Name: _____ Date: _____

EQUATIONS OF PROPORTIONAL RELATIONSHIPS
N-GEN MATH® 7

When two variables are proportionally related, we can write equations (or formulas) that find the value of one of the variables if we know the value of the other. Let's look at a simple example.

***Exercise* #1:** A bake sale is selling brownies at a certain price per brownie. The total cost, c, of the brownies is proportional to the number of brownies bought, b. An advertisement states that 6 brownies cost $4.50.

(a) Samantha buys 14 brownies. Let c be the cost. Set up and solve a proportion to find c.

(b) What is the ratio of the brownie cost to the number of brownies? Set up as a fraction and evaluate using your calculator for both the 6 brownie case and the 14 brownie case.

6 brownies: 14 brownies:

(c) The result in (b) should be the same for both, called the **constant of proportionality**. How do you interpret this unit rate?

(d) If c is the total cost of b brownies, then fill in the blank using what you've found:

$$\frac{c}{b} = \_\_\_\_\_$$

(e) Solve this equation for the variable c. Why does this formula (equation) for c make sense?

(f) How much would two dozen brownies cost? Use your answer from (e).

All equations of proportional relationships "look" like the ones from *Exercise* #1(d) and (e):

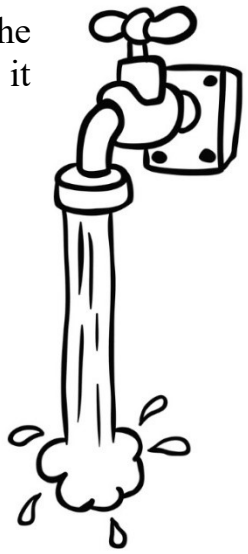
EQUATIONS OF PROPORTIONAL RELATIONSHIPS

If x and y are **proportionally related** with a constant of proportionality k then:

$$\frac{y}{x} = k \text{ which means } y = k \cdot x$$

When two variables are **proportional**, that just means one variable is a **constant multiple** of the other (the multiplier being k).

***Exercise* #2:** Water is flowing into a swimming pool at a **constant rate**. The volume of water that has entered the pool is proportional to the amount of time it has been filling. After 5 minutes, 41 gallons have come into the pool.



(a) What is the constant of proportionality in gallons per minute? Show the fraction and then the decimal answer with units.

(b) Let g be the gallons of water that have entered the pool and m be the number of minutes that have passed. Using your answer from (a), set up a proportion and then solve it for g.

(c) Use your answer from (b) to find out how many gallons of water would enter the pool in one hour.

(d) The pool needs 1,230 gallons. Set up an equation and solve it for the number of minutes, m, that it will take.

(e) A second tap of water is turned on to help fill up the pool. If it adds 58 gallons in 8 minutes, which tap has a higher rate?

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EQUATIONS OF PROPORTIONAL RELATIONSHIPS
N-GEN MATH® 7 HOMEWORK

FLUENCY

1. If two variables, a and b, are proportional, which of the following expressions must be constant?

   (1) $a+b$ (3) $a \cdot b$

   (2) $a-b$ (4) $\frac{a}{b}$

_____

2. If the ratio of m to n is equal to 5 then which of the following is true?

   (1) $m = n+5$ (3) $n = m+5$

   (2) $m = 5n$ (4) $n = 5m$

_____

USING YOUR MATH

3. A car is moving at a steady rate. The distance it travels is proportional to the amount of time, in hours, it has been driving. It has traveled a total of 168 miles in 3 hours.

   (a) What is the ratio of the distance to the number of hours? Express as a fraction and as a unit rate with appropriate units.

   (b) Given the unit rate in (a), determine the distance the car would travel in 5 hours. Justify your answer with a calculation.

   (c) Let d be the distance the car has traveled and let t be the time it has traveled, in hours, set up a proportion relating d and t and solve it for the variable d.

   (d) How long would it take to drive 126 miles at this rate? Set up and solve an equation using (c).

4. Sean is filling his truck with gasoline. He knows the total cost, c, will be proportional to the number of gallons of gasoline, g, that he puts into the gas tank. After putting 8.5 gallons in the tank, the cost is \$23.63.

   (a) Find the ratio of the cost to the gallons as a unit rate. Show the division as a fraction and then state the answer with appropriate units.

   (b) What is the real world meaning of your answer in (a)?

   (c) If c is the cost and g is the number of gallons bought, write a proportion involving c and g and then solve it for c.

   (d) If Sean puts 17 gallons of gasoline into his truck, what is his cost? Justify.

5. A construction crew is pouring concrete to make a floor in a building. The weight, w, of the concrete is proportional to the volume of concrete, v, that has been poured. After pouring 5 cubic feet, they know the weight of the concrete is 740 pounds.

   (a) If the construction crew uses a total of 12 cubic feet of concrete, set up and solve a proportion for the amount the concrete weighs, w.

   (b) The crew wants to create an equation of the form $w = k \cdot v$ to calculate the weight, w, of the concrete based on its volume, v, in cubic feet. What is the value of k in this equation? Explain.

REVIEWING YOUR MATH

6. Without your calculator, evaluate each of the following calculations with signed numbers:

   (a) $-4+12=$ _____ (b) $7-12=$ _____ (c) $12-(-6)=$ _____

   (d) $5\cdot -7=$ _____ (e) $-4\cdot -9=$ _____ (f) $\frac{18}{-3}=$ _____