Evaluating Function Rules

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[Figure 1]

Timothy is planning a surprise birthday party for his sister at the local bowling alley. He has already arranged the food but wants to include bowling as an extra. The bowling alley has told Timothy that bowling shoes cost a flat rate of $2.00 and the cost to bowl is $3.00 per game. He has to figure out the cost for his sister and three friends to bowl and how many games they can bowl. Timothy only has $50.00 to spend on bowling. How can he figure out how many games they can bowl and have enough money to pay the total cost for four people?

In this concept, you will learn to evaluate function rules.

Function Tables

A **function** is a relation such that each member of the domain is paired with one and only one member of the range. A set of ordered pairs (x, y) is a **relation**. The **domain** is the set of values made up of the x-coordinates of the ordered pairs while the **range** is the set of values made up of the y-values of the ordered pairs. A **function table** is an output/input table where the **input value** is a member of the domain and the output value is a member of the range. The **output value** is the result of an operation or operations performed on the input value and its value depends upon the input number.

Look at the following function table:

Input	Output
3	6
4	8
5	10
6	12

If 'x' represents the input value and 'y' represents the output value, the table can be used to write a function rule. A **function rule** is an expression written in either words or symbols to represent the operation or operations performed on the input number to give the output number. From the above table it is obvious that each output number 'y' is the result of doubling the input number 'x.' The function rule written using symbols is the equation:

$$y = 2x$$

Let's apply a function rule to complete the following input/output table.

Use the function rule $y = 3x + 2$ to complete the table below.

Input (x)	Output (y)
2	8
3	11
4	14
5	17

First, substitute the input value of 2 into the function rule for the variable 'x.'

$$\begin{aligned} y &= 3x + 2 \\ y &= 3(2) + 2 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned} y &= 3(2) + 2 \\ y &= 6 + 2 \end{aligned}$$

Next, perform the addition on the right side of the equation.

$$\begin{aligned} y &= 6+2 \\ y &= 8 \end{aligned}$$

The answer is 8.

The output value is 8 when the input value is 2.

Then, write the output number in the table.

Repeat the above process for each of the given input numbers.

$$\begin{aligned} x &= 3 \\ y &= 3x+2 \\ y &= 3(3)+2 \\ y &= 9+2 \\ y &= 11 \end{aligned}$$

The answer is 11.

$$\begin{aligned} x &= 4 \\ y &= 3x+2 \\ y &= 3(4)+2 \\ y &= 12+2 \\ y &= 14 \end{aligned}$$

The answer is 14.

$$\begin{aligned} x &= 5 \\ y &= 3x+2 \\ y &= 3(5)+2 \\ y &= 15+2 \\ y &= 17 \end{aligned}$$

The answer is 17.

Then, complete the table by filling in the calculated output numbers.

Examples

Example 1

Earlier, you were given a problem about Timothy and the surprise birthday party.

He needs to figure out how many games of bowling his sister and her friends can play for $50.00 or less.

First, he must write a function rule to represent the information he has from the bowling alley.

Shoes are a flat rate of $2.00 and each game played costs $3.00. The function rule for the information is: $y = 3x + 2$ where 'y' is the total cost and 'x' is the number of games played.

Next, create an input/output table.

Input (x)	Output (y)
1	$5.00
2	$8.00
3	$11.00
4	$14.00

First, substitute the input value of 1 into the function rule for the variable 'x.'

$$\begin{aligned} y &= 3x + 2 \\ y &= 3(1) + 2 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned} y &= 3(1) + 2 \\ y &= 3 + 2 \end{aligned}$$

Next, perform the addition on the right side of the equation.

$$\begin{aligned} y &= 3 + 2 \\ y &= 5 \end{aligned}$$

The answer is 5.

The output value is $5.00 for one person to bowl one game.

Next, write the output number in the table.

Then, multiply $5.00 by 4 to determine the cost for four people to bowl one game.

$$\$5.00 \times 4 = \$20.00$$

The answer is $20.00.

It will cost $20.00 for his sister and three friends to bowl one game.

First, substitute the input value of 2 into the function rule for the variable 'x.'

$$\begin{aligned} y &= 3x + 2 \\ y &= 3(2) + 2 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned} y &= 3(2) + 2 \\ y &= 6 + 2 \end{aligned}$$

Next, perform the addition on the right side of the equation.

$$\begin{aligned} y &= 6 + 2 \\ y &= 8 \end{aligned}$$

The answer is 8.

