Complying with Title IX

2

Constant of Proportionality

MATERIALS

None

Lesson Overview

Students learn how to use equations to represent proportional relationships. Students write constants of proportionality based on the direction of proportional relationships. They then use a scenario to set up a proportion and write two different equations for the scenario, depending on the direction of the proportional relationship. Students identify and interpret the constant of proportionality in the context of a scenario and solve problems using the equations that represent the proportional relationship.

Next, students consider an additional situation in which the constant of proportionality and the corresponding equation depend on the question asked. They use the constant of proportionality to write equations, express the equations in terms of proportional relationships, and generalize the equation for proportional relationships. Students then practice using the constant of proportionality to solve for unknown quantities.

Grade 7
Proportionality

(4) The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:

(A) represent constant rates of change in mathematical and real-world problems given pictorial, tabular, verbal, numeric, graphical, and algebraic representations, including $d = rt$.

(C) determine the constant of proportionality ($k = \frac{y}{x}$) within mathematical and real-world problems.

(D) solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems.

ELPS

1.A, 1.C, 1.E, 1.F, 1.G, 2.C, 2.E, 2.I, 3.D, 3.E, 4.B, 4.C, 4.D, 4.J, 5.B, 5.F, 5.G

Essential Ideas

- In a proportional relationship, the ratio between two quantities is always the same. It is called the constant of proportionality.
- The constant of proportionality in a proportional relationship is the ratio of the outputs to the inputs.
- In a proportional relationship, two different proportional equations can be written. The coefficients, or constants of proportionality, in the two equations are reciprocals.
- The equation used to represent the proportional relationship between two values is $y = kx$, where x and y are the quantities that vary, and k is the constant of proportionality.
- Proportional relationships are used to write equations and solve for unknown values.

Lesson Structure and Pacing: 3 Days

Day 1

Engage

Getting Started: Is It Proportional?

Students analyze four different real-world situations: three described in a table of values and one described verbally. They determine if the relationships are proportional and identify the equivalent ratio when appropriate. They will determine that the first two situations are proportional.

Develop

Activity 2.1: Defining the Constant of Proportionality

The term *constant of proportionality* is defined as the ratio of outputs to inputs in a proportional relationship. Students write the constants of proportionality for the two proportional scenarios in the Getting Started. They examine student thinking to understand that the order in which the ratio is written is important when determining the constant of proportionality.

Day 2

Activity 2.2: The Meaning of the Constant of Proportionality

Students consider a scenario and two questions in which the unknown quantities are different. They set up and solve two proportions. Next, students define variables for the quantities that are changing, set up a proportion using the variables, and use the proportion to write equations. They then identify the constants of proportionality in each equation as the coefficient of the input variable and explain what it means in the problem situations. They conclude that the two constants of proportionality in the equations that relate the same two quantities are reciprocals of each other.

Day 3

Activity 2.3: Representing Proportional Relationships with Equations

Students consider two scenarios in the context of a situation in which the unknown quantity is different. They determine the constants of proportionality and write equations to represent each scenario using two variables and the appropriate constant of proportionality. They then express the constant of proportionality and the equation for a proportional relationship in terms of x, y, and k.

Activity 2.4: Using the Constant of Proportionality to Solve Problems

Students consider a problem situation to determine the amount of water or reagent needed in different chemistry solutions. They define variables for quantities that are changing, write an equation, and identify the constant of proportionality. Students also write an equation for the reciprocal relationship. They then determine the value of unknown variables in mathematical problems using the constant of proportionality.

Demonstrate

Talk the Talk: Turning the Tables

Students create their own scenario for a proportional relationship given the value of the constant of proportionality. They interpret the constant of proportionality in the context of their scenario. They then write and solve questions that can be solved with their equation.

ENGAGE

Getting Started: Is It Proportional?

Facilitation Notes

In this activity, students analyze four different real-world situations: three described in a table of values and one described verbally. They determine if the relationships are proportional and identify the equivalent ratio when appropriate. They will determine that the first two situations are proportional.

Have students work with a partner or in a group to complete Questions 1 through 4. Share responses as a class.

As students work, look for

- Ratios using different columns from the table and different placements in the numerator or denominator of the ratio.
- Inconsistencies in writing the ratios.

Differentiation strategy

Require students to write a generic ratio or label their first ratio to help keep corresponding values aligned when writing additional ratios. For example, $\frac{\text{actual show}}{\text{program length}}$.

Questions to ask

- What ratios did you consider in each situation?
- If the ratios are equal, what does this imply about the relationship?
- If the ratios are not equal, what does this imply about the relationship?
- If the three relationships in the table of values were proportional, what would you expect to happen, with respect to the ratios?
- If the three relationships in the table of values were not proportional, what would you expect to happen, with respect to the ratios?
- How did you determine the relationships are not proportional?

