



# Using Function Notation to Describe Rules (Part 1)

Let's look at some rules that describe functions and write some too.

## 4.1 Notice and Wonder: Two Functions

What do you notice? What do you wonder?

| $x$ | $f(x) = 10 - 2x$ |
|-----|------------------|
| 1   | 8                |
| 1.5 | 7                |
| 5   | 0                |
| -2  | 14               |

| $x$ | $g(x) = x^3$ |
|-----|--------------|
| -2  | -8           |
| 0   | 0            |
| 1   | 1            |
| 3   | 27           |

## 4.2

## Four Functions

Here are descriptions and equations that represent four functions.

- $f(x) = 3x - 7$

- $g(x) = 3(x - 7)$

- $h(x) = \frac{x}{3} - 7$

- $k(x) = \frac{x - 7}{3}$

A. To get the output, subtract 7 from the input, then divide the result by 3.

B. To get the output, subtract 7 from the input, then multiply the result by 3.

C. To get the output, multiply the input by 3, then subtract 7 from the result.

D. To get the output, divide the input by 3, then subtract 7 from the result.

1. Match each equation with a verbal description that represents the same function. Record your results.
2. For one of the functions, when the input is 6, the output is -3. Which is that function:  $f$ ,  $g$ ,  $h$ , or  $k$ ? Explain how you know.
3. Which of the four functions have the greatest value when the input is 0? What about when the input is 10?

**Are you ready for more?**

Mai says  $f(x)$  is always greater than  $g(x)$  for the same value of  $x$ . Is this true? Explain how you know.

## 4.3 Rules for Area and Perimeter

1. A square that has a side length of 9 cm has an area of  $81 \text{ cm}^2$ . The relationship between the side length and the area of the square is a function.

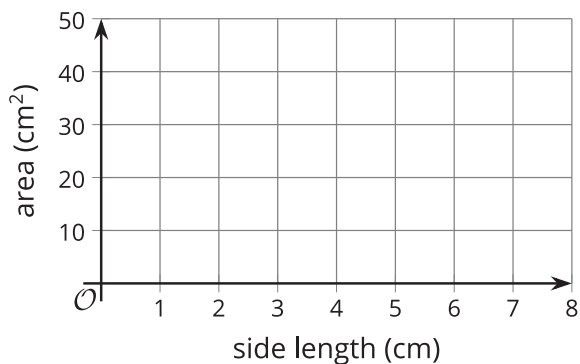
- a. Complete the table with the area for each given side length.

Then, write a rule for a function,  $A$ , that gives the area of the square in  $\text{cm}^2$  when the side length is  $s$  cm. Use function notation.

| side length (cm) | area ( $\text{cm}^2$ ) |
|------------------|------------------------|
| 1                |                        |
| 2                |                        |
| 4                |                        |
| 6                |                        |
| $s$              |                        |

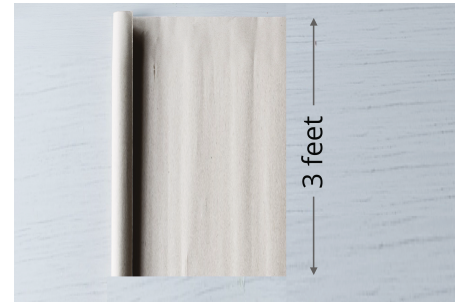
- b. What does  $A(2)$  represent in this situation? What is its value?

- c. On the coordinate plane, sketch a graph of this function.



2. A roll of paper that is 3 feet wide can be cut to any length.

- a. If we cut a length of 2.5 feet, what is the perimeter of the paper?



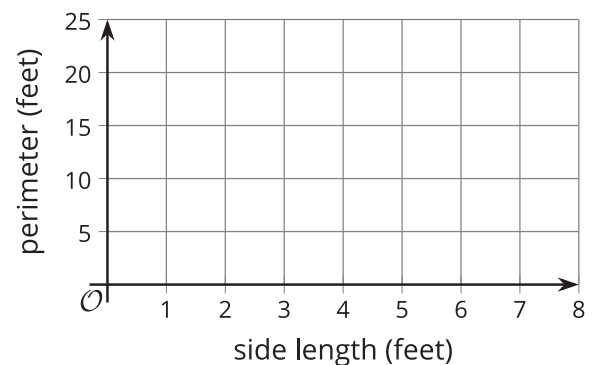
- b. Complete the table with the perimeter for each given side length.

Then, write a rule for a function,  $P$ , that gives the perimeter of the paper in feet when the side length in feet is  $\ell$ . Use function notation.

| side length (feet) | perimeter (feet) |
|--------------------|------------------|
| 1                  |                  |
| 2                  |                  |
| 6.3                |                  |
| 11                 |                  |
| $\ell$             |                  |

- c. What does  $P(11)$  represent in this situation? What is its value?

- d. On the coordinate plane, sketch a graph of this function.



## Lesson 4 Summary

Some functions are defined by rules that specify how to compute the output from the input. These rules can be verbal descriptions or expressions and equations. For example:

Rules in words:

- To get the output of function  $f$ , add 2 to the input, then multiply the result by 5.
- To get the output of function  $m$ , multiply the input by  $\frac{1}{2}$  and subtract the result from 3.

Rules in function notation:

- $f(x) = (x + 2) \cdot 5$  or  $f(x) = 5(x + 2)$
- $m(x) = 3 - \frac{1}{2}x$

Some functions are defined by rules that relate two quantities in a situation. These functions can also be expressed algebraically with function notation.

Suppose function  $c$  gives the cost of buying  $n$  pounds of apples at \$1.49 per pound. We can write the rule  $c(n) = 1.49n$  to define function  $c$ .

To see how the cost changes when  $n$  changes, we can create a table of values.

| pounds of apples, $n$ | cost in dollars, $c(n)$ |
|-----------------------|-------------------------|
| 0                     | 0                       |
| 1                     | 1.49                    |
| 2                     | 2.98                    |
| 3                     | 4.47                    |
| $n$                   | $1.49n$                 |

Plotting the pairs of values in the table gives us a graphical representation of  $c$ .

