Words, Equations, Tables, and Graphs

Essential Question

How can you use numbers and symbols to represent mathematical ideas?

CCSS **Common Core State Standards**

Content Standards
7.EE.4

Mathematical Practices
1, 3, 4, 8

Vocabulary

equation

What You'll Learn

- Use multiple representations to represent relations.
- Translate among different verbal, tabular, graphical, and algebraic representations of relations.

Real-World Link

Fireworks Physics can be used to calculate the path of fireworks. In general, for every 1-inch increase in shell diameter, a firework's height increases by about 100 feet. This relationship can be represented using an equation, a table, or a graph.

Represent Relations

You have already seen that a relation may be represented as a set of ordered pairs. You can also write a rule for the operation(s) performed on the domain value to get the range value. A table may list the x-coordinates (domain values), the rule, and the y-coordinates (range values).

Example 1

Tools | Tutor

In a game of *What's My Rule*? Kinna picked the card shown at the right. Make a table for four different domain values and write an algebraic expression for the rule. Then state the domain and range of the relation.

What's My Rule?

double a number, then add three

Step 1 Create a table showing the x-coordinates, the rule, and the y-coordinates. Enter four different domain values.

Step 2 The rule "double a number, then add three" translates to $2x + 3$. Use the rule to complete the table.

Step 3 The domain is {1, 2, 3, 4}. The range is {5, 7, 9, 11}.

x	Rule: $2x + 3$	y
1	$2(1) + 3$	5
2	$2(2) + 3$	7
3	$2(3) + 3$	9
4	$2(4) + 3$	11

Got It? Do this problem to find out.

1. Jenna picked the game card shown. Make a table for four different domain values and write an algebraic expression for the rule. Then state the domain and range of the relation. **See Answer Appendix.**

What's My Rule?

triple the number and subtract one

Equation An equation always contains an equal sign. For example, 60t is an expression, but $d = 60t$ is an equation.

Multiple Representations

Words, equations, tables, and graphs can be used to represent relations. An **equation** is a mathematical sentence stating that two quantities are equal. Relations are often written as equations with two variables—one to represent domain values and one to represent range values.

Concept Summary Multiple Representations

Words	Equation
Distance is equal to 60 miles per hour times the number of hours.	$d = 60t$

Table	Graph

Time (h)	Distance (mi)
1	60
2	120
3	180
4	240

Example 2

Tools **Tutor**

STEM **The navigation message from a satellite to a GPS in an airplane is sent once every 12 minutes.**
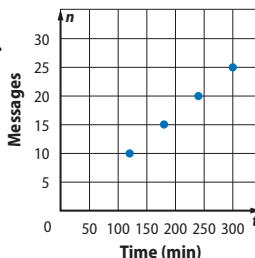
a. Write an equation to find the number of messages sent in any number of minutes.

Let t represent the time and n represent the number of messages. The equation is $n = t \div 12$.

b. Make a table to find the number of messages in 120, 180, 240, and 300 minutes. Then graph the ordered pairs.

GPS Messages

| t	$t \div 12$	n
120	120 ÷ 12	10
180	180 ÷ 12	15
240	240 ÷ 12	20
300	300 ÷ 12	25

Got It? **Do this problem to find out.**

2. Sound travels at about 1088 feet per second at 32°F in dry air at sea level.

    a. Write an equation to find the distance traveled by sound for any number of seconds. **Sample answer: $y = 1088x$**

    b. Make a table to find the distance sound travels in 0, 1, 2, and 3 seconds. Then graph the ordered pairs. **See Answer Appendix.**

34c. The points appear to lie in a straight line that slants down from left to right.

34d. Sample answer: (12, 18); 12 minutes spent playing the piano, 18 minutes spent studying for the test

35a.

Mr. Maloney's Students
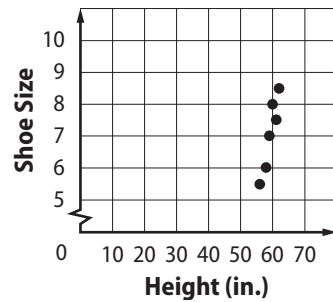
36b.

Arithmetic Sequence
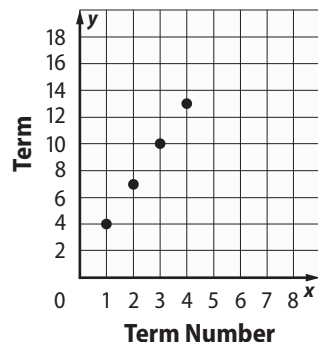
39. Exercise 33; Sample answer: By connecting the points on the graph in Exercise 33, you could determine how far Aaron will have hiked at any time other than a whole number of hours. In Exercise 32, the points do not need to be connected because you would not need to know how much a portion of a pizza would cost.

40. Sample answer: Point M is 4 units to the right on the x-axis and 3 units up on the y-axis. Point N is 3 units to the right on the x-axis and 4 units up on the y-axis.

1. Sample answer:

x	$3x - 1$	y
2	3(2)−1	5
4	3(4) − 1	11
6	3(6) − 1	17
8	3(8) − 1	23

D = {2, 4, 6, 8}, R = {5, 11, 17, 23}

2b.

x	$1088x$	y
0	1088(0)	0
1	1088(1)	1088
2	1088(2)	2176
3	1088(3)	3264

Speed of Sound
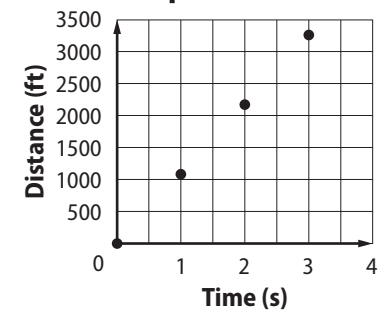
3b.

p	$16p$	z
5	16(5)	80
8	16(8)	128
11	16(11)	176
13	16(13)	208

3c.

Conversions