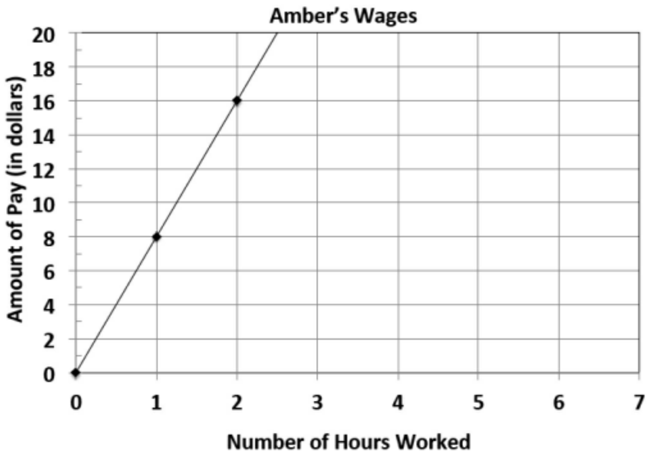
Name ____ Date____________________

Equations

John and Amber work at an ice cream shop. The hours worked and wages earned are given for each person.

John's Wages	
Time (in hours)	Wages (in dollars)
2	18
3	27
4	36



1. Determine if John's wages are proportional to time. If they are, determine the unit rate of $\frac{y}{x}$. If not, explain why they are not.

2. Determine if Amber's wages are proportional to time. If they are, determine the unit rate of $\frac{y}{x}$. If not, explain why they are not.

3. Write an equation for both John and Amber that models the relationship between their wage and the time they worked. Identify the constant of proportionality for each. Explain what it means in the context of the situation.

4. How much would each worker make after working 10 hours? Who will earn more money?

5. How long will it take each worker to earn $50?

Write an equation that will model the proportional relationship given in each real-world situation.

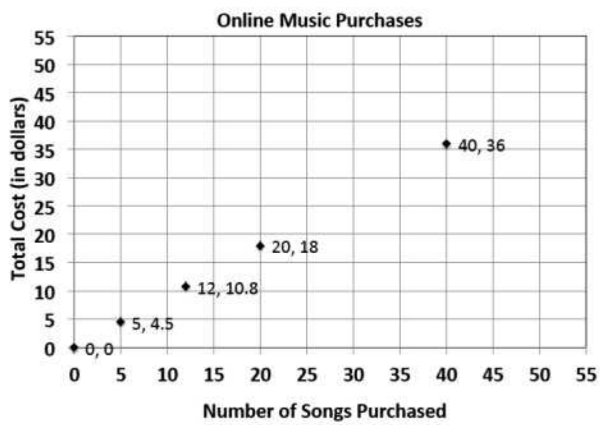
1. There are 3 cans that store 9 tennis balls. Consider the number of balls per can.
   a. Find the constant of proportionality for this situation.
   b. Write an equation to represent the relationship.

2. In 25 minutes Li can run 10 laps around the track. Determine the number of laps she can run per minute.
   a. Find the constant of proportionality in this situation.
   b. Write an equation to represent the relationship.

3. Jennifer is shopping with her mother. They pay $\$2$ per pound for tomatoes at the vegetable stand.
   a. Find the constant of proportionality in this situation.
   b. Write an equation to represent the relationship.

4. It costs $\$15$ to send 3 packages through a certain shipping company. Consider the number of packages per dollar.
   a. Find the constant of proportionality for this situation.
   b. Write an equation to represent the relationship.

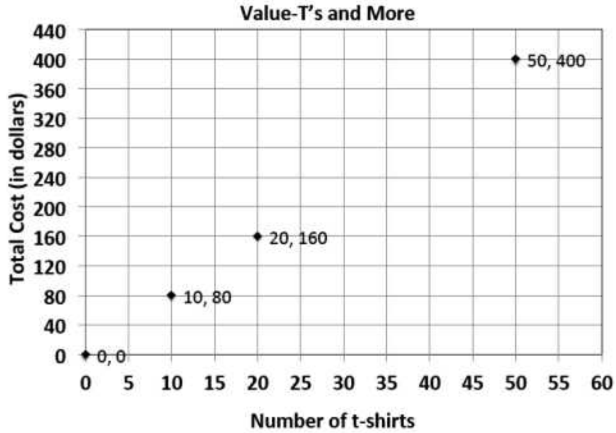
5. On average, Susan downloads 60 songs per month. An online music vendor sells package prices for songs that can be downloaded on to personal digital devices. The graph below shows the package prices for the most popular promotions. Susan wants to know if she should buy her music from this company or pay a flat fee of $\$58.00$ per month offered by another company. Which is the better buy?
   a. Find the constant of proportionality for this situation.
   b. Write an equation to represent the relationship.
   c. Use your equation to find the answer to Susan's question above. Justify your answer with mathematical evidence and a written explanation.



