Writing Equations from Tables

? ESSENTIAL QUESTION

How can you use an equation to show a relationship between two variables?

EXPLORE ACTIVITY *Real World* FL 6.EE.3.9

Writing an Equation to Represent a Real-World Relationship

Many real-world situations involve two variable quantities in which one quantity depends on the other. This type of relationship can be represented by a table. You can also use an equation to model the relationship.

The table shows how much Amanda earns for walking 1, 2, or 3 dogs. Use the table to determine how much Amanda earns per dog. Then write an equation that models the relationship between number of dogs walked and earnings. Use your equation to complete the table.

Dogs walked	1	2	3	5	10	20
Earnings	$8	$16	$24			

> For 1 dog, Amanda earns $1 \cdot 8 = \$8$. For 2 dogs, she earns $2 \cdot 8 = \$16$.

A For each column, compare the number of dogs walked and earnings. What is the pattern?

_____

_____

B Based on the pattern, Amanda earns $ _____ for each dog she walks.

C Write an equation that relates the number of dogs Amanda walks to the amount she earns. Let *e* represent earnings and *d* represent dogs.

_____

D Use your equation to complete the table for 5, 10, and 20 walked dogs.

E Amanda's earnings depend on _____.

Reflect

1. What If? If Amanda changed the amount earned per dog to $11, what equation could you write to model the relationship between number of dogs walked and earnings? _____

Writing an Equation Based on a Table

The relationship between two variables where one variable depends on the other can be represented in a table or by an equation. An equation expresses the dependent variable in terms of the independent variable.

When there is no real-world situation to consider, we usually say *x* is the independent variable and *y* is the dependent variable. The value of *y* depends on the value of *x*.

EXAMPLE 1

FL 6.EE.3.9

Write an equation that expresses *y* in terms of *x*.

A

x	1	2	3	4	5
y	0.5	1	1.5	2	2.5

STEP 1 Compare the *x*- and *y*-values to find a pattern.

Each y-value is $\frac{1}{2}$, or 0.5 times, the corresponding x-value.

STEP 2 Use the pattern to write an equation expressing *y* in terms of *x*.

$y = 0.5x$

B

x	2	4	6	8	10
y	5	7	9	11	13

STEP 1 Compare the *x*- and *y*-values to find a pattern.

Each y-value is 3 more than the corresponding x-value.

STEP 2 Use the pattern to write an equation expressing *y* in terms of *x*.

$y = x + 3$

Math Talk

Mathematical Practices

How can you check that your equations are correct?

YOUR TURN

For each table, write an equation that expresses *y* in terms of *x*.

2.

x	12	11	10
y	10	9	8

3.

x	10	12	14
y	25	30	35

_____

4.

x	5	4	3
y	10	9	8

5.

x	0	1	2
y	0	2	4

_____

Using Tables and Equations to Solve Problems

You can use tables and equations to solve real-world problems.

EXAMPLE 2 *Problem Solving*   FL **6.EE.3.9**

A certain percent of the sale price of paintings at a gallery will be donated to charity. The donation will be $50 if a painting sells for $200. The donation will be $75 if a painting sells for $300. Find the amount of the donation if a painting sells for $1,200.

Analyze Information

You know the donation amount when the sale price of a painting is $200 and $300. You need to find the donation amount if a painting sells for $1,200.

Formulate a Plan

You can make a table to help you determine the relationship between sale price and donation amount. Then you can write an equation that models the relationship. Use the equation to find the unknown donation amount.

Solve

Make a table.

Sale price ($)	200	300
Donation amount ($)	50	75

$$\frac{50}{200} = \frac{50 \div 2}{200 \div 2} = \frac{25}{100} = 25\% \qquad \frac{75}{300} = \frac{75 \div 3}{300 \div 3} = \frac{25}{100} = 25\%$$

> One way to determine the relationship between sale price and donation amount is to find the percent.

Write an equation. Let p represent the sale price of the painting. Let d represent the donation amount to charity.

The donation amount is equal to 25% of the sale price.

$$d = 0.25 \cdot p$$

> p is the independent variable; its value does not depend on any other value. d is the dependent variable; its value depends on the price of the painting.

