LESSON 7: Representing Proportional Relationships with Equations

[Objective]
The student will represent proportional relationships with equations.

[Prerequisite Skills]
recognizing patterns, writing ratios, unit rates, finding constant of proportionality (Lesson 6)

[Materials]
Student pages **S57 – S68**
Two-color counters (12 per student pair)

[Essential Questions]
1. What is the form of any equation that shows a proportional relationship?
2. What does the coefficient of the *x*-variable represent in the equation?
3. Where are the independent and dependent variables in the equation?

[Words For Word Wall]
constant of proportionality, unit rate, dependent variable, independent variable, coefficient

[Grouping]
Cooperative Pairs (CP), Whole Group (WG), Individual (I)
*For Cooperative Pairs (CP) activities, assign the roles of Partner A and Partner B to students. This allows each student to be responsible for designated tasks within the lesson.

[Levels of Teacher Support]
Modeling (M), Guided Practice (GP), Independent Practice (IP)

[Multiple Representations]
SOLVE, Algebraic Formula, Verbal Description, Pictorial Representation, Concrete Representation, Graph, Graphic Organizer, Table

[Warm-Up] (IP, I, WG) S57 (Answers are on T132.)
- Have students turn to S57 in their books to begin the Warm-Up. Students will find the constant of proportionality. Monitor students to see if any of them need help during the Warm-Up. Have students complete the problems and then review the answers as a class. **{Pictorial Representation, Graph, Verbal Description, Table}**

[Homework]
Take time to go over the homework from the previous night.

[Lesson] [2-3 days (1 day = 80 minutes) - (M, GP, IP, WG, CP, I)]

SOLVE Problem (WG, GP) S58 (Answers on T133.)

Have students turn to S58 in their books. The first problem is a SOLVE problem. You are only going to complete the S step with students at this point. Tell students that during the lesson they will learn how to write an equation to show the relationship between two variables in a proportional relationship. They will use this knowledge to complete this SOLVE problem at the end of the lesson. **{SOLVE, Verbal Description, Graphic Organizer}**

Proportional Relationships with Equations - Concrete (M, GP, CP, WG) S58 (Answers on T133.)

M, GP, WG, CP: Students will continue to work on S58. Students will work on proportional relationships with two-color counters and equations. Give each student pair 12 two-color counters. Make sure students know their designation as Partner A or Partner B. **{Concrete Representation, Verbal Description, Algebraic Formula, Graphic Organizer}**

MODELING

Proportional Relationships with Equations - Concrete

Step 1: Have Partner A place 3 yellow chips on the work space.
- Partner B, place 1 red chip below the yellow chips on the work space.
- Partner A, describe the relationship between the red and yellow chips. (For every 1 red chip there are 3 yellow chips.)
- Partner B, identify the **unit rate** of yellow to red chips. (3 to 1)

Step 2: Partner A, what is another term we can use for the unit rate? **(constant of proportionality)**
- Partner B, what is the constant of proportionality for the number of red chips to the number of yellow chips? ($\frac{1}{3}$) Record in Question 1.
- Partner A, explain the meaning of $\frac{1}{3}$ as the constant of proportionality. (This means that for every 1 red chip there are 3 yellow chips.) Record.

Step 3: Have partners discuss a variable they can use to represent the red and yellow chips.
- If you wanted to identify the chips with a variable, what might be a good letter to use? (y – yellow; r – red) Record in Question 2 and the graphic organizer.

***Teacher Note:** The table is set up so the students will always see the independent variable on the top and the dependent variable on the bottom. This is because you usually always see the independent variable on the top if the table is horizontal and on the left if the table is vertical. With the idea of proportional relationships, watch to see if the students switch the numbers around since the dependent variable is above the independent variable. This is a good place to take time and make sure your students understand how to set up a constant of proportionality. This will be very important for when the students move to a rate of change (slope) in 8th grade.

Step 4: Direct students' attention to Question 3.

- Partner A, what term can we use to represent the yellow chips? (dependent variable) Record in the graphic organizer. Explain your thinking. (The number of yellow chips is dependent on how many red chips are shown.)
- Partner B, what term can we use to represent the red chips. (independent variable) Record in the graphic organizer. Explain your thinking. (The number of red chips is independent from the number of yellow chips, meaning that the yellow chips depend on the number of red chips.)

Step 5: Partner A, place 3 more yellow chips on the work space.

- Partner B, place 1 red chip below the second set of yellow chips.
- Partner A, did the constant of proportionality change? (No.)
- Partner B, explain why not? (There are still 3 yellow chips to every red chip.)
- Have students record the values of 6 for yellow and 2 for red in the graphic organizer.

Step 6: Have Partner A place 3 more yellow chips on the work space.