6. Allison's middle school team has designed t-shirts containing their team name and color. Allison and her friend Nicole have volunteered to call local stores to get an estimate on the total cost of purchasing t-shirts. Print-o-Rama charges a set-up fee, as well as a fixed amount for each shirt ordered. The total cost is shown below for the given number of shirts. Value T's and More charges $8 per shirt. Which company should they use?

Print-o-Rama

# shirts	Total cost
10	95
25	
50	375
75	
100	



a. Does either pricing model represent a proportional relationship between the quantity of t-shirts and the total cost? Explain.

b. Write an equation relating cost and shirts for Value T's and More.

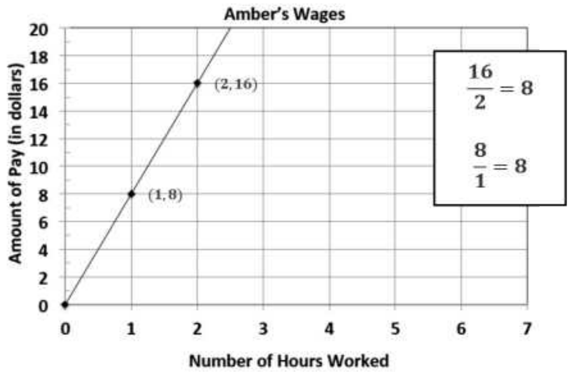
c. What is the constant of proportionality Value T's and More? What does it represent?

d. How much is Print-o-Rama's set-up fee?

e. Write a proposal to your teacher indicating which company the team should use. Be sure to support your choice. Determine the number of shirts that you need for your team.

John and Amber work at an ice cream shop. The hours worked and wages earned are given for each person.

John's Wages		
Time (in hours)	Wages (in dollars)	
2	18	$\frac{18}{2} = 9$
3	27	$\frac{27}{3} = 9$
4	36	$\frac{36}{4} = 9$



1. Determine if John's wages are proportional to time. If they are, determine the unit rate of $\frac{y}{x}$. If not, explain why they are not.

   Yes, the unit rate is 9. The collection of ratios is equivalent.

2. Determine if Amber's wages are proportional to time. If they are, determine the unit rate of $\frac{y}{x}$. If not, explain why they are not.

   Yes, the unit rate is 8. The collection of ratios is equivalent.

3. Write an equation for both John and Amber that models the relationship between their wage and the time they worked. Identify the constant of proportionality for each. Explain what it means in the context of the situation.

   John: $w = 9h$; the constant of proportionality is 9; John earns $\$9$ for every hour he works.

   Amber: $w = 8h$; the constant of proportionality is 8; Amber earns $\$8$ for every hour she works.

4. How much would each worker make after working 10 hours? Who will earn more money?

   After 10 hours John will earn $\$90$ because 10 hours is the value of the independent variable which should be multiplied by k, the constant of proportionality. $w = 9h$; $w = 9(10)$; $w = 90$. After 10 hours, Amber will earn $\$80$ because her equation is $w = 8h$; $w = 8(10)$; $w = 80$. John will earn more money than Amber in the same amount of time.

5. How long will it take each worker to earn $\$50$?

   To determine how long it will take John to earn $\$50$, the dependent value will be divided by 9, the constant of proportionality. Algebraically, this can be shown as a one-step equation: $50 = 9h$; $\left(\frac{1}{9}\right)50 = \left(\frac{1}{9}\right)9h$; $\frac{50}{9} = 1\,h$; $5.56 = h$ (round to the nearest hundredth). It will take John nearly 6 hours to earn $\$50$. To find how long it will take Amber to earn $\$50$, divide by 8, the constant of proportionality. $50 = 8h$; $\left(\frac{1}{8}\right)50 = \left(\frac{1}{8}\right)8h$; $\frac{50}{8} = 1h$; $6.25 = h$. It will take Amber 6.25 hours to earn $\$50$.

Write an equation that will model the proportional relationship given in each real-world situation.

1. **There are 3 cans that store 9 tennis balls. Consider the number of balls per can.**

   a. **Find the constant of proportionality for this situation.**

   $$\frac{9\ \textit{balls}\ (B)}{3\ \textit{cans}\ (C)} = 3\ \frac{\textit{balls}}{\textit{can}}$$

   The constant of proportionality is 3.

   b. **Write an equation to represent the relationship.**

   $B = 3C$

2. **In 25 minutes, Li can run 10 laps around the track. Determine the number of laps she can run per minute.**

   a. **Find the constant of proportionality in this situation.**

   $$\frac{10\ \textit{laps}\ (L)}{25\ \textit{minutes}\ (M)} = \frac{2}{5}\ \frac{\textit{laps}}{\textit{minute}}$$

   The constant of proportionality is $\frac{2}{5}$.