Find the donation amount when the sale price is $1,200.

$$d = 0.25 \cdot p$$
$$d = 0.25 \cdot 1{,}200 \qquad \text{Substitute \$1,200 for the sale price of the painting.}$$
$$d = 300 \qquad \text{Simplify to find the donation amount.}$$

When the sale price is $1,200, the donation to charity is $300.

Justify and Evaluate

Substitute values from the table for p and d to check that they are solutions of the equation $d = 0.25 \cdot p$. Then check your answer of $300 by substituting for d and solving for p.

$$d = 0.25 \cdot p \qquad\qquad d = 0.25 \cdot p \qquad\qquad d = 0.25 \cdot p$$
$$d = 0.25 \cdot 200 \qquad\quad d = 0.25 \cdot 300 \qquad\quad 300 = 0.25 \cdot p$$
$$d = 50 \quad \checkmark \qquad\quad d = 75 \quad \checkmark \qquad\quad p = 1{,}200 \quad \checkmark$$

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YOUR TURN

6. When Ryan is 10, his brother Kyle is 15. When Ryan is 16, Kyle will be 21. When Ryan is 21, Kyle will be 26. Write and solve an equation to find Kyle's age when Ryan is 52.

_____

Guided Practice

Write an equation to express *y* in terms of *x*. (Explore Activity, Example 1)

1.

x	10	20	30	40
y	6	16	26	36

_____

2.

x	0	1	2	3
y	0	4	8	12

_____

3.

x	4	6	8	10
y	7	9	11	13

_____

4.

x	12	24	36	48
y	2	4	6	8

_____

5. Jameson downloaded one digital song for $1.35, two digital songs for $2.70, and 5 digital songs for $6.75. Write and solve an equation to find the cost to download 25 digital songs. (Example 2)

Songs downloaded	1	2	5	10
Total cost ($)	1.35			

Number of songs = *n*; Cost = _____

The total cost of 25 songs is _____

ESSENTIAL QUESTION CHECK-IN

6. Explain how to use a table to write an equation that represents the relationship in the table.

_____

_____

12.3 Independent Practice

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7. Vocabulary What does it mean for an equation to express y in terms of x?

_____

_____

_____

8. The length of a rectangle is 2 inches more than twice its width.

Write an equation relating the length l of the rectangle to its width w.

_____

9. Look for a Pattern Compare the y-values in the table to the corresponding x-values. What pattern do you see? How is this pattern used to write an equation that represents the relationship between the x- and y-values?

x	20	24	28	32
y	5	6	7	8

_____

_____

10. Explain the Error A student modeled the relationship in the table with the equation $x = 4y$. Explain the student's error. Write an equation that correctly models the relationship.

x	2	4	6	8
y	8	16	24	32

_____

_____

11. Multistep Marvin earns $8.25 per hour at his summer job. He wants to buy a video game system that costs $206.25.

a. Write an equation to model the relationship between number of hours worked h and amount earned e.

_____

b. Solve your equation to find the number of hours Marvin needs to work in order to afford the video game system.

_____

12. Communicate Mathematical Ideas For every hour that Noah studies, his test score goes up 3 points. Explain which is the independent variable and which is the dependent variable. Write an equation modeling the relationship between hours studied h and the increase in Noah's test score s.

_____

_____

_____

H.O.T. FOCUS ON HIGHER ORDER THINKING

13. Make a Conjecture Compare the y-values in the table to the corresponding x-values. Determine whether there is an additive relationship or a multiplicative relationship between x and y. If possible, write an equation modeling the relationship. If, not explain why.

x	1	3	5	7
y	3	6	8	21

_____

_____

14. Represent Real-World Problems Describe a real-world situation in which there is an additive or multiplicative relationship between two quantities. Make a table that includes at least three pairs of values. Then write an equation that models the relationship between the quantities.

_____

_____

_____

15. Critical Thinking Georgia knows that there is either an additive or multiplicative relationship between x and y. She only knows a single pair of data values. Explain whether Georgia has enough information to write an equation that models the relationship between x and y.

_____

_____

_____

_____