

3-2

Functions

© CONTENT STANDARDS

8.F.1

What You'll Learn

To evaluate functions and complete input-output tables

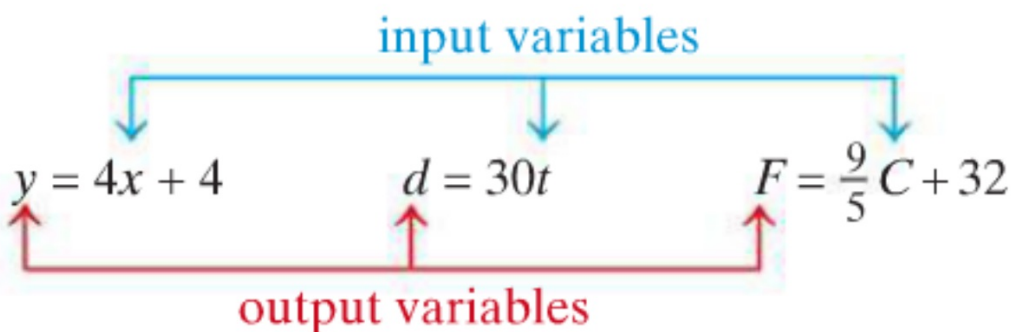
🔊 **New Vocabulary** function, function rule**Why Learn This?**

The time it takes you to get to your destination is a function of how fast you travel. Your speed affects how long the trip will take.



A **function** is a rule that assigns to each input value exactly one output value. A **function rule** is an equation that describes a function.

You can use a function rule to evaluate a function. Functions have input variables and output variables. Examples of function rules appear below.



EXAMPLE**Evaluating Functions****1**

Juan begins his exercise walk from his friend's house which is 50 m from his own house. The function $d = 3t + 50$ gives the distance d in meters after t seconds that Juan is from his own house while walking. Find the output d for the input $t = 10$.

$$d = 3t + 50 \quad \leftarrow \text{Write the function.}$$

$$d = 3(10) + 50 \quad \leftarrow \text{Substitute 10 for } t.$$

$$d = 30 + 50 \quad \leftarrow \text{Simplify.}$$

$$d = 80$$

The output d for the input $t = 10$ is 80. So, after 10 minutes of walking, Juan is 80 meters from his house.

Examples

- 1 Evaluating Functions** Julia deposited \$40 in a savings account. The function $s = 5w + 40$ gives the total savings s in dollars after w weeks that Julia has been saving. Find the output s for the input $w = 12$.

$$s = 5w + 40 \quad \leftarrow \text{Write the function.}$$

$$s = 5 \cdot \boxed{12} + 40 \quad \leftarrow \text{Substitute the input value for } w.$$

$$s = \boxed{60} + 40 \quad \leftarrow \text{Simplify.}$$

$$s = \boxed{100}$$

The output s for the input $w = \boxed{12}$ is $\boxed{100}$. So, after depositing \$40, Julia's total savings is $\boxed{\$100}$.

table talk through this problem

Debbie earns \$15 plus \$10 per hour mowing lawns. The function $e = 10h + 15$ gives her earnings e in dollars after mowing lawns for h hours. Find the output e for the input $h = 3$.

An input-output table is useful to evaluate multiple values for a function. It also helps you organize data when the function represents a real-world situation.

EXAMPLE Input-Output Tables

- 2 The function $t = \frac{1}{2}m - 12$ gives the temperature t in a container in degrees Celsius m minutes before, at the start, and during an experiment. Use the function to make an input-output table for $m = -2, -1, 0, 1,$ and 2 .

Input m (mins)	Output t (temp)
-2	-13
-1	$-12\frac{1}{2}$
0	-12
1	$-11\frac{1}{2}$
2	-11

$$\leftarrow \frac{1}{2}(-2) - 12 = -13$$

$$\leftarrow \frac{1}{2}(-1) - 12 = -12\frac{1}{2}$$

$$\leftarrow \frac{1}{2}(0) - 12 = -12$$

$$\leftarrow \frac{1}{2}(1) - 12 = -11\frac{1}{2}$$

$$\leftarrow \frac{1}{2}(2) - 12 = -11$$

2 Input-Output Tables The function $t = 2h + 15$ gives the outdoor temperature t in degrees Fahrenheit h hours before, at, and after sunrise on a cold winter day. Use the function to complete the table for $h = -4, -2, 0, 2, 4$.