   b. **Write an equation to represent the relationship.**

   $L = \frac{2}{5}M$

3. **Jennifer is shopping with her mother. They pay $\$2$ per pound for tomatoes at the vegetable stand.**

   a. **Find the constant of proportionality in this situation.**

   $$\frac{2\ \textit{dollars}\ (D)}{1\ \textit{pound}\ (P)} = 2\ \frac{\textit{dollars}}{\textit{pound}}$$

   The constant of proportionality is 2.

   b. **Write an equation to represent the relationship.**

   $D = 2P$

4. **It cost $\$15$ to send 3 packages through a certain shipping company. Consider the number of packages per dollar.**

   a. **Find the constant of proportionality for this situation.**

   $$\frac{3\ \textit{packages}\ (P)}{15\ \textit{dollars}\ (D)} = \frac{3}{15}\ \frac{\textit{packages}}{\textit{dollar}}$$

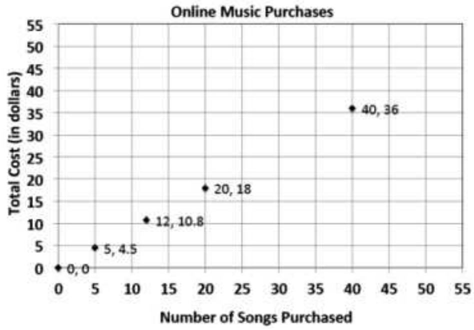
   The constant of proportionality is $\frac{1}{5}$.

   b. **Write an equation to represent the relationship.**

   $P = \frac{1}{5}D$

5. On average, Susan downloads 60 songs per month. An online music vendor sells package prices for songs that can be downloaded onto personal digital devices. The graph below shows the package prices for the most popular promotions. Susan wants to know if she should buy her music from this company or pay a flat fee of $\$58.00$ per month offered by another company. Which is the better buy?

Number of Songs Purchased (S)	*Total Cost (C)*	*Constant of Proportionality*
40	36	$\frac{36}{40} = \frac{9}{10} = 0.9$
20	18	$\frac{18}{20} = \frac{9}{10} = 0.9$
12	10.80	$\frac{10.80}{12} = \frac{9}{10} = 0.9$
5	4.50	$\frac{4.50}{5} = \frac{9}{10} = 0.9$



a. Find the constant of proportionality for this situation.

The constant of proportionality (k) is 0.9.

b. Write an equation to represent the relationship.

$C = 0.9S$

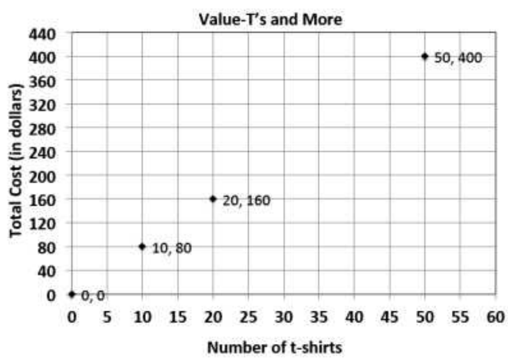
c. Use your equation to find the answer to Susan's question above. Justify your answer with mathematical evidence and a written explanation.

Compare the flat fee of $\$58$ per month to $\$0.90$ per song. If $C = 0.9S$ and we substitute S with 60 (the number of songs), then the result is $C = 0.9(60) = 54$. She would spend $\$54$ on songs if she bought 60 songs. If she maintains the same number of songs, the charge of $\$0.90$ per song would be cheaper than the flat fee of $\$58$ per month.

6. Allison's middle school team has designed t-shirts containing their team name and color. Allison and her friend Nicole have volunteered to call local stores to get an estimate on the total cost of purchasing t-shirts. Print-o-Rama charges a set-up fee, as well as a fixed amount for each shirt ordered. The total cost is shown below for the given number of shirts. Value T's and More charges $\$8$ per shirt. Which company should they use?

Print-o-Rama

Number of Shirts (S)	Total Cost (C)
10	95
25	
50	375
75	
100	



a. **Does either pricing model represent a proportional relationship between the quantity of t-shirts and the total cost? Explain.**

The unit rate of $\frac{y}{x}$ *for Print-o-Rama is not constant. The graph for Value T's and More is proportional since the ratios are equivalent* (8) *and the graph shows a line through the origin.*

b. **Write an equation relating cost and shirts for Value T's and More.**

$C = 8S$ *for Value T's and More*

c. **What is the constant of proportionality of Value T's and More? What does it represent?**

8*; the cost of one shirt is* $\$8$.

d. **How much is Print-o-Rama's set-up fee?**

The set-up fee is $\$25$

e. **Write a proposal to your teacher indicating which company the team should use. Be sure to support your choice. Determine the number of shirts that you need for your team.**

Since we plan on a purchase of 90 *shirts, we should choose Print-o-Rama.*

Print-o-Rama: $C = 7S + 25$; $C = 7(90) + 25$; $C = 655$

Value T's and More: $C = 8S$; $C = 8(90)$; $C = 720$

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