- Have Partner B, place 1 red chip below the third set of yellow chips.
- Partner B, did the constant of proportionality change? (No.)
- Partner A, explain why not. (There are still 3 yellow chips to every red chip.)
- Have student pairs record the values of 9 for yellow and 3 for red in the graphic organizer.
- Have partners discuss whether or not there is a consistent relationship between the values of the red chips and the yellow chips in the table. (Yes.) Record.

Step 7: Have students discuss the relationship and define an operation that can be used to represent the relationship. (Multiplication) Record. Ask students for ideas about an explanation of why we would use multiplication. (We multiply the number of red chips (r) by 3 to determine the number of yellow chips (y).) Record.

Step 8: Partner A, if we had 4 red chips, how many yellow chips would there be? (12). How do you know? (4 times 3 is 12.)
- Partner B, if we had 5 red chips, how many yellow chips would there be? (15) How do you know? (5 times 3 is 15.)
- Have partners write an equation that can be used to describe the relationship between the number of red chips (r) and the number of yellow chips (y) as an equation? ($y = 3r$) Record.

Proportional Relationships with Equations – Pictorial

(M, GP, CP, IP, WG) S59, S60 (Answers on T134, T135.)

M, GP, WG, CP: Have students turn to page S59 in their books. Students will represent proportional relationships with equations using pictorial representations. Make sure students know their designation as Partner A or Partner B. **{Pictorial Representation, Algebraic Formula, Verbal Description}**

MODELING

Proportional Relationships with Equations - Pictorial

Step 1: Direct students to Problem 1 with the pictorial representation of stars and hearts.

Step 2: Partner A, if there is only 1 heart, how many stars are there? (2) Record.
- Partner B, if there are 2 hearts, how many stars are there? (4) Record.
- Partner A, if there are 3 hearts, how many stars are there? (6) Record. This means that for every one heart you add, you must add how many stars? (2) Record.

Step 3: Partner A, identify the constant of proportionality for the number of stars to hearts. ($\frac{2}{1}$) Record.
- Partner B, explain how many stars you would have with four hearts. (8) Record.
- Partner A, explain why this is true. (Every time we add a heart, we must add two stars to continue the pattern. There are always twice as many stars as hearts.) Record.

Step 4: Read Question 5 and discuss the dependent and independent variables in this situation. Remind students that the value of the **dependent variable** depends on the value of the **independent variable**.
- Have student pairs discuss Question 6. How did you determine the number of stars there would be for each number of hearts? (Multiply the number of hearts by two.) Record.

Step 7: Have students write an equation for Question 7 and fill in the blanks using the information from Step 6.

IP, CP, WG: Have students work with a partner to complete the problems with the pictorial representations on S60. Remind them that if they need help they can refer to the examples on S59. Then come back together as a class and share their results. **{Pictorial Representation, Algebraic Formula, Verbal Description}**

Proportional Relationships with Equations – Tables

(M, GP, CP, IP, WG) S61, S62 (Answers on T136, T137.)

M, GP, WG, CP: Have students turn to S61 in their books. Students will work on proportional relationships with tables and equations. Make sure students know their designation as Partner A or Partner B. **{Graphic Organizer, Algebraic Formula, Verbal Description}**

MODELING

Proportional Relationships with Equations – Tables

Step 1: Have students look at Question 1 and the table below.

- Partner A, how can we find the constant of proportionality? (Find the unit rate.)
- Partner B, how do we find the unit rate for $\frac{15}{60}$? (Divide the numerator and denominator by 60.)
- Have partners work together to find the constant of proportionality for all rows of the chart. What is the constant of proportionality? (0.25) Record.

Step 2: Have students use the information from the table to answer the questions below.

- Partner B, if there are 120 minutes in a show, how many minutes of commercials would there be? (30 minutes) Record.
- Partner A, if there are 150 minutes in a show, how many minutes of commercials would there be? (37.5 minutes) Record.
- Partner B, if there are 200 minutes in a show, how many minutes of commercials would there be? (50 minutes) Record.

Step 3: Have partners discuss Question 3. How did you determine the number of minutes of commercials there would be for the number of minutes in the television show? (Multiply the number of minutes in the television show by 0.25.) Record.

Step 4: Discuss Questions 4 and 5 with students about the use of the *x* and *y* variables to represent the dependent and independent variables.

Step 5: Partner A, identify the equation that could be used for the relationships. ($y = 0.25x$) Record.
- Partner B, fill in the blanks in the explanation of the equation in Question 6. Record.

Step 6: Write the equations for both examples in Question 7 and have students determine the minutes of commercials in each situation.

IP, CP, WG: Have students work with a partner to complete the problems with the graphic organizers on S62. Remind them that if they need help they can refer to the examples on S61. Then come back together as a class and share their results. **{Graphic Organizer, Algebraic Formula, Verbal Description}**

Proportional Relationships with Equations – Graphs

(M, GP, CP, IP, WG) S63, S64 (Answers on T138, T139.)