Summary

In a proportional relationship, a constant ratio exists between corresponding values of the two quantities.

Activity 2.1
Defining the Constant of Proportionality

DEVELOP

Facilitation Notes

In this activity, the scenario from the previous activity is represented in a table of values. Students use these values to create ratios and review ideas for determining the constant of proportionality.

Ask a student to read the introduction aloud. Complete Question 1 as a class.

Questions to ask

- Is the input quantity the actual show length or the commercial length?
- Is the input quantity the total program length?
- Is the output quantity the actual show length or the commercial length?
- Is the output quantity the total program length?

Have students work with a partner or in a group to complete Questions 2 through 3. Share responses as a class.

Differentiation strategies

- To scaffold support, discuss this activity in contrast with the previous one. Through questioning, establish the fact that when writing a constant of proportionality, there is no flexibility; you have to know the input and output and use them to write the ratio. In the previous activity, there were many correct ratios because inputs and outputs were not defined.
- To extend the activity, have students explore the statement after Question 1 in more depth. Make the connection that the units of the constant of proportionality multiplied by the units for the x-value, yield the units for the y-value. For example,

$$y = kx$$

$$\text{show min} = \left(\frac{\text{show min}}{\text{program min}}\right)\left(\frac{\text{program min}}{1}\right)$$

$$\text{show min} = \text{show min}$$

Questions to ask

- Does the order of the ratio matter when writing the constant of proportionality?
- In this situation, what determines the numerator in the constant of proportionality?
- In this situation, what determines the denominator in the constant of proportionality?

Summary

When the direction of the relationship is specified, the order in which the ratio is written is important for determining the constant of proportionality.

Activity 2.2

The Meaning of the Constant of Proportionality

Facilitation Notes

In this activity, students use a scenario to set up and solve proportions. They define variables for the quantities, set up a proportion using the variables, use the proportions to write equations, and use the equations to identify the constants of proportionality.

Have students work with a partner or in a group to complete Questions 1 through 5. Share responses as a class.

Questions to ask

- Did you write the ratio of the number of girls to the number of boys, or the number of boys to number of girls?
- What is the difference between the ratio of the number of girls to the number of boys and the ratio of the number of boys to the number of girls? How are they related?
- Does it make a difference whether the number of girls or the number of boys is placed in the numerator or the denominator when setting up a proportion?
- If the ratios are equal, what does this imply about the relationship?
- If the ratios are not equal, what does this imply about the relationship?
- When writing your constant of proportionality, which quantity is the input and which quantity is the output?
- What are you solving for in this situation?
- Where is the variable placed in this proportion?
- How do you know what the quantities are that are changing?
- How many variables are in this proportion?

Have students work with a partner to complete Questions 6 and 7. Share responses as a class.

Questions to ask

- How can it take $\frac{5}{6}$ of a boy to equal 1 girl? Does this make sense? Explain.

- How can it take $\frac{6}{5}$ girls to equal 1 boy? Does this make sense? Explain.
- Which proportion is used to determine the number of girls enrolled?
- Which proportion is used to determine the number of boys enrolled?
- How are the two constants of proportionality related to each other?
- Is one constant of proportionality the reciprocal of the other?

Ask a student to read the paragraph after Question 7. Have students work with a partner to complete Question 8. Share responses as a class.

Differentiation strategy

Some students may ask why they can't just use proportions to answer Question 8. While proportions are a valid strategy for these relationships, use of the constant of proportionality provides a foundation to build upon for later math topics. At this point, require students make sense of the constant of proportionality and practice using it to solve problems. Students can use proportions as a method to check their work.

Summary

The constant of proportionality is the ratio of the outputs to the inputs.

Activity 2.3
Representing Proportional Relationships with Equations

Facilitation Notes

In this activity, given a problems situation, students determine the constants of proportionality, define variables, and write equations representing each scenario. The constant of proportionality and the equation for a proportional relationship is written in terms of *x*, *y*, and *k*.

Ask a student to read the scenario aloud and discuss as a class. Have students work with a partner or in a group to complete Questions 1 through 5. Share responses as a class.

Differentiation strategy

To scaffold support for interpreting the context to write a constant of proportionality, model some active reading strategies and provide a set of instructions. For example, for Question 1, part (a):

Step 1: Circle what the Guidance Counselor needs to figure out and label it *y*.

"number of girls who play sports"

Step 2: Circle what is known or given and label it x.

