

Understanding Functions and Function Notation

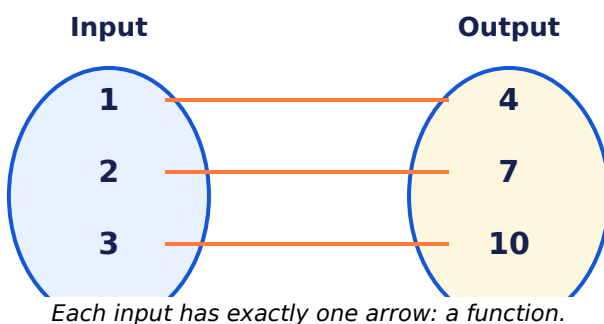
Grade 9 – Algebra 1 math · Lesson · Standards: F-IF.A.1, F-IF.A.2, F-IF.B.5

Quick answer: A function assigns exactly one output to every input. Its domain is the set of allowed inputs and its range is the set of outputs. On a graph, the vertical line test checks this rule. The notation $f(a) = b$ means that input a gives output b , and context tells what that statement means.

Standards: F-IF.A.1, F-IF.A.2, F-IF.B.5 · **Level:** Grade 9 Algebra 1

What is a function?

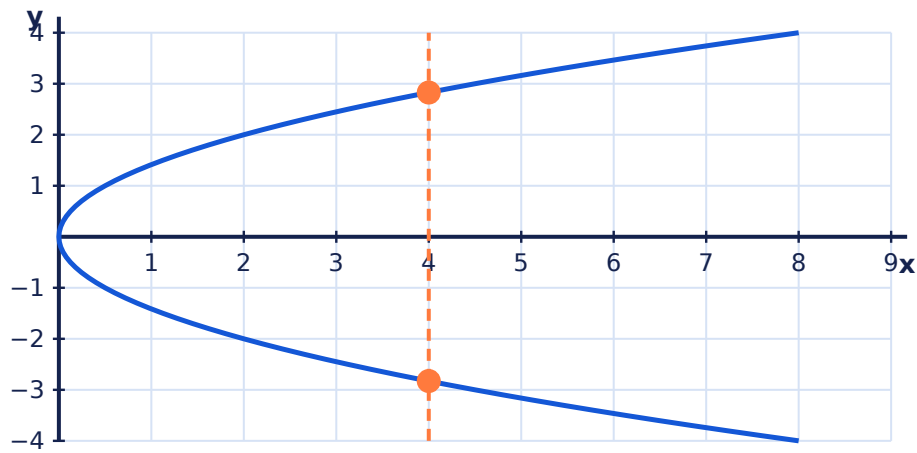
A **function** assigns to each input exactly one output. The set of allowed inputs is the **domain**, and the set of outputs that actually occur is the **range**. Different inputs may share an output, but one input may never have two.



Each input has exactly one arrow: a function.

How does the vertical line test work?

On a graph, inputs run along the horizontal axis. If any vertical line crosses the graph more than once, one input has two outputs, so the graph is not a function.



A vertical line crossing twice means two outputs for one input.

What does function notation mean?

The symbol $f(x)$ is read " f of x " and names the output for input x . It does not mean f times x .

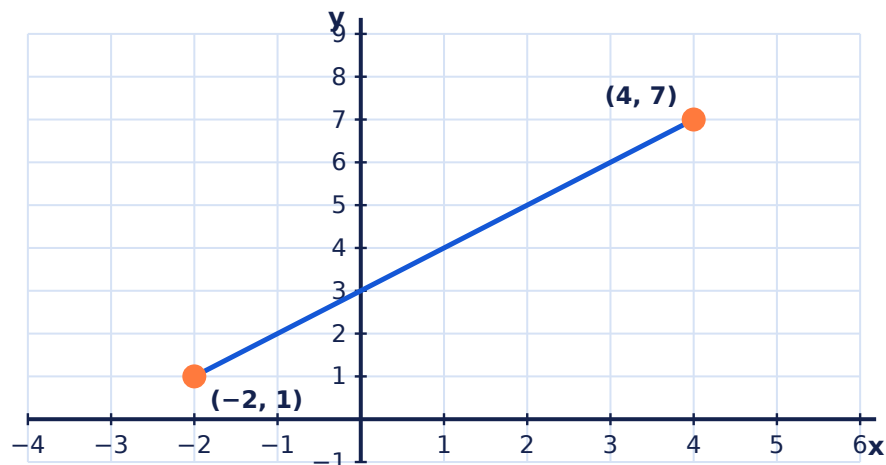
Method: evaluate $f(x) = 2x^2 - x + 1$ at $x = -2$

1. Replace every x with -2 , using parentheses: $2(-2)^2 - (-2) + 1$.
2. Square first: $2(4) + 2 + 1$.
3. Add: **$f(-2) = 11$** .

Context gives the statement meaning. If $f(t)$ is a drone's height in feet after t seconds, then $f(8) = 120$ says the drone is 120 feet high at 8 seconds.

How do you find domain and range?

Read the domain from left to right on the graph and the range from bottom to top. Circles show whether endpoints are included. In context, the domain is discrete when only whole counts make sense and continuous when any value in an interval is possible.



Domain: $-2 \leq x \leq 4$. Range: $1 \leq y \leq 7$.

Situation	Domain type	Example domain
Tickets sold, n tickets	discrete	whole numbers 0, 1, 2, ..., 60
Water in a tank over time	continuous	$0 \leq t \leq 25$ minutes

Common mistake

Reading $f(3)$ as $f \times 3$. It means the output when the input is 3.

Mathbot's tip

When a graph's end has a filled dot, include it; with an open dot, exclude it. Say "domain" for left-to-right and "range" for bottom-to-top.

Key points to remember

- Every input in the domain has exactly one output.
- A graph fails the vertical line test when one input has two outputs.
- $f(a) = b$ means the output is b when the input is a .
- Domain is read left to right on a graph; range is read bottom to top.
- Discrete domains contain separate values; continuous domains fill an interval.

Understanding Functions and Function Notation: frequently asked questions

Can two different inputs have the same output?

Yes. A function only forbids one input having two outputs. For $f(x) = x^2$, both $f(2)$ and $f(-2)$ equal 4, and that is allowed.

What does $f(x)$ mean?

It is the output of the function named f when the input is x . The parentheses show the input, not multiplication. So $f(5)$ is the output when $x = 5$.

How do you use the vertical line test?

Imagine sliding a vertical line across the graph. If it ever touches the graph at two or more points, one input has several outputs and the graph is not a function.

What is the difference between discrete and continuous domains?

A discrete domain has separate values, such as the number of tickets sold. A continuous domain includes every number in an interval, such as the time a tank fills.

How do you interpret $f(a) = b$ in context?

Name the quantity for the input and for the output with their units. If $h(t)$ is height in feet after t seconds, $h(3) = 48$ means the height is 48 feet after 3 seconds.