M, GP, WG, CP : Have students turn to S63 in their books. Students will work on proportional relationships with graphs and equations. Make sure students know their designation as Partner A or Partner B. **{Graphs, Algebraic Formula, Verbal Description}**

MODELING

Proportional Relationships with Equations – Graphs

Step 1: Have students look at Question 1 and the graph about Jesse's pushups.
- Partner B, how can we find the constant of proportionality. (Find the unit rate).
- Partner A, how do we find the unit rate in a graph? (Look for the number of pushups in one day.)
- Partner B, what is the constant of proportionality? (25) Record.
- Partner A, identify the number of pushups for 2 days. (50) Record.
- Partner B, identify the number of pushups for 3 days. (75) Record.
- Partner A, identify the number of pushups for 4 days. (100) Record.

Step 2: Have partners discuss Question 3. How did you determine the number of pushups Jesse would do, based on the number of days? (Multiply the number of days by 25.) Record.

Step 3: Discuss Questions 4 and 5 with students about the use of the *x* and *y* variables to represent the dependent and independent variables.

Step 4: Partner B, identify the equation that could be used for the relationships. ($y = 25x$) Record.
- Partner A, fill in the blanks in the explanation of the equation in Question 5. Record.

***Teacher Note:** This is a good place to discuss that the equation is in terms of $y = kx$ where k is constant.

Step 5: Write the equations for both examples in Questions 6 and 7 and have students determine the number of pushups in each situation.

IP, CP, WG: Have students work with a partner to complete the problems on S64. Remind them that if they need help they can refer to the examples on S63. Then come back together as a class and share their results. **{Graph, Algebraic Formula, Verbal Description}**

Proportional Relationships with Equations – Abstract

(M, GP, CP, IP, WG) S65 (Answers on T140.)

M, GP, WG, CP: Have students turn to S65 in their books. Students will work on proportional relationships using word problems and equations. Make sure students know their designation as Partner A or Partner B. **{Algebraic Formula, Verbal Description}**

MODELING

Proportional Relationships with Equations – Abstract

Step 1: Read Problem 1 together.
- Partner A, describe the relationship between the weight of the dog and the amount of medicine. (1 pound to 0.1 cc of medicine)
- Partner B, if the number of cc of medicine depends on the number of pounds the dog weighs, what is the dependent variable? (cc of medicine) Record in the chart.
- Partner A, what does the variable, *y*, represent? (dependent variable) Record.

- Partner B, identify the independent variable. (the weight of the dog) Record in the table.
- Partner A, what does the variable, x, represent? (independent variable) Record.
- Have student pairs discuss how they can write an equation to model the relationship between the weight of the dog and the amount of medicine.

  ($y = 0.1x$) Record in the chart. Explain your equation. (Because the dog gets 0.1 cc of medicine for each pound, the coefficient of x is 0.1.)

Step 2: Direct students' attention to Question 2.

- Partner B, explain how we determine the constant of proportionality. (It is the coefficient of the x-variable.) Record in Question 2 and then fill in the Constant of Proportionality in the chart.

Step 3: Partner A, what equation could you use to determine the amount of medicine if the dog's weight is 5 pounds? ($y = 0.1x$) Record in the chart.

- Partner B, what is the value of y if the dog weighs 5 pounds? ($y = 0.5$ cc) Record in the chart.

Step 4: Partner A, what equation could you use to determine the amount of medicine if the dog's weight is 20 pounds? ($y = 0.1x$) Record in the chart.

- Partner B, what is the value of y if the dog weighs 20 pounds? ($y = 2$ cc) Record in the chart.

Step 5: Partner A, what equation could you use to determine the amount of medicine if the dog's weight is 25 pounds? ($y = 0.1x$) Record in the chart.

- Partner B, what is the value of y if the dog weighs 25 pounds? ($y = 2.5$ cc) Record in the chart.

IP, CP, WG: Have students work with a partner to complete Problems 4 and 5 at the bottom of S65. Then come back together as a class and share their results. **{Algebraic Formula, Verbal Description, Graphic Organizer}**

SOLVE Problem **(GP, WG) S66 (Answers on T141.)**

Remind students that the SOLVE problem on S66 is the same one from the beginning of the lesson. Complete the SOLVE problem with your students. Ask them for possible connections from the SOLVE problem to the lesson. Students should say that they need to use the constant of proportionality to write an equation. **{SOLVE, Algebraic Formula, Verbal Description}**

If time permits... **(IP, CP) S67 (Answers on T142.)**

Have students complete the graphic organizer on S67.

[Closure]

To wrap up the lesson, go back to the essential questions and discuss them with students.