"number of girls in the school"

Step 3: Write $\frac{y}{x} = \frac{\text{number of girls who play sports}}{\text{number of girls in the school}}$

Step 4: Substitute values for $\frac{y}{x}$.

$$\frac{5}{7} = \frac{\text{number of girls who play sports}}{\text{number of girls in the school}}$$

Step 5: Identify the constant of proportionality, $k = \frac{5}{7}$.

Step 6: Equation: $y = \frac{5}{7}x$

After completing Question 5, add this statement next to Step 6: $y = kx$.

Questions to ask

- How did you determine the constant of proportionality for the Counselor?
- How did you determine the constant of proportionality for the Director?
- What are the quantities that are changing in the first situation?
- What are the quantities that are changing in the second situation?
- Which situation uses $\frac{5}{7}$?
- Which situation uses $\frac{7}{5}$?
- Which variable is associated with outputs?
- Which variable is associated with inputs?
- Which variable is associated with the x-axis?
- Which variable is associated with the y-axis?
- What operation or operations need to be performed to rewrite the first equation as the second equation?

Have students work with a partner to complete Question 6. Share responses as a class.

Questions to ask

- What is the relationship between the diameter and radius of a circle?
- What is the relationship between the perimeter of an equilateral triangle and the length of one side of the triangle?

Summary

The equation for the constant of proportionality is $k = \frac{y}{x}$, where y represents the dependent or output quantity and x represents the independent or input quantity. Proportional relationships can also be represented by the equation $y = kx$.

Activity 2.4
Using the Constant of Proportionality to Solve Problems

Facilitation Notes

In this activity, given a scenario, students define variables, write an equation, and identify the constant of proportionality. An equation for the reciprocal relationship is also written. Students practice writing equations and solving for unknown values.

Have students work with a partner or in a group to complete Questions 1 through 4. Share responses as a class.

As students work, look for

- The use of diagrams to interpret the context.
- Use of the active reading strategies to determine y and x.
- Two different methods to answer Question 3, taking the reciprocal of the fraction in Question 2 or referring back to the original problem to create a new ratio.

Questions to ask

- How do you know what the quantities are that are changing?
- What does the constant of proportionality tell you about the amount of water related to the amount of reagent?
- What does the constant of proportionality tell you about the amount of reagent related to the amount of water?
- What equation did you use to solve the problem?
- What proportion did you use to solve the problem?
- What is another way to correctly set up this proportion?
- What steps did you perform to solve the proportion?
- How can you verify your solution is correct?

Have students work with a partner to complete Question 5. Share responses as a class.

Questions to ask

- What information are you given?
- Is there more than one way to correctly write an equation to determine the unknown value?

Summary

The equation for the constant of proportionality is $k = \frac{y}{x}$, where y represents the dependent or output quantity and x represents the independent or input quantity. This equation be used to solve real-world problem situations.

DEMONSTRATE

Talk the Talk: Turning the Tables

Facilitation Notes

In this activity, students create their own scenario for a proportional relationship and interpret the constant of proportionality in the context. They also write and solve questions that can be solved with their equation.

Assign every student, or every group of students, a different constant of proportionality, or allow students to select their own constant of proportionality. Use a variety of values including whole numbers, fractions less than 1, fractions greater than 1, and decimals. Have students complete the activity and share responses as a class.

Differentiation strategies

- Have students write their scenarios and the questions on poster paper. Ask them to participate in a gallery walk to solve each group's problems.
- Have groups swap problems and they must solve the other group's problems.

Summary

Proportional relationships represented by the equation $y = kx$, where k represents the constant of proportionality, y represents the dependent or output quantity, and x represents the independent or input quantity can be used to solve real-world problem situations.

Complying with Title IX

2

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?

LEARNING GOALS

- Determine if there is a constant ratio between two variables.
- Identify the constant of proportionality in proportional relationships.
- Identify the constant of proportionality in equations.
- Represent proportional relationships by equations.

KEY TERM

- constant of proportionality

You know how to recognize proportional relationships from tables and graphs. How do you represent proportional relationships with equations?

Warm Up Answers

1. $\frac{\text{102 cans of food}}{\text{180 students}}$ or an equivalent ratio
2. 0.567 can per student
3. 119 cans of food

Answers

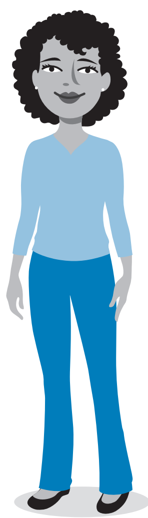
1. This does represent a proportional relationship. Equivalent ratios will vary but can be any combination of part-to-part or part-to-whole ratios.
2. This does represent a proportional relationship. Equivalent ratios can be $\frac{\text{3 students in band}}{\text{10 total students}}$ or $\frac{\text{10 total students}}{\text{3 students in band}}$.

