

## Lesson 9: Representing Proportional Relationships with Equations

### Classwork

#### Example 1: Jackson's Birdhouses

Jackson and his grandfather constructed a model for a birdhouse. Many of their neighbors offered to buy the birdhouses. Jackson decided that building birdhouses could help him earn money for his summer camp, but he is not sure how long it will take him to finish all of the requests for birdhouses. If Jackson can build 7 birdhouses in 5 hours, write an equation that will allow Jackson to calculate the time it will take him to build any given number of birdhouses, assuming he works at a constant rate.

- Write an equation that you could use to find out how long it will take him to build any number of birdhouses.
- How many birdhouses can Jackson build in 40 hours?
- How long will it take Jackson to build 35 birdhouses? Use the equation from part (a) to solve the problem.
- How long will it take to build 71 birdhouses? Use the equation from part (a) to solve the problem.

**Example 2: Al's Produce Stand**

Al's Produce Stand sells 6 ears of corn for \$1.50. Barbara's Produce Stand sells 13 ears of corn for \$3.12. Write two equations, one for each produce stand, that model the relationship between the number of ears of corn sold and the cost. Then, use each equation to help complete the tables below.

Al's Produce Stand					Barbara's Produce Stand				
<b>Ears</b>	6	14	21		<b>Ears</b>	13	14	21	
<b>Cost</b>	\$1.50			\$50.00	<b>Cost</b>	\$3.12			\$49.92

### Lesson Summary

How do you find the constant of proportionality? Divide to find the unit rate,  $\frac{y}{x} = k$ .

How do you write an equation for a proportional relationship?  $y = kx$ , substituting the value of the constant of proportionality in place of  $k$ .

What is the structure of proportional relationship equations, and how do we use them?  $x$  and  $y$  values are always left as variables, and when one of them is known, they are substituted into  $y = kx$  to find the unknown using algebra.

### Problem Set

- A person who weighs 100 pounds on Earth weighs 16.6 lb. on the moon.
  - Which variable is the independent variable? Explain why.
  - What is an equation that relates weight on Earth to weight on the moon?
  - How much would a 185-pound astronaut weigh on the moon? Use an equation to explain how you know.
  - How much would a man who weighs 50 pounds on the moon weigh on Earth?
- Use this table to answer the following questions.

Number of Gallons of Gas	Number of Miles Driven
0	0
2	62
4	124
10	310

- Which variable is the dependent variable, and why?
- Is the number of miles driven proportionally related to the number of gallons of gas consumed? If so, what is the equation that relates the number of miles driven to the number of gallons of gas?
- In any ratio relating the number of gallons of gas and the number of miles driven, will one of the values always be larger? If so, which one?
- If the number of gallons of gas is known, can you find the number of miles driven? Explain how this value would be calculated.
- If the number of miles driven is known, can you find the number of gallons of gas consumed? Explain how this value would be calculated.
- How many miles could be driven with 18 gallons of gas?
- How many gallons are used when the car has been driven 18 miles?
- How many miles have been driven when half a gallon of gas is used?
- How many gallons of gas have been used when the car has been driven for a half mile?

3. Suppose that the cost of renting a snowmobile is \$37.50 for 5 hours.
- If  $c$  represents the cost and  $h$  represents the hours, which variable is the dependent variable? Explain why.
  - What would be the cost of renting 2 snowmobiles for 5 hours?
4. In Katya's car, the number of miles driven is proportional to the number of gallons of gas used. Find the missing value in the table.

Number of Gallons	Number of Miles Driven
0	0
4	112
6	168
	224
10	280

- Write an equation that will relate the number of miles driven to the number of gallons of gas.
- What is the constant of proportionality?
- How many miles could Katya go if she filled her 22-gallon tank?
- If Katya takes a trip of 600 miles, how many gallons of gas would be needed to make the trip?
- If Katya drives 224 miles during one week of commuting to school and work, how many gallons of gas would she use?