The output value is $8.00 for one person to bowl two games.

Next, write the output number in the table.

Then, multiply $8.00 by 4 to determine the cost for four people to bowl two games.

$$\$8.00 \times 4 = \$32.00$$

The answer is $32.00.

It will cost $32.00 for his sister and three friends to bowl two games.

First, substitute the input value of 3 into the function rule for the variable 'x.'

$$\begin{aligned} y &= 3x + 2 \\ y &= 3(3) + 2 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned} y &= 3(3) + 2 \\ y &= 9 + 2 \end{aligned}$$

Next, perform the addition on the right side of the equation.

$$\begin{aligned} y &= 9 + 2 \\ y &= 11 \end{aligned}$$

The answer is 11.

The output value is $11.00 for one person to bowl three games.

Next, write the output number in the table.

Then, multiply $11.00 by 4 to determine the cost for four people to bowl three games.

$$\$11.00 \times 4 = \$44.00$$

The answer is $44.00.

It will cost $44.00 for his sister and three friends to bowl three games.

First, substitute the input value of 4 into the function rule for the variable 'x.'

$$\begin{aligned} y &= 3x + 2 \\ y &= 3(4) + 2 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$
\begin{aligned}
y &= 3(4) + 2 \\
y &= 12 + 2
\end{aligned}
$$

Next, perform the addition on the right side of the equation.

$$
\begin{aligned}
y &= 12 + 2 \\
y &= 14
\end{aligned}
$$

The answer is 14.

The output value is $14.00 for one person to bowl four games.

Next, write the output number in the table.

Then, multiply $14.00 by 4 to determine the cost for four people to bowl four games.

$$\$14.00 \times 4 = \$56.00$$

The answer is $56.00.

It will cost $56.00 for his sister and three friends to bowl four games.

Timothy has enough money for his sister and three friends to bowl three games.

Examples 2

Use the following function rule to complete the input/output table.

$$y = 2x - 5$$

Input (x)	Output (y)
-5	-15
-1	-7
2	-1
6	7

First, substitute the input value of -5 into the function rule for the variable 'x.'

$$\begin{aligned} y &= 2x - 5 \\ y &= 2(-5) - 5 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned} y &= 2(-5) - 5 \\ y &= -10 - 5 \end{aligned}$$

Next, perform the addition of the two negative values on the right side of the equation.

$$\begin{aligned} y &= -10 - 5 \\ y &= -15 \end{aligned}$$

The answer is -15.

The output value is -15 when the input value is -5.

Then, write the output number in the table.

Repeat the above process for each of the given input numbers.

$$\begin{aligned} x &= -1 \\ y &= 2x - 5 \\ y &= 2(-1) - 5 \\ y &= -2 - 5 \\ y &= -7 \end{aligned}$$

The answer is -7.

$$\begin{aligned} x &= 2 \\ y &= 2x - 5 \\ y &= 2(2) - 5 \\ y &= 4 - 5 \\ y &= -1 \end{aligned}$$

The answer is -1.

$$\begin{aligned}
x &= 6 \\
y &= 2x - 5 \\
y &= 2(6) - 5 \\
y &= 12 - 5 \\
y &= 7
\end{aligned}$$

The answer is 7.

Example 3

Use the given function rule to complete the input/output table:

$$y = 4x - 3$$

Input (x)	Output (y)
4	13
5	17
7	25
9	33

First, substitute the input value of 4 into the function rule for the variable ' x .'

$$\begin{aligned}
y &= 4x - 3 \\
y &= 4(4) - 3
\end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned}
y &= 4(4) - 3 \\
y &= 16 - 3
\end{aligned}$$

Next, perform the subtraction on the right side of the equation.

$$y = 16 - 3$$
$$y = 13$$

The answer is 13.

The output value is 13 when the input value is 4.

Then, write the output number in the table.

Repeat the above process for each of the given input numbers.

$$x = 5$$
$$y = 4x - 3$$
$$y = 4(5) - 3$$
$$y = 20 - 3$$
$$y = 17$$

The answer is 17.

$$x = 7$$
$$y = 4x - 3$$
$$y = 4(7) - 3$$
$$y = 28 - 3$$
$$y = 25$$

The answer is 25.

$$x = 9$$
$$y = 4x - 3$$
$$y = 4(9) - 3$$
$$y = 36 - 3$$
$$y = 33$$

The answer is 33.

