## Lesson 4: 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?

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

| $x$ | $g\left(x\right)=x^{3}$ |
| --- | --- |
| -2 | -8 |
| 0 | 0 |
| 1 | 1 |
| 3 | 27 |

### 4.2: Four Functions

Here are descriptions and equations that represent four functions.

$f\left(x\right)=3x−7$

$g\left(x\right)=3\left(x−7\right)$

$h\left(x\right)=\frac{x}{3}−7$

$k\left(x\right)=\frac{x−7}{3}$

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, and 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 function value—$f\left(x\right),g\left(x\right),h\left(x\right)$, or $k\left(x\right)$—is the greatest when the input is 0? What about when the input is 10?

#### Are you ready for more?

Mai says $f\left(x\right)$ is always greater than $g\left(x\right)$ 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 cm2. The relationship between the side length and the area of the square is a function.
	1. 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 cm2 when the side length is $s$ cm. Use function notation.

| * + side length (cm)
 | * + area (cm2)
 |
| --- | --- |
| * + 1
 | * +
 |
| * + 2
 | * +
 |
| * + 4
 | * +
 |
| * + 6
 | * +
 |
| * + $s$
 | * +
 |

* 1. What does $A\left(2\right)$ represent in this situation? What is its value?
	2. On the coordinate plane, sketch a graph of this function.
	+ 
1. A roll of paper that is 3 feet wide can be cut to any length.
	1. If we cut a length of 2.5 feet, what is the perimeter of the paper?
	* 
	1. 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 $ℓ$. Use function notation.

| * + side length (feet)
 | * + perimeter (feet)
 |
| --- | --- |
| * + 1
 | * +
 |
| * + 2
 | * +
 |
| * + 6.3
 | * +
 |
| * + 11
 | * +
 |
| * + $ℓ$
 | * +
 |

* 1. What does $P\left(11\right)$ represent in this situation? What is its value?
	2. 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:

* $f\left(x\right)=\left(x+2\right)⋅5$ or $5\left(x+2\right)$
* $m\left(x\right)=3−\frac{1}{2}x$

Some functions that relate two quantities in a situation can also be defined by rules and can therefore be expressed algebraically, using function notation.

Suppose function $c$ gives the cost of buying $n$ pounds of apples at $1.49 per pound. We can write the rule $c\left(n\right)=1.49n$ 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, $c\left(n\right)$ |
| --- | --- |
| 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 $c$.





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