4-3 Write Function Rules

Objective To write function rules • To make function tables

Michael is going on a 2-week vacation. Since he cannot bring his dog on the trip, he decides to hire a dog sitter. A local pet shop charges $3 per hour for home dog-sitting services plus a basic 2-week fee of $50. How can Michael determine the total cost of the dog-sitting services?

To determine the total cost of the dog-sitting services, write a function rule or an equation.

- Write a relationship for the total cost. Notice that there are two components: the basic fee and the hourly charges. Since the basic fee is constant, the total cost then depends on the number of hours spent carrying out the selected services.

  Let c = the total cost. ← the dependent variable

  Let h = the number of hours of service. ← the independent variable

  total cost *equals* basic fee *plus* hourly charges

  $c = 50 + 3h$

- Write the equation using function notation.

  Since h is the independent variable, c is a function of h.

  $c(h) = 50 + 3h$ ← function rule

  Remember: Read $c(h)$ as "c of h."

  So Michael can input different values of h into the function rule to determine the total costs of the dog-sitting services.

  Suppose Michael needs dog-sitting services for 28 hours over a 2-week period. What is the total cost of the services?

$$c(h) = 50 + 3h \rightarrow c(28) = 50 + 3 \cdot 28$$
$$= 50 + 84$$
$$= 134$$

So the 2-week cost for 28 hours of dog-sitting services is $134.

► To show solutions of a function, such as $c(h) = 50 + 3h$, you can make a function table. Choose several values for the input, h. Then substitute each value into the function to find the corresponding output, c.

function table

h	$c(h) = 50 + 3h$	Relation (hours, cost)
10	$c(10) = 50 + 3 \cdot 10 = 80$	(10, 80)
20	$c(20) = 50 + 3 \cdot 20 = 110$	(20, 110)
30	$c(30) = 50 + 3 \cdot 30 = 140$	(30, 140)

Think
The ordered pair (10, 80) stands for "$80 for 10 hours of service."

▶ Given a function table, you can write a function rule that describes the relationship by looking for a pattern.

Write a rule that expresses a relationship between the given x- and y-values.

Think
Since the y-values are greater than the x-values, test patterns using addition or multiplication.

x	y
-2	2
-1	3
0	4
1	5

Test Addition

$-2 + 4 = 2$ True
$-1 + 4 = 3$ True
$0 + 4 = 4$ True
$1 + 4 = 5$ True

Test Multiplication

$-2(-1) = 2$ True
$-1(-1) = 3$ False
There is no need to continue the test.

So a rule that relates the given x- and y-values is $y = x + 4$, or $f(x) = x + 4$.

You can find other ordered pairs that satisfy the function rule $f(x) = x + 4$ by using different input values for x.

Examples

What equation or function rule can be written to represent the relationship between x and $f(x)$?

1

Input (x)	Output $f(x)$	
-1	1.5	$\leftarrow -1 + 2.5 = 1.5$
0	2.5	$\leftarrow 0 + 2.5 = 2.5$
1	3.5	$\leftarrow 1 + 2.5 = 3.5$
2	4.5	$\leftarrow 2 + 2.5 = 4.5$
3	5.5	$\leftarrow 3 + 2.5 = 5.5$
4	6.5	$\leftarrow 4 + 2.5 = 6.5$

Each $f(x)$ value is 2.5 greater than each x value. The function rule is $f(x) = x + 2.5$.

2

Input (x)	Output $f(x)$	
0	5	$\leftarrow 5(0) + 5 = 5$
1	10	$\leftarrow 5(1) + 5 = 10$
2	15	$\leftarrow 5(2) + 5 = 15$
3	20	$\leftarrow 5(3) + 5 = 20$

Each $f(x)$ value is five more than five times the x value. The function rule is $f(x) = 5x + 5$.

Try These

Write a function rule for the situation. Use function notation.

1. The total distance, d, traveled after h hours at a constant rate of 55 miles per hour

2. The perimeter, p, of an equilateral triangle when you know the length, s, of a side

3. Janet has joined a gym. By contract, she pays a one-time membership fee of \$100 and \$60 per month for as long as she remains a member.

Make a function table using integers from -2 to 2 as input values for each function.

4. $f(x) = 2x - 7$

5. $c(m) = 20 + 3.5m$

6. $d(t) = 6t + 55$

7. Discuss and Write Mr. Higgins asked his class to write a function rule for the values shown in the table at the right. Harriet's answer is $y = |x| + 5$. Pat's answer is $y = |x + 5|$. Who is correct? Justify your answer.

x	5	0	-6	-10
y	10	5	1	5

Go to PRACTICE BOOK Lesson 4-3 for exercise sets.