- What is the form of any equation that shows a proportional relationship? *(y = kx)*
- What does the coefficient of the *x*-variable represent in the equation? *(the constant of proportionality)*
- Where are the independent and dependent variables in the equation? *(The independent variable is x, which is multiplied by the constant of proportionality, and the dependent variable is y.)*

[Homework] Assign S68 for homework. (Answers on T143.)

[Quiz Answers] T144 – T146

1. **B** 2. **A** 3. **A** 4. **B** 5. **C** 6. **D** 7. **A** 8. **C** 9. **A** 10. **B**

The quiz can be used at any time as extra homework or to see how students progress on writing an equation to show the proportional relationship between two variables.

Here is the key to **S57**.

Warm–Up

Directions: Find the constant of proportionality for each problem.

1. Stars to circles

5

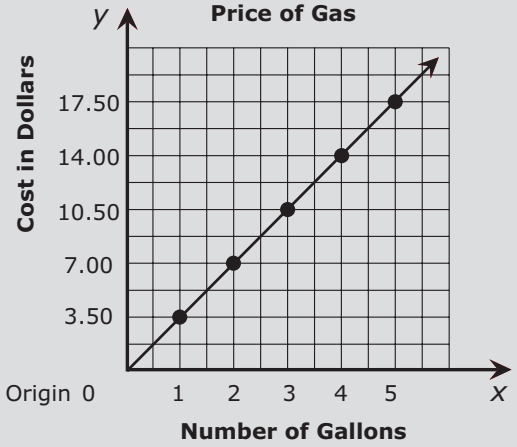
2.

Touchdowns	Points
1	6
2	12
3	18
4	24

Points per Touchdown

6

3.



Cost per gallon

$3.50

4. For every question Beth answers correctly on a game show, she receives 10 points.

10

Here is the key to **S58**.

Directions: Complete the following SOLVE problem with your teacher. You will only complete the S step.

Nick is purchasing some supplies for a party. He is trying to decide how many cases of water he can afford to buy. Each case of water costs $4.50. What equation can he use to represent the proportional relationship between the number of cases of water he buys and the cost?

S Underline the question.
This problem is asking me to find **the equation that Nick can use to find the cost of any number of cases of water.**

Directions: Complete this page with your teacher and partner.

1. What is the constant of proportionality for the number of red chips to yellow chips? $\frac{1}{3}$ This means that for every **1** red chip there are **3** yellow chips.

2. Let's choose a variable to represent the yellow chips and the red chips.
red chips – *r*; yellow chips - *y*

3. The number of yellow chips (dependent variable) that are in the work space depends on the number of red chips (independent variable) in the work space.

	Variable	Relationship	Value	Value	Value
Red Chip	***r***	**Independent variable**	**1**	**2**	**3**
Yellow Chip	***y***	**Dependent variable**	**3**	**6**	**9**

4. Is there a pattern or relationship between the values of the red chips and the yellow chips in the table? **Yes.**

5. What operation can be used to represent that relationship? **multiplication**
Why? **We multiply the number of red chips (*r*) by 3 to determine the number of yellow chips (*y*).**

6. How can we show the relationship in an equation? ***y* = 3*r*; the number of red chips, (*r*), multiplied by 3 is equal to the number of yellow chips, (*y*).**

Here is the key to **S59**.

Directions: Complete this page with your teacher and partner.

Use the pictorial representation of the stars and hearts to answer Questions 1 – 7.

1. If there is only 1 heart, how many stars are there? **2**

If there are two hearts, how many stars are there? **4**

If there are three hearts, how many stars are there? **6**

2. This means that for every one heart you add, you must add **two** stars to the diagram.

3. What is the constant of proportionality (or unit rate) for the number of stars to hearts? $\frac{\mathbf{2}}{\mathbf{1}}$

4. If there were four hearts, how many stars would we have? **8**

Explain your thinking. Every time we add a heart, we must add **two** stars to continue the pattern. There are always twice as many **stars** as hearts.

5. The **number of stars** that are in the diagram depends on the **number of hearts** in the diagram. So, if *s* represents the number of stars, the **dependent** variable, and *h* represents the number of hearts, the **independent** variable, we can write an equation that shows the relationship between hearts (*h*) and stars (*s*).

6. How did you determine the number of stars (*s*) there would be for each number of hearts (*h*)? **Multiply the number of hearts by 2.**

7. How could we show that in an equation? $\boldsymbol{s = 2h}$ The number of **hearts (*h*)** multiplied by **2** equals the number of **stars (*s*)**.

LESSON 7: Representing Proportional Relationships with Equations

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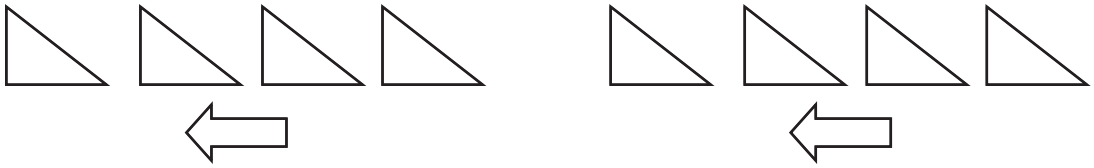
Here is the key to **S60**.

