

Function Notation

In this lesson you will

- learn to use **function notation**
- use a graph to evaluate a function for various input values
- use an equation to evaluate a function for various input values

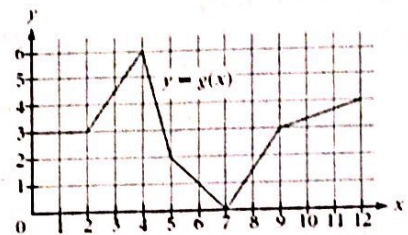
when $x = 2$, $y = -3$

$$y = 1 - 2x \rightarrow f(x) = 1 - 2x$$

$$f(2) = -3$$

The equation $y = 1 - 2x$ represents a function. You can use the letter f to name this function and then use **function notation** to express it as $f(x) = 1 - 2x$. You read $f(x)$ as "f of x," which means "the output value of the function f for the input value x ." So, for example, $f(2)$ is the value of $1 - 2x$ when x is 2, so $f(2) = -3$. (Note: In function notation, the parentheses do *not* mean multiplication.)

Not all functions are expressed as equations. Here is a graph of a function g . The equation is not given, but you can still use function notation to express the outputs for various inputs. For example, $g(0) = 3$, $g(4) = 6$, and $g(6) = 1$. Can you find x -values for which $g(x) = 3$?



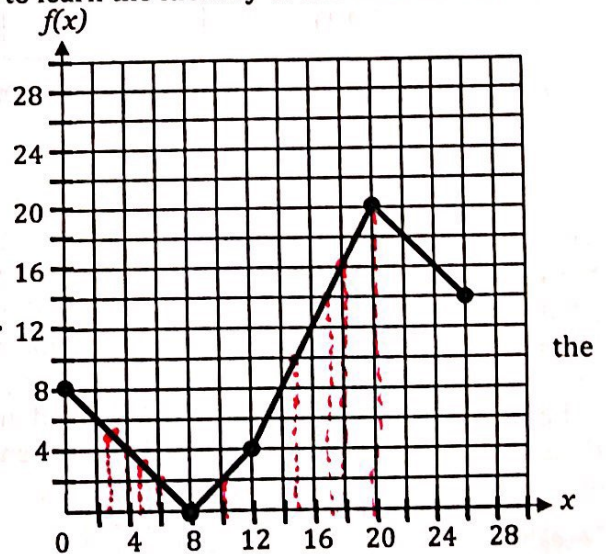
Investigation: A Graphic Message

In this investigation, you will apply function notation to learn the identity of the mathematician who introduced functions. Look at the graph below.

What is the domain? $[0, 26]$

What is the range? $[0, 20]$

Use the graph to find each function value in the table. Then do the indicated operations. Show all work to the right.



Notation	Value
$f(3)$	5
$f(18) + f(3)$	21
$f(5) \cdot f(4)$	12
$f(15) \div f(6)$	5
$f(20) - f(10)$	18

$$16 + 5$$

$$3(4)$$

$$\frac{10}{2} = 5$$

$$20 - 2$$

Think of the numbers 1 through 26 as the letters A through Z. Find the letters that match your answers in the table to learn the mathematician's last name.

Use the rules for order of operations to evaluate the expressions that involve function values. Do the operations inside parentheses first. Then find the function values before doing the remaining operations. Write your answers in the table. Show all work to the right of the table.

Notation	Value
$f(0) + f(3) - 1$	12
$5 \cdot f(9)$	5
x when $f(x) = 10$	15
$f(9 + 8)$	14
$\frac{f(17) + f(10)}{2}$	8
$f(8 \cdot 3) - 5 \cdot f(11)$	1
$f(4 \cdot 5 - 1)$	18
$f(12)$	4

$$8 + 5 - 1$$

$$5(1)$$

$$f(17) = 14$$

$$\frac{14 + 2}{2} = 8$$

$$f(24) - 5f(11) = 16 - 5(3) = 1$$

$$f(19)$$

Find the letters that match your answers in the table to learn the mathematician's first name.

