Revisiting Proportional Relationships

Let's use constants of proportionality to solve more problems.

3.1 Agua Fresca

A recipe for watermelon *agua fresca* calls for $\frac{1}{2}$ cup of cubed, seeded watermelon and 1 cup of ice. Complete the table to show how much watermelon and ice to use in different numbers of batches of the recipe.

watermelon (cups)	ice (cups)
$\frac{1}{2}$	1
$\frac{3}{4}$	
	$1\frac{3}{4}$
1	
	$2\frac{1}{2}$

3.2 The Price of Rope

Two students are solving the same problem: At a hardware store, they can cut a length of rope off of a big roll so that the customer can buy any length they like. The cost for 6 feet of rope is $7.50. How much would the customer pay for 50 feet of rope at this rate?

1. Kiran knows he can solve the problem this way.

length of rope (feet)	price of rope (dollars)
6	7.50
1	1.25
50	

(· $\frac{1}{6}$ from 6 to 1; · 50 from 1 to 50; · $\frac{1}{6}$ from 7.50 to 1.25; · 50 from 1.25 to the blank)

What would be Kiran's answer?

2. Kiran wants to know if there is a more efficient way of solving the problem. Priya says she can solve the problem with only 2 rows in the table.

length of rope (feet)	price of rope (dollars)
6	7.50
50	

What do you think Priya's method is?

3.3 Swimming, Manufacturing, and Painting

1. Tyler swims at a constant speed, 5 meters every 4 seconds. How long does it take him to swim 114 meters?

distance (meters)	time (seconds)
5	4
114	

2. A factory produces 3 bottles of sparkling water for every 8 bottles of plain water. How many bottles of sparkling water does the company produce when it produces 600 bottles of plain water?

number of bottles of sparkling water	number of bottles of plain water

3. A certain shade of light blue paint is made by mixing $1\frac{1}{2}$ quarts of blue paint with 5 quarts of white paint. How much white paint would need to be mixed with 4 quarts of blue paint?

4. For each of the previous three situations, write an equation to represent the proportional relationship.

Are you ready for more?

Different nerve signals travel at different speeds.

- Pressure and touch signals travel about 250 feet per second.
- Dull pain signals travel about 2 feet per second.

1. How long does it take a person to feel an ant crawling on their foot?

2. How much longer does it take to feel a dull ache in their foot?

3.4 Finishing the Race and More Agua Fresca

1. To make watermelon *agua fresca*:
   - Diego mixes $\frac{1}{4}$ cup of lime juice into $\frac{3}{4}$ gallon of watermelon juice.
   - Elena mixes $\frac{1}{3}$ cup of lime juice into $\frac{7}{8}$ gallon of watermelon juice.

   Which mixture has a stronger lime flavor? Explain or show your reasoning.

2. Lin runs $2\frac{3}{4}$ miles in $\frac{2}{5}$ of an hour. Tyler runs $8\frac{2}{3}$ miles in $\frac{4}{3}$ hours. How long does it take each of them to run 10 miles at that rate? Explain or show your reasoning.

Lesson 3 Summary

If we identify two quantities in a problem and one quantity is proportional to the other, then we can calculate the constant of proportionality and use it to answer other questions about the situation. For example, Andre runs at a constant speed of 5 meters every 2 seconds. How long does it take him to run 91 meters at this rate?

In this problem there are two quantities, time (in seconds) and distance (in meters). Since Andre is running at a constant speed, time is proportional to distance. We can make a table with distance and time as column headers and fill in the given information.

distance (meters)	time (seconds)
5	2
91	

To find a value in the right column, we multiply the value in the left column by $\frac{2}{5}$ because $\frac{2}{5} \cdot 5 = 2$. This means that it takes Andre $\frac{2}{5}$ of a second to run 1 meter.

At this rate, it would take Andre $\frac{2}{5} \cdot 91 = \frac{182}{5}$, or 36.4, seconds to walk 91 meters. More generally, if t is the time it takes to walk d meters at that pace, then $t = \frac{2}{5}d$.