Directions: Complete this page with your partner.

Use the pictorial representation of the triangles and arrows to answer Questions 1 – 7.



1. If there is only 1 arrow how many triangles are there? **4**

If there are 2 arrows, how many triangles are there? **8**

2. What is the constant of proportionality (or unit rate) for the number of triangles to arrows? $\frac{\mathbf{4}}{\mathbf{1}}$

3. If there were three arrows, how many triangles would we have? **12**

If there were four arrows, how many triangles would we have? **16**

4. Explain your thinking. Every time we add an arrow, we must add **four** triangles to continue the pattern. There are always four times as many **triangles** as arrows.

5. The **number of triangles** that are in the diagram depends on the **number of arrows** in the diagram. So, if *t* represents the number of triangles, the **dependent** variable, and *a* represents the number of arrows, the **independent** variable, we can write an equation that shows the relationship between triangles (*t*) and arrows (*a*).

6. How did you determine the number of triangles (*t*) there would be for each number of arrows (*a*)? **Multiply the number of arrows by 4**.

7. How could we show that in an equation? $\boldsymbol{t = 4a}$ The number of **arrows (*a*)** multiplied by **4** equals the number of **triangles (*t*)**.

Here is the key to **S61**.

Directions: Complete this page with your teacher and partner.

1. The table shows how many minutes of commercials are within television shows of certain lengths. What is the constant of proportionality? **0.25**

TV Show Length (x)	Minutes of Commercials (y)
60	15
90	22.5
120	30
240	60

2. The number of minutes of commercials depends on the number of minutes in the television show.

- If there were 120 minutes in the television show, how many minutes of commercials would there be? **30 minutes**
- If there were 150 minutes in the television show, how many minutes of commercials would there be? **37.5 minutes**
- If there were 200 minutes in the television show, how many minutes of commercials would there be? **50 minutes**

3. How did you determine the number of minutes of commercials, y, there would be for the number of minutes in the television show, x? **Multiply the number of minutes in the television show by 0.25.**

4. We can use **variables** to represent the situation. This time we are going to use the variables x and y because those are the most common variables used in written equations.

5. If we use y to represent the **number of minutes of commercials**, the **dependent** variable, and x represents the **number of minutes in the television show**, the **independent** variable, we can write an equation that shows the relationship between x and y.

6. How could we show that in an equation? $\boldsymbol{y = 0.25x}$ The number of **television show minutes, (x)**, multiplied by **0.25** equals the number of **commercial minutes, (y)**.

7. If there were 100 minutes in the television show, how many minutes of commercials would there be? $\boldsymbol{y = 0.25x;\ y = 25}$ **minutes**

If there were 300 minutes in the television show, how many minutes of commercials would there be? $\boldsymbol{y = 0.25x;\ y = 75}$ **minutes**

Here is the key to **S62**.

Directions: Complete this page with your partner.

1. The table shows the cost of different numbers of pictures.

Number of Pictures	Cost
10	$5.00
15	$7.50
20	$10.00
25	$12.50

2. The cost depends on the number of pictures ordered.

If there were 10 pictures ordered, what is the cost? **$5.00**

If there were 20 pictures ordered, what is the cost? **$10.00**

If there were 25 pictures ordered, what is the cost? **$12.50**

3. How did you determine the cost, *y*, for the number of pictures ordered, *x*? **Multiply the number of pictures by 0.50.**

4. If we use *y* to represent the **cost**, the **dependent** variable, and *x* represents the **number of pictures ordered**, the **independent** variable, we can write an equation that shows the relationship between *x* and *y*.

5. How could we show that in an equation? ***y* = 0.50*x*** The number of pictures ordered, ***x***, multiplied by **0.50** equals the **cost, *y***.

6. If there were 30 pictures ordered, what is the cost? ***y* = 0.50*x*; *y* = $15.00**

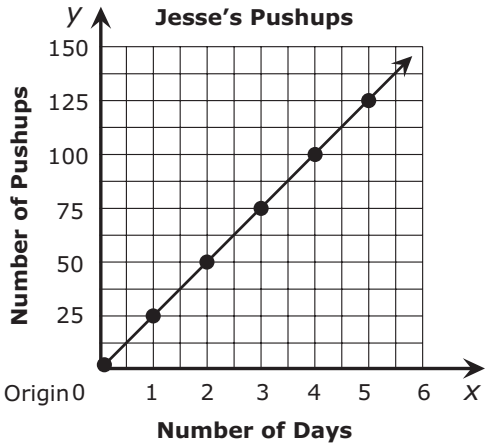
7. If there were 50 pictures ordered, what is the cost? ***y* = 0.50*x*; *y* = $25.00**

Here is the key to **S63**.