LEONHARD

This mathematician, who lived from 1707 to 1783, was a pioneering Swiss mathematician and physicist. He made important discoveries in calculus and graph theory. He also introduced much of the modern mathematical terminology and notation, including function notation. He is also renowned for his work in mechanics, fluid dynamics, optics, and astronomy. He spent most of his adult life in St. Petersburg, Russia and in Berlin (then a part of Prussia). He is considered to be the preeminent mathematician of the 18th Century, and one of the greatest of all time.*



* adapted from Wikipedia

EXAMPLE You can use the function $f(x) = 19.4 + 1.28x$ to approximate the wind chill temperature $f(x)$ for a given actual temperature when the wind speed is 15 miles per hour. Both x and $f(x)$ are in degrees Fahrenheit. Find $f(x)$ for each given value of x .

a. $f(-10)$

$$19.4 + 1.28(-10)$$

~~19.4~~
6.6

b. $f(0)$

$$19.4 + 1.28(0)$$

$$19.4$$

c. x when $f(x) = 19$

$$19 = 19.4 + 1.28x$$

$$-.4 = 1.28x$$

$$-.3125 = x$$

d. x when $f(x) = -13$

$$-13 = 19.4 + 1.28x$$

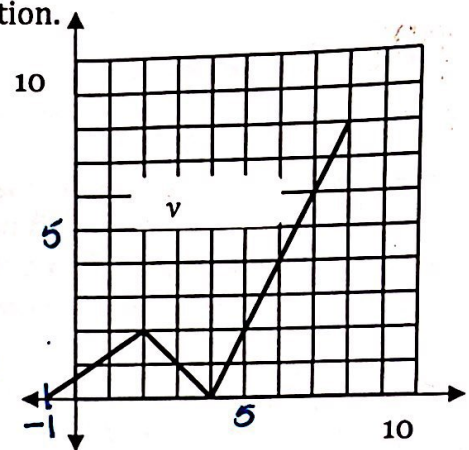
$$-32.4 = 1.28x$$

$$-25.3125 = x$$

Adapted from *Discovering Algebra: An Investigative Approach* by Murdock, Kamischke, and Kamischke

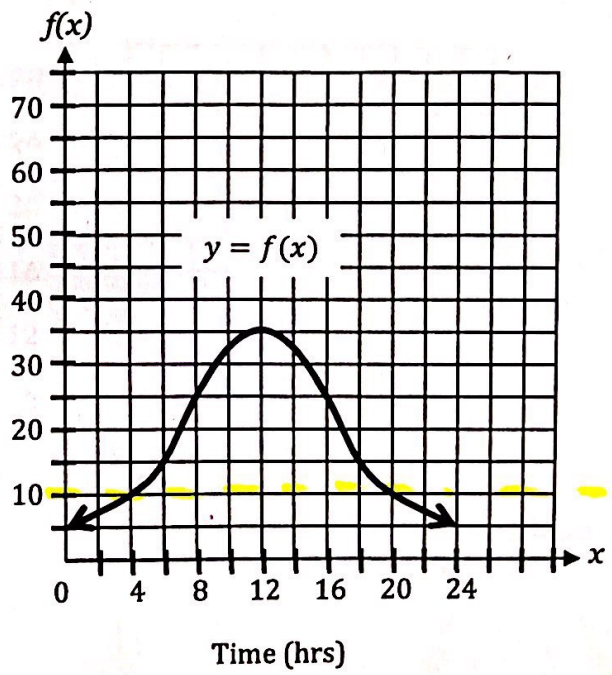
EXAMPLE Use the graph of $y = f(x)$ at the right to answer each question.

- a) What is the value of $f(4)$? 0
- b) What is the value of $f(6)$? 4
- c) For what value(s) does $f(x) = 2$? $x=2$ $x=5$
- d) For what value(s) does $f(x) = 1$? $x=\frac{1}{2}$ $x=3$ $x=4.5$
- e) How many x -values make the statement $f(x) = 0.5$ true? 3
- f) For what x -values is $f(x)$ greater than 2? (5, 8)
- g) What are the domain and range shown on the graph?
Domain: $[-1, 8]$ Range: $[0, 8]$



EXAMPLE The graph of $y = f(x)$ below shows the temperature y outside at different times x over a 24-hour period. Use the graph to answer each question.

- a) What are the dependent and independent variables?
Independent: Time (hours)
Dependent: Temperature ($^{\circ}$ F)
- b) What are the domain and range shown on the graph?
Domain: $(-\infty, +\infty)$
Range: $(-\infty, 35]$



- c) Use function notation to represent the temperature at 10 hours.
 $f(10) = 32.5$
- d) Use function notation to represent the time at which the temperature is 10° F.
 $f(4) = 10$ and $f(20) = 10$