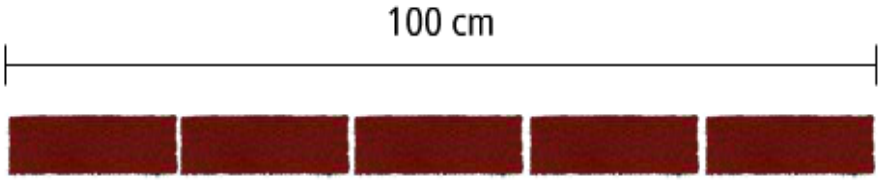
Constant of Proportionality

Topic 8-3

Recall that two quantities x and y have a proportional relationship if y is always a constant multiple of x. This constant multiple $\frac{y}{x}$ is called the **constant of proportionality.**
If x and y have different units, then the constant of proportionality can be written as a unit rate.



Number of Bricks	1	2	3	4	5
Total Length (cm)	20	40	60	80	100

$\frac{\text{Total Length (cm)}}{\text{Number of Bricks}}$	$\frac{20}{1} = 20$	$\frac{40}{2} = 20$	$\frac{60}{3} = 20$	$\frac{80}{4} = 20$	$\frac{100}{5} = 20$

The constant of proportionality is 20 cm per brick.

Example 1

The weight of the stack depends on the number of books in the stack. Identify the constant of proportionality for this situation. Then use the constant of proportionality to find the weight of 11 books.

Example 1- Solution

The constant of proportionality is the ratio $\frac{y}{x}$ where x is the independent variable and y is the dependent variable.

Here the independent variable is the number of books and the dependent variable is the weight of the stack.

$$\text{constant of proportionality} = \frac{\text{weight of stack}}{\text{number of books}}$$

$$= \frac{15.75 \text{ lb}}{9 \text{ books}}$$

A stack of 9 books weighs 15.75 lb.

$$= 1.75 \text{ lb per book}$$

The constant of proportionality is 1.75 lb per book.

Example 2

You have a recipe that calls for 2 cups of flour to make 3 dozen cookies. Your friend has a cookie recipe that calls for 3 cups of flour to make 60 cookies. Are the constants of proportionality the same for the two recipes? Are the recipes for the same cookie? How do you know?

Example 2- Solution

Since the number of cookies made depends on the amount of flour used, the constant proportionality is the ratio of the number of cookies to the amount of flour.

$$\text{constant of proportionality} = \frac{\text{number of cookies}}{\text{amount of flour}}$$

3 dozen = 36

You:

$$\text{constant of proportionality} = \frac{36 \text{ cookies}}{2 \text{ cups flour}}$$

$$= 18 \text{ cookies per cup of flour}$$

Your friend:

$$\text{constant of proportionality} = \frac{60 \text{ cookies}}{3 \text{ cups flour}}$$

$$= 20 \text{ cookies per cup of flour}$$

Example 2- Solution

Your recipe has a constant of proportionality of 18 cookies per cup of flour. Your friend's recipe has a constant of proportionality of 20 cookies per cup of flour.

The recipes do *not* have the same constant of proportionality since each recipe makes a different number of cookies per cup of flour. This means the recipes are *not* for the same cookie.

Example 3

The table shows the amount of money raised based on the number of tickets sold for a charity concert.

a. Does the table show a constant of proportionality? If so, what is the constant of proportionality for this situation?

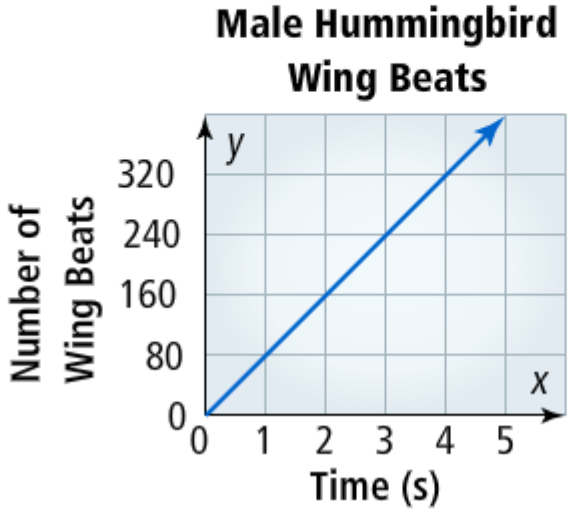
b. You can sell no more than 2,500 tickets for the concert. Find the maximum amount of money the fundraiser can raise.

Charity Fundraiser

Tickets Sold	Money Raised ($)
160	3,600
500	11,250
750	16,875
1,600	36,000

Example 4

The graph shows the number of times a male hummingbird beats its wings based on time.

a. What is the constant of proportionality for this situation?

b. What does the point (1, 80) represent?