Input h	Output t
-4	7
-2	11
0	15
2	19
4	23

$$\leftarrow 2(\boxed{-4}) + 15 = \boxed{7}$$

$$\leftarrow 2(\boxed{-2}) + 15 = \boxed{11}$$

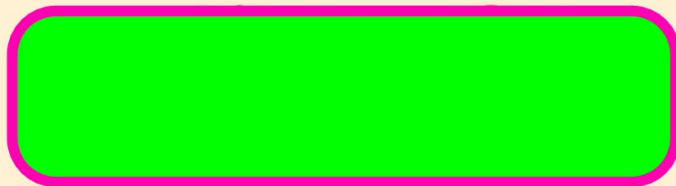
$$\leftarrow 2(\boxed{0}) + 15 = \boxed{15}$$

$$\leftarrow 2(\boxed{2}) + 15 = \boxed{19}$$

$$\leftarrow 2(\boxed{4}) + 15 = \boxed{23}$$

Table talk through this one---you will need to make a input-output table

2 The function $a = \frac{1}{4}m + 8$ gives the amount of water a in pints m minutes before, at the start, and during an experiment. Use the function to make an input-output table for $m = -2, -1, 0, 1,$ and 2 .



To encourage recycling, some states require a five-cent deposit on drink containers. The total deposit you pay depends on how many containers you buy. You can describe this relationship with a function rule.

$$d = 0.05c \leftarrow \text{input variable } c = \text{number of containers}$$

↑
output variable $d = \text{deposit}$

EXAMPLE Application: Recycling



- 3 Recycling** Complete the table of input-output pairs for the function rule $d = 0.05c$, where d represents the deposit in dollars and c represents the number of containers.

Input c (number of containers)	Output d (dollars)
6	■
12	■
24	■

$$\leftarrow 0.05 \times 6 = 0.30$$

$$\leftarrow 0.05 \times 12 = 0.60$$

$$\leftarrow 0.05 \times 24 = 1.20$$

- 3 Input-Output Table Application** Complete the table of input-output values for the function rule $t = 4c$, where c represents the number of cars and t represents the number of tires.

Input c (number of cars)	Output t (number of tires)
3	12
6	24
9	36

$$\leftarrow 4 \cdot \boxed{3} = \boxed{12}$$

$$\leftarrow 4 \cdot \boxed{6} = \boxed{24}$$

$$\leftarrow 4 \cdot \boxed{9} = \boxed{36}$$

Table talk to solve this problem

3 Complete the table for $p = 4s$.

Input s	3	5	7	9
Output p	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Quick Check


1. The function $F = \frac{9}{5}C + 32$ converts temperatures in degrees Celsius, C , to degrees Fahrenheit, F . Evaluate the function for $C = 20$.

2. Use the function $m = \frac{1}{3}n + 1$ to make an input-output table for $n = -1, 0, 1,$ and 2 .

Input n	Output m
-1	<input type="text"/>
0	<input type="text"/>
1	<input type="text"/>
2	<input type="text"/>

3. The deposit on a drink container is \$.10 in the state of Michigan. Use the function rule $d = 0.1c$. Make a table of input-output pairs to show the total deposits on 5, 10, and 15 containers.

Input c	Output d
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>

4. Complete the input-output table for the function $f = 3 + n$. 

Input n	0	1	2	3
Output f	3	■	■	■

You have a short assignment worksheet, and time to begin working on it now.

Reteaching 3-2

Functions

A *function* describes the relationship between two variables called the *input* and the *output*. In a function, each input value has only one output value.

Function:

$$y = 2x + 4$$

\uparrow \uparrow
output variable y *input variable x*

You can list input/output pairs in a table.

$y = 2x + 4$

Input x	Output y
-10	-16
-5	-6
0	4
1	6

To find output y , substitute values for input x into the function equation.

For $x = -10$: $y = 2(-10) + 4$
 $y = -16$

You can also show input/output pairs using *function rules*.

Function rule:

$$y = 2x + 4$$

$$y = 2(-10) + 4 = -16$$

\uparrow \uparrow
input *output*

Find y when $x = 0$.

$$y = 2(0) + 4$$

$$y = 4$$

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Complete the table of input/output pairs for each function.

1. $y = 3x$

Input x	Output y
5	
7	
9	
11	

2. $d = 20r$

Input r	Output d
1	
2	
3	
	160

3. $y = 25 - 2x$

Input x	Output y
0	
1	
	21
	19

Use the function rule $y = 3x + 1$. Find each output.

4. y when $x = 0$.
 $= 3(\underline{\quad}) + 1$
 $= \underline{\quad}$

5. y when $x = 1$.
 $= 3(\underline{\quad}) + 1$
 $= \underline{\quad}$

6. y when $x = 5$.
 $\underline{\quad}$

7. y when $x = -6$.
 $\underline{\quad}$

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