Getting Started

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.

Does the order in which you write your ratios, $\frac{x}{y}$ or $\frac{y}{x}$, matter when determining if a proportional relationship exists?



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.**

Answers

3. This does not represent a proportional relationship.
4. This does not represent a proportional relationship.

Answers

1. The input quantities are 30 and 120, representing the total program length in minutes.
   The output quantities are 22 and 88, representing the actual show length in minutes.

ACTIVITY 2.1

Defining the Constant of Proportionality

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.

The input value is known. The output value is what you are trying to determine.

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

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

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

Keisha

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

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

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

Susan

I think the constant of proportionality is

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

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

JAMIE

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

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

2. Explain why Susan's solution is incorrect.

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

Answers

2. The quantities being compared are the total time and the length of the actual show. Susan compared the length of the show and the length of the commercials.
3. The constant of proportionality is the ratio of the outputs to inputs, so there can only be one solution. The inputs are the combined lengths of the show and commercials, and the outputs are the actual lengths of the shows. So Jeremiah used the correct ratio.

Answers

1a. There are 250 girls enrolled in the school.

1b. There are 390 boys enrolled in the school.

2. Let *b* equal the number of boys enrolled in the school, and let *g* equal the number of girls enrolled in the school.

ACTIVITY 2.2

The Meaning of the Constant of Proportionality

"The term *proportional* is used often in the Title IX document. What does this mean for sports at schools?"

In 1972, the federal government passed Title IX, a law requiring educational institutions that receive federal funds to provide equitable athletic opportunities for all students, regardless of their sex. One of the requirements for compliance with Title IX is for institutions to provide opportunities for each subgroup that are *proportional* to their rates of enrollment, or to show that they are working to increase such opportunities. Similarly, athletes of different sexes are to receive athletic scholarship dollars *proportional* to their subgroup's 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.

NOTES

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?

Answers

3. $\frac{5 \text{ girls}}{6 \text{ boys}} = \frac{g \text{ girls}}{b \text{ boys}}$

4a. $g = \frac{5}{6}b$

4b. $\frac{5}{6}$

4c. The constant of proportionality is the ratio of the number of girls to the number of boys.

Answers

5a. $b = \frac{6}{5}g$

5b. Because the input is number of girls and the output is number of boys, the constant of proportionality is $\frac{6}{5}$. This is the numerical coefficient of the variable g, the input, in the equation.

5c. The constant of proportionality means that for every girl enrolled in the school, there is $\frac{6}{5}$ of a boy enrolled.

6. The constants of proportionality are reciprocals of each other.

7. No. The constants of proportionality are fractions of people.

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?

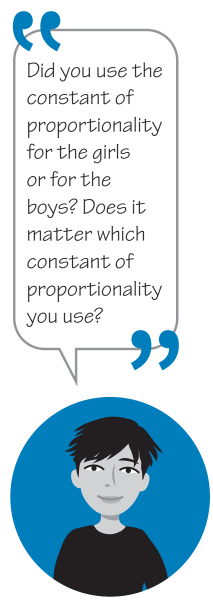
7. Do you think each constant of proportionality makes sense in terms of the problem situation?

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?



Answers

8a. $g = 65.833$
. There should be approximately 66 opportunities for girls to participate in athletics.

8b. $b = 142.8$.
There should be approximately 143 opportunities for boys to participate in athletics.

ELL Tip

Have students read the paragraph that discusses why the constant of proportionality could be represented as a decimal or fraction. Allow students time to share ideas on how a fractional or decimal constant of proportionality could be used to predict outcomes. Have students use examples from their work or create their own examples to support their ideas.

Answers

1a. $k = \frac{5}{7}$

1b. $k = \frac{7}{5}$

2. Let p equal the number of girls that play sports, and let t equal the total number of girls enrolled in the school.

ACTIVITY 2.3

Representing Proportional Relationships with Equations

Title IX addresses the number of athletics opportunities provided to different sexes, but the actual participation at schools may differ. Also, the same person may participate in multiple sports.

At Vista Middle School, 5 out of every 7 girls play sports. The guidance counselor, Ms. Shanahan, and the athletics director, Coach Culpepper, are completing reports about the students at Vista Middle School.

Consider the information each person knows and use the constant of proportionality to write equations for each situation.

Guidance Counselor

Ms. Shanahan knows the number of girls in the school on a given day, and she needs to be able to calculate the expected number of girls who play sports.