Directions: Complete this page with your teacher and partner.

1. The graph shows the total number of pushups that Jesse has done this week.

What is the constant of proportionality? **25**



2. The number of pushups depends on the number of days.

If Jesse does pushups for 2 days, how many pushups will he do? **50**

If Jesse does pushups for 3 days, how many pushups will he do? **75**

If Jesse does pushups for 4 days, how many pushups will he do? **100**

3. How did you determine the number of pushups Jesse would do based on the number of days he did pushups? **Multiplied the number of days by 25.**

4. If *y* represents the **number of pushups**, the **dependent** variable, and *x* represents the **number of days**, the **independent** variable, we can write an equation that shows the relationship between *x* and *y*.

5. How could we show that in an equation? ***y* = 25*x*** The number of **days (*x*)** multiplied by **25** equals the number of **pushups (*y*)**.

6. If Jesse does pushups for 5 days, how many pushups will he do?
***y* = 25*x*; *y* = 125 pushups**

7. If Jesse does pushups for 10 days, how many pushups will he do?
***y* = 25*x*; *y* = 250 pushups**

Here is the key to **S64**.

Directions: Complete this page with your partner.

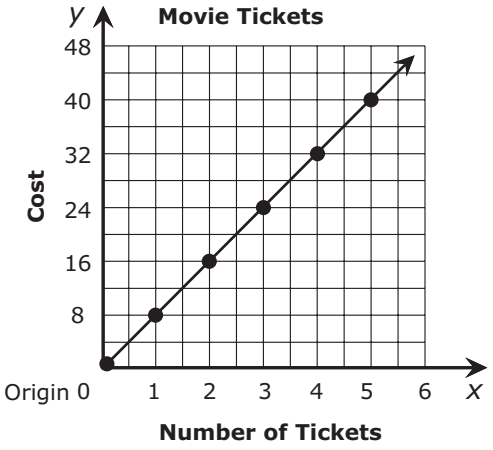
1. The graph shows the cost of movie tickets. What is the constant of proportionality? **8**

2. The cost depends on the number of tickets.

If 2 tickets are bought, what is the cost? **$16**

If 3 tickets are bought, what is the cost? **$24**

If 5 tickets are bought, what is the cost? **$40**



3. How did you determine the cost, *y*, of the tickets, *x*? **Multiply the number of tickets by 8**.

4. If *y* represents the **cost**, the **dependent** variable, and *x* represents the number of **tickets**, the **independent** variable, we can write an equation that shows the relationship between *x* and *y*.

5. How could we show that in an equation? ***y* = 8*x*** The number of **tickets, *x***, multiplied by **8** equals the **cost, *y***.

6. If 6 tickets are bought, what is the cost? ***y* = 8*x*; *y* = $48.00**

7. If 8 tickets are bought, what is the cost? ***y* = 8*x*; *y* = $64.00**

Here is the key to **S65**.

Directions: Complete this page with your teacher and partner.

1. The veterinarian says that for every pound your dog weighs, the dog should get 0.1 cc of medicine.

The number of cc of medicine depends on the number of pounds the dog weighs. If *y* represents the **dependent variable**, and *x* represents the **independent variable,** then we can write an equation that shows the relationship between *x* and *y* by using the coefficients given in the problem.

2. How do we determine the constant of proportionality? **It is the coefficient of the *x* variable.**

3. How can you determine the number of cc of medicine, *y*, there would be for the number of pounds the dog weighs, *x*? **multiply the number of pounds the dog weighs by 0.1**

Constant of Proportionality (*k*)	*y* (dependent variable)	*x* (independent variable)	Equation	Dog weight: 5 pounds	Dog weight: 20 pounds	Dog weight: 25 pounds
0.1	**cc of medicine**	**weight of dog**	***y* = 0.1*x***	***y* = 0.1*x* *y* = 0.1(5) *y* = 0.5 cc**	***y* = 0.1*x* *y* = 0.1(20) *y* = 2 cc**	***y* = 0.1*x* *y* = 0.1(25) *y* = 2.5 cc**

4. Tim gets paid $1.00 for every five golf balls he finds and returns at the golf course. What is the constant of proportionality? **0.20**

The **amount of money he earns** depends on the **number of golf balls he finds**. So, if *y* represents the **amount of money earned**, the **dependent** variable, and *x* represents the **number of golf balls he finds**, the **independent** variable, we can write an equation that shows the relationship between *x* and *y*.