Example 4

Use the given function rule to complete the input/output table:

$$y = -2x + 7$$

Input (x)	Output (y)
-14	35
-9	25
4	-1
11	-15

First, substitute the input value of -14 into the function rule for the variable 'x.'

$$\begin{aligned} y &= -2x + 7 \\ y &= -2(-14) + 7 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned} y &= -2(-14) + 7 \\ y &= 28 + 7 \end{aligned}$$

Next, perform the addition on the right side of the equation.

$$\begin{aligned} y &= 28 + 7 \\ y &= 35 \end{aligned}$$

The answer is 35.

The output value is 35 when the input value is -14.

Then, write the output number in the table.

Repeat the above process for each of the given input numbers.

$$\begin{aligned} x &= -9 \\ y &= -2x + 7 \\ y &= -2(-9) + 7 \\ y &= 18 + 7 \\ y &= 25 \end{aligned}$$

The answer is 25.

$$\begin{aligned} x &= 4 \\ y &= -2x + 7 \\ y &= -2(4) + 7 \\ y &= -8 + 7 \\ y &= -1 \end{aligned}$$

The answer is -1.

$$\begin{aligned} x &= 11 \\ y &= -2x + 7 \\ y &= -2(11) + 7 \\ y &= -22 + 7 \\ y &= -15 \end{aligned}$$

The answer is -15.

Example 5

Use the given function rule to complete the input/output table:

$$y = 3x - 14$$

Input (x)	Output (y)
-10	-44
-7	-35
2	-8
9	13

First, substitute the input value of -10 into the function rule for the variable ' x .'

$$\begin{aligned} y &= 3x - 14 \\ y &= 3(-10) - 14 \end{aligned}$$

Next, perform the multiplication to clear the parenthesis.

$$\begin{aligned} y &= 3(-10) - 14 \\ y &= -30 - 14 \end{aligned}$$

Next, perform the addition on the right side of the equation.

$$\begin{aligned} y &= -30 - 14 \\ y &= -44 \end{aligned}$$

The answer is -44.

The output value is -44 when the input value is -10.

Then, write the output number in the table.

Repeat the above process for each of the given input numbers.

$$\begin{aligned} x &= -7 \\ y &= 3x - 14 \\ y &= 3(-7) - 14 \\ y &= -21 - 14 \\ y &= -35 \end{aligned}$$

The answer is -35.

$$
\begin{aligned}
x &= 2 \\
y &= 3x - 14 \\
y &= 3(2) - 14 \\
y &= 6 - 14 \\
y &= -8
\end{aligned}
$$

The answer is -8.

$$
\begin{aligned}
x &= 9 \\
y &= 3x - 14 \\
y &= 3(9) - 14 \\
y &= 27 - 14 \\
y &= 13
\end{aligned}
$$

The answer is 13.

Review

For numbers 1-5, find each output if the function rule is $y = 3x + 2$.

Problem Number	Input	Output
1.	3	
2.	5	
3.	6	
4.	9	
5.	11	

For numbers 6-10, find each output if the function rule is $y = 4x$.

Problem Number	Input	Output
6.	-3	
7.	-4	
8.	0	
9.	1	
10.	2	

For numbers 11-15, find each output if the function rule is $y = -3x$.

Problem Number	Input	Output
11.	4	
12.	5	
13.	7	
14.	9	
15.	10	

Answer each question about functions.

16. A pastry chef needs to purchase enough dough for her cookies. She buys one pound of dough for every twenty cookies she is going to make. She uses the function $C(d) = 20d$ where C is the number of cookies and d is the pounds of dough she should buy. Identify which variable is the domain and which is the range.

17. Evaluate the function $f(x) = 2x + 7$ when the domain is $\{-3, -1, 1, 3\}$.

18. Evaluate the function $f(x) = \dfrac{2}{5}x - 6$ when the domain is $\{-10, -5, 0, 5, 10\}$.

19. Evaluate the function $f(x) = 3x - 1$ when the domain is $\{5, 6, 7, 8, 9\}$.

20. Evaluate the function $f(x) = x - 9$ when the domain is $\{1, 2, 3, 4, 5\}$.

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

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1.0 REFERENCES

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