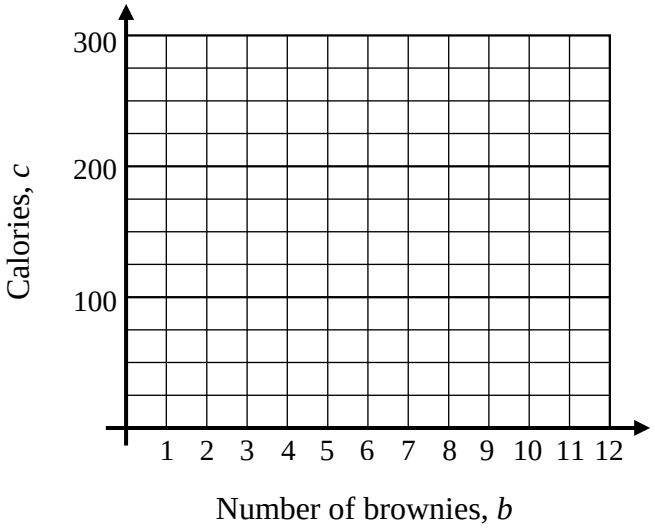
   (c) Determine how many calories 14 brownies would have. Round to the nearest calorie.

   (d) If c represents the number of calories and b represents the number of brownies, write a proportional relationship involving c and b and solve it for c.

   (e) Graph the proportional relationship you found in part (d) on the grid shown.

   (f) Using the graph, what is the smallest whole number of brownies a person would need to eat in order to consume 125 calories? Illustrate on your graph.

   (g) Algebraically determine the number of brownies a person would need to eat in order to consume 300 calories.



2. A local animal feed company makes its feed by the ton, which is 2000 pounds. They want to include a medication in the feed. Each cow needs 300 milligrams (mg) of this medication a day and each cow consumes 15 pounds of the feed per day. If there are 1,000 milligrams in a gram, how many grams of the medication should the feed company add for each ton of feed they produce?

3. Kwan is driving at a constant speed. After $1\frac{1}{4}$ hours he has driven a total distance of 90 miles.

   (a) How far will Kwan drive in 2 hours at this rate?

   (b) If D represents the distance Kwan has driven in miles and t represents the time he has been driving, in hours, then write an equation for D in terms of t.

   (c) Use your equation from (b) to determine how far Kwan drives in 15 minutes.

   (d) Kwan is driving a total of 234 miles. How long will his trip take him, to the nearest tenth of an hour, assuming he travels at this constant rate? Use proper units.

REASONING

Unit rates are proportions where we compare the change in one variable to a change of one unit in the other variable. When we typically report speeds in miles per hour, that is a unit rate. A speed of 65 miles per hour should be interpreted as 65 miles traveled per 1 hour of time. When we say that fat has 9 calories per gram, that is a unit rate because we are comparing 9 calories to 1 gram.

4. Convert each of these into unit rates. Some will be decimal unit rates.

   (a) 24 feet per 3 seconds (b) 30 pounds per 8 boxes (c) 50 calories per 20 chips