Constant of Proportionality (*k*)	*y* (dependent variable)	*x* (independent variable)	Equation	Found: 5 golf balls	Found: 20 golf balls	Found: 25 golf balls
0.20	**money earned**	**number of golf balls collected**	***y* = 0.20*x***	***y* = 0.20*x* *y* = 0.20(5) *y* = $1.00**	***y* = 0.20*x* *y* = 0.20(20) *y* = $4.00**	***y* = 0.20*x* *y* = 0.20(25) *y* = $5.00**

5. If Tim finds 30 golf balls, how much money should he get?
***y* = 0.20*x*; *y* = $6.00**

Here is the key to **S66**.

Directions: Complete the following SOLVE problem with your teacher.

~~Nick is purchasing some supplies for a party.~~| ~~He is trying to decide how many cases of water he can afford to buy.~~| Each case of water costs $4.50.| What equation can he use to represent the proportional relationship between the number of cases of water he buys and the cost?

S Underline the question.
This problem is asking me to find **the equation that Nick can use to find the cost of any number of cases of water.**

O Identify the facts.
Eliminate the unnecessary facts.
List the necessary facts. **One case of water is $4.50**

L Write in words what your plan of action will be. **Set up a proportional equation using the constant of proportionality as the coefficient of *x*.**

Choose an operation or operations. **Multiplication**

V Estimate your answer. **equation in the form of $y = kx$**

Carry out your plan. **$y = 4.50x$**

E Does your answer make sense? (Compare your answer to the question.) **Yes, I wrote an equation that will give the cost of cases of water.**

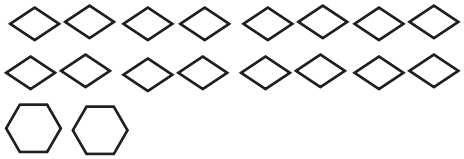
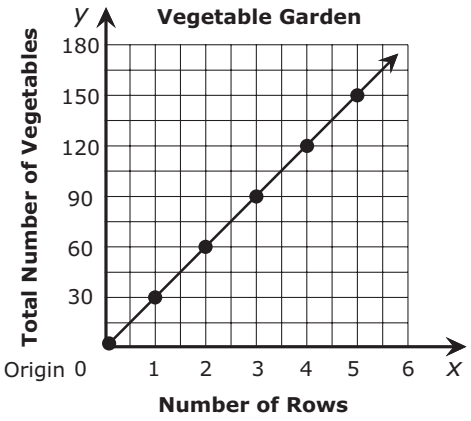
Is your answer reasonable? (Compare your answer to the estimate.) **Yes, because it can be used to determine the cost of any number of cases of water.**

Is your answer accurate? (Check your work.) **Yes.**

Write your answer in a complete sentence. **The cost is equal to the cost of a case times the number of cases purchased; $y = 4.50x$**

Here is the key to **S67**.

Directions: Complete this page by writing the equation that will represent the constant of proportionality.

Type of Representation	Example	Constant of Proportionality and Equation
Diagram	 x = hexagons, y = diamonds	Ratio: $\frac{16}{2} = \frac{8}{1}$ Constant of Proportionality: **8** Equation: $y = 8x$
Table	Cups of granola: 2, 4, 6, 22 Cups of candy: 3, 6, 9, 33 x = granola, y = candy	Ratio: $\frac{3}{2} = \frac{1.5}{1}$ Constant of Proportionality: **1.5** Equation: $y = 1.5x$
Graph		Ratio: $\frac{30}{1}$ Constant of Proportionality: **30** Equation: $y = 30x$
Verbal Description	The band is selling coupon books for $25 each. For each book they sell, they get to keep $10. x = coupon books sold, y = total amount raised.	Ratio: $\frac{10}{1}$ Constant of Proportionality: **10** Equation: $y = 10x$

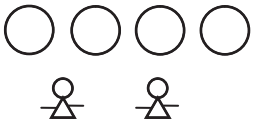
Here is the key to **S68**.

Homework

Name _____ **Date** _____

Directions: Write an equation that represents each proportional relationship.

1. Cookies to students ***y* = 2*x***



2. Stars to Moons ***y* = 9*x***

3.

Laps in pool	2	4	6	8
meters	100	200	300	400

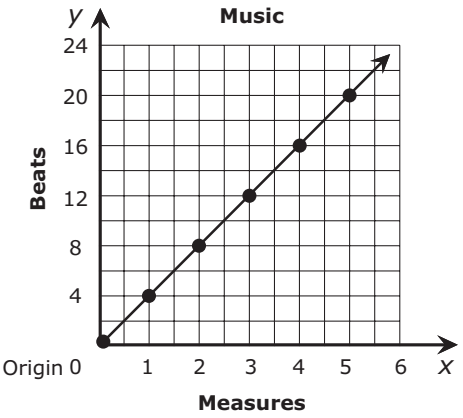
y* = 50*x

4.