Athletics Director

Coach Culpepper knows the number of girls participating in sports during a given season, and she needs to be able to calculate the expected number of total girls in the school.

1. Determine the constant of proportionality for each situation.

a. Guidance Counselor

b. Athletics Director

2. Define variables for the quantities that are changing in these situations.

3. **Use the constants of proportionality to write equations to determine the information needed by each person.**

   a. **Guidance Counselor** b. **Athletics Director**

In terms of proportionality, Ms. Shanahan could state that the number of girls who play sports is proportional to the number of total girls in the school at a constant rate equal to the constant of proportionality.

4. **Write Coach Culpepper's situation using the language of proportionality and include the value for the constant of proportionality.**

5. **Consider the given equations, where y represents the dependent, or output, quantity and x represents the independent, or input, quantity.**

$$\frac{y}{x} = k$$

$$\frac{y}{x} = \frac{k}{1}$$

$$y = kx$$

   a. **Describe how the first equation represents the constant of proportionality.**

   b. **Explain how the second equation represents proportional relationships.**

   c. **Describe how the first equation was rewritten to create the third equation.**

   d. **Explain the meaning of the constant of proportionality, k, in the third equation.**

Answers

3a. $p = \frac{5}{7}t$

3b. $t = \frac{7}{5}p$

4. The total number of girls in the school is proportional to the number of girls who play sports at a constant rate of $\frac{7}{5}$.

5a. The constant of proportionality is the ratio of the outputs to the inputs. On a graph, x and y are common variables, with x representing the input and y representing the output. So the constant of proportionality would be $k = \frac{y}{x}$.

5b. The output value, y, is proportional to the input value, x, at a rate equal to the constant of proportionality, k.

5c. To write the first equation as the second equation, the constant of proportionality was rewritten as a fraction. Then, the means and extremes method was used to create the third equation.

5d. The y-value will increase by k for every one unit the x-value increases.

Answers

6a. The constant of proportionality is 2. The diameter (y) divided by the radius (x) always equals 2.

6b. The constant of proportionality is 3. The perimeter (y) divided by a side length (x) always equals 3.

6. Identify the constant of proportionality in each equation and describe its meaning.

a. $d = 2r$, where d represents the diameter of a circle and r represents the radius of a circle.

b. $P = 3s$, where P represents the perimeter and s represents the sides of an equilateral triangle.

ACTIVITY 2.4 Using the Constant of Proportionality to Solve Problems

A chemist must use a solution that is 30% of reagent and 70% of water for an experiment. A *solution* is a mixture of two or more liquids. A *reagent* is a substance used in a chemical reaction to produce other substances.

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

2. Write an equation for the amount of water needed based on the amount of reagent. What is the constant of proportionality?

Answers

1. Let r equal the number of units of reagent, and let w equal the number of units of water in the solution.

2. The equation is $w = \frac{7}{3}r$. The constant of proportionality is $\frac{7}{3}$.

3. Use your equation from Question 2 to write an equation for the amount of reagent needed based on the amount of water. Explain your reasoning.

> In Question 3, you can say that the amount of reagent varies directly as the amount of water in the solution.

4. Use your equations to answer each question.

   a. If the chemist uses 6 liters of reagent, how many liters of water will she need to make her 30% solution?

   b. If the chemist uses 77 milliliters of water, how many milliliters of reagent will she need to make her 30% solution?

5. Write an equation to show that y is directly proportional to x using the constant of proportionality given. Then, solve for the unknown value.

   a. $k = 0.7$ and $y = 4$

   b. $k = \frac{3}{11}$ and $x = 9$

   c. $k = 5$ and $x = 1\frac{1}{2}$

   d. $k = \frac{1}{6}$ and $y = 3\frac{1}{3}$

Answers

3. The equation is $r = \frac{3}{7}w$. When the input and output quantities are interchanged, the new constant of proportionality is the reciprocal of the original constant of proportionality.

4a. The chemist should use 14 L of water.

4b. The chemist should use 33 mL of reagent.

5a. $x = 5\frac{5}{7}$

5b. $y = 2\frac{5}{11}$

5c. $y = 7\frac{1}{2}$

5d. $x = 20$

Answers

1. Answers will vary.
2. Answers will vary.
3. Answers will vary.

NOTES

TALK the TALK

Turning the Tables

Consider the equation $y = kx$. Use the value of the constant of proportionality assigned to you to answer the questions. You will present your work to your class.

1. **Write a scenario for a proportional relationship that would be represented by the equation. Clearly define your variables and identify the direction of the proportional relationship.**

2. **Interpret the constant of proportionality in the context of your scenario.**

3. **Write and solve at least 2 questions that could be solved using your equation.**