Objective | Constant of Proportionality

Warm-Up

Washington Middle School collects canned food for a local community food bank. Last year, there were 180 students enrolled at the school and they collected 102 cans of food.

1. Write the ratio representing the number of cans of food contributed to the total number of students in the school.

2. What is the unit rate of cans contributed per student?

3. This year, 210 students are enrolled in the school. Assume the number of cans of food contributed per student for both years is the same. How many cans of food should the school expect to be contributed this year?

Is It Proportional?

Analyze each table to determine if the relationship is proportional. If the table represents a proportional relationship, state the constant ratio that exists between corresponding values of the two quantities.

1. A 30-minute television show has 8 minutes of commercials and 22 minutes of the show. A 120-minute television movie has 32 minutes of commercials and 88 minutes of the movie.

Total Program Length (minutes)	Actual Show Length (minutes)	Commercial Length (minutes)
30	22	8
120	88	32

2. There are 250 boys in 6th grade, and 75 are in the band.
There are 200 girls in 6th grade, and 60 are in the band.

6th Grade Class	Total	Band
Boys	250	75
Girls	200	60

3. Commuters in McKnight and Mitenridge either drive to work or take public transportation.

Commuters	Drive to Work	Public Transportation to Work
McKnight	175	120
Mitenridge	525	300

4. Of the 250 middle-school boys who have a subscription to Boys Noise, 125 access the magazine through the website. Of the 280 middle-school girls who have a subscription to Girls Rockstar, 160 access the magazine through the website.

In a proportional relationship, the ratio of all y-values, or outputs, to their corresponding x-values, or inputs, is constant. This specific ratio, $\frac{y}{x}$, is called the **constant of proportionality**. Generally, the variable k is used to represent the constant of proportionality. Let's revisit the television show scenario. This situation represents a proportional relationship.

Total Program Length (minutes)	Actual Show Length (minutes)	Commercial Length (minutes)
30	22	8
120	88	32

Suppose you want to determine the actual lengths of your favorite television shows, without commercials, if you know the total program length.

1. Identify the input and output quantities in this scenario.

To determine the length of a program, without commercials, you will need to multiply the total program length by a constant of proportionality.

Analyze the different ideas for determining the constant of proportionality.

Jeremiah 👍

We want to know the actual show length and we know the total program length, so

$k = \dfrac{22 \text{ minutes of show}}{30 \text{ minutes of total length}}$,

or $k = \dfrac{11}{15}$.

Keisha 👎

To determine if a proportional relationship exists the order of the ratio doesn't matter, so the constant of proportionality can be

$k = \dfrac{15}{11}$

or $k = \dfrac{11}{15}$.

Susan 👎

I think the constant of proportionality is

$k = \dfrac{22 \text{ minutes of show}}{8 \text{ minutes of commercials}}$,

or $k = \dfrac{11}{4}$.

JAMie 👎

JEREMIAH'S CORRECT ABOUT WHICH NUMBERS TO USE BUT HE HAS THEM MIXED UP. THE CONSTANT OF PROPORTIONALITY IS

$K = \dfrac{30 \text{ MINUTES OF TOTAL LENGTH}}{22 \text{ MINUTES OF SHOW}}$, OR $K = \dfrac{15}{11}$.

2. Explain why Susan's solution is incorrect.

3. Explain why Jeremiah is correct but Jamie and Keisha are incorrect.

In 1972, the federal government passed Title IX, a law requiring educational institutions that receive federal funds to provide equitable athletic opportunities for boys and girls. One of the requirements for compliance with Title IX is for institutions to provide opportunities for each gender that are proportional to their rates of enrollment or show that they are working to increase such opportunities. Similarly, male and female athletes are to receive athletic scholarship dollars proportional to their participation.

Let's think about the implications of Title IX at Vista Middle School.

There are 5 girls for every 6 boys enrolled in Vista Middle School.

1. Set up proportions for each question. Then, solve each proportion to determine the unknown value. Use the information from the ratio given.

a. If there are 300 boys enrolled in the school, how many girls are enrolled in the school?

b. If there are 325 girls enrolled in the school, how many boys are enrolled in the school?

2. Define variables for the quantities that are changing in this situation.

3. Set up a proportion using your variables for the quantities to the ratio given for the enrollment of girls to boys enrolled in Vista Middle School.

4. Use your proportion.
a. Write an equation to determine the number of girls enrolled at Vista Middle School if you know the number of boys enrolled.

b. What is the constant of proportionality in this situation?
Where is the constant of proportionality in the equation?

c. What does the constant of proportionality mean in this problem situation?

5. Use your proportion.
a. Write an equation to determine the number of boys enrolled at Vista Middle School if you know the number of girls enrolled.

b. What is the constant of proportionality in this situation?
Where do you see the constant of proportionality in the equation?

c. What does the constant of proportionality mean in this problem situation?

6. What do you notice about the constant of proportionality in each situation?

7. Do you think each constant of proportionality makes sense in terms of the problem situation?

Sometimes, the constant of proportionality is not a whole number. The constant of proportionality can also be a decimal or a fraction. When the constant of proportionality involves whole items, like people, it may seem strange to think about the constant of proportionality in terms of a fraction. Instead, you can think of the constant of proportionality as a way to predict outcomes of a situation.

8. Use your equations and the information about Title IX to answer each question.

a. If there are opportunities for 79 boys to participate in athletics, how many opportunities must be available for girls?

b. If there are opportunities for 119 girls to participate in athletics, how many opportunities must be available for boys?

LESSON 3.2a
Complying with title IX

Homework HW

Objective Constant of Proportionality

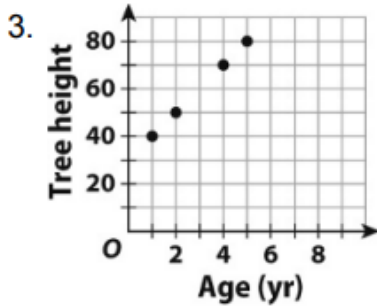**Complete each table. Explain why the relationship is a proportional relationship.**
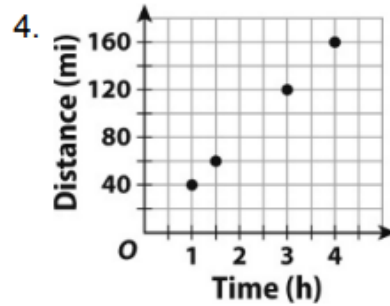
1. A cashier earns $8 per hour.

Time (h)	2	4		
Pay ($)	16		40	72

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2. Tomatoes cost $0.70 per pound.

Weight (lb)	2		6	8
Price ($)	1.40	2.10		

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Tell whether the relationship is a proportional relationship. Explain your answer.

3.

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4.

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The graph shows the relationship between the distance traveled by a car and the amount of fuel used by the car.

5. Explain the meaning of (2, 40).

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6. Write an equation for this relationship.

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