Guests	3	5	8	11
Cost	$9	$15	$24	$33

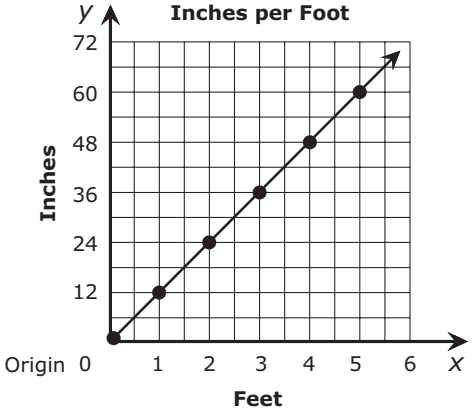
y* = 3*x

5.



y* = 4*x

6.



y* = 12*x

7. Theresa is buying snacks for soccer practice. The snacks are $0.95 each.

y* = 0.95*x

8. Jack works at a hospital where he gets paid $19 an hour.

y* = 19*x

9. Janice is having a cartwheel competition. She completed 15 cartwheels in two minutes.

y* = 7.5*x

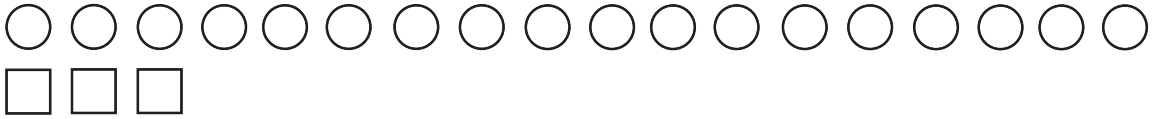
10. For a stage production, 108 light bulbs are needed for 12 posts.

y* = 9*x

Name _____ Date _____

Quiz

1. Which equation could be used to tell the number of circles, y, compared to the number of squares, x?



A. $x = 6y$

B. $y = 6x$

C. $x = y + 15$

D. $y = x + 15$

2. Which equation can be used to find the number of donuts, y, based on the number of cups of coffee, x?

A. $y = 3x$

B. $x = 3x$

C. $x = 9 + y$

D. $y = 9 + x$

3. Which equation shows the relationship between x and y in the table?

x	3	8	11	14
y	13.50	36.00	49.50	63.00

A. $y = 4.50x$

B. $x = 4.50x$

C. $x = y + 10.50$

D. $y = x + 10.50$

4. Sherri works at a store where everything costs the same. Which choice shows the equation that can be used to find the cost of any number of items?

Number of Items	2	3	4	5
Total Cost	$5.00	$7.50	$10.00	$12.50

A. $y = 5x$

B. $y = 2.5x$

C. $y = x + 2.50$

D. $y = x + 5.00$

---

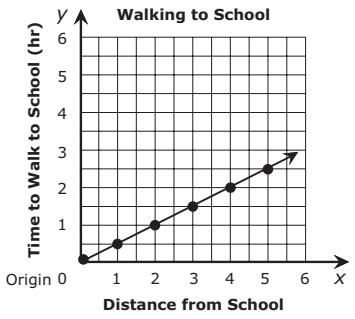
5. Which equation represents the relationship in the graph?

A. $x = 0.5y$

B. $x = 1y$

C. $y = 0.5x$

D. $y = 1x$



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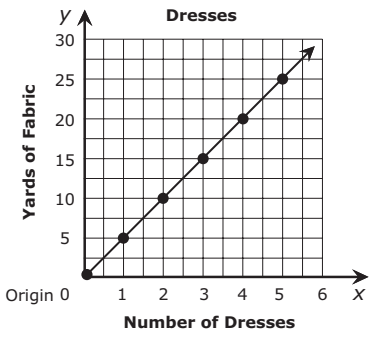
6. Which equation represents the relationship in the graph?

A. $x = y + 4$

B. $y = x + 4$

C. $x = 5y$

D. $y = 5x$



7. Dana has a babysitting job on the weekends. She charges $7.00 per hour for friends and family. Which equation shows the relationship between y, the amount of money she earns, and x, the number of hours she babysit?

A. $y = 7x$

B. $y = 7y$

C. $y = 7 + x$

D. $y = 7 - x$

8. Denis has several chores that he can do around the house. For each hour he spends working, his parents pay him $6. Which equation shows the relationship between y, the amount of money he is paid, and x, the number of hours he works?

A. $y = x + 6$

B. $x = y + 6$

C. $y = 6x$

D. $x = 6y$

9. Caitlyn is making cookies for a fundraiser. For each batch of cookies she needs 3 cups of flour. Which equation shows how many cups of flour she needs for x number of batches of cookies?

A. $y = 3x$

B. $y = x + 3$

C. $x = 3y$

D. $x = y + 3$

10. Blaine hosts birthday parties on Saturdays. For every guest that is invited, he needs 20 ounces of soda. Which equation shows the proportional relationship between the number of guests, x, and the number of ounces of soda, y?

A. $x = 20y$

B. $y = 20x$

C. $x = y + 20$

D. $y = x + 20$