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Lesson 2-1: Functions**Objective**

Students will...

- Be able to define what an input and an output is.
- Be able to define what a function is.

Functional Relationship

A _____ is a relationship in which one quantity **depends** on another. In other words, given two variables, one is always _____ on the other.
ex.

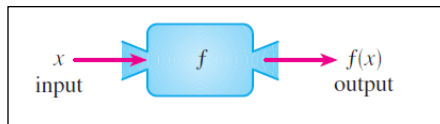
Independent vs Dependent Variables

That being said, we must always be able to define both the _____ and _____ variables.

- ex. Height is a function of age.
Temperature is a function of date.
Cost of mail is a function of weight.

Input vs Output

Mathematically speaking, we can also differentiate the independent and the dependent variables as _____ and _____. Consider the following picture:



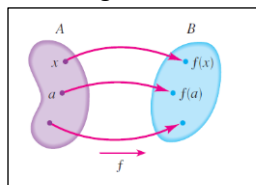
Here the function " f " is the rule that the machine operates in, and what comes out _____ on what goes in.

Definition of a Function

So now we are ready to define what a function is.

A _____, say f , is a rule that assigns to each element (item) x in a certain set A _____ element, called $f(x)$, in a set B .

Ex.



The set A is also known as the _____, and set B is known as the _____.

Examples of Functions

Another way to define function is for every **input**, there is exactly _____ **output**.

Ex. $f(x) = x - 3$ $f(x) = x^2$

Evaluating Functions

Consider the function $f(x) = x - 3$

Here, x is the input, while $f(x)$ is the output. That being said, $f(x)$ would change as x changes. We can evaluate functions by placing different inputs. For the above function,

$$f(1) = (1) - 3 = -2 \quad f(2) = (2) - 3 = -1 \quad f(0) = (0) - 3 = -3 \quad f(-3) = (-3) - 3 = -6$$

Examples

Let $f(x) = 3x^2 + x - 5$. Evaluate each function value.

1. $f(-2)$

2. $f(0)$

3. $f(4)$

4. $f\left(\frac{1}{2}\right)$

Piecewise Functions

functions are combination of functions that are defined by the _____.

Ex.

$$C(x) = \begin{cases} 39 & \text{if } 0 \leq x \leq 400 \\ 39 + 0.2(x - 400) & \text{if } x > 400 \end{cases}$$

So whenever x is in between or equal to 0 and 400, then the output is always 39. Whenever x is strictly above 400, the bottom function applies.

Examples

Evaluate

$$22. f(x) = \begin{cases} 5 & \text{if } x \leq 2 \\ 2x - 3 & \text{if } x > 2 \end{cases}$$

$f(-3), f(0), f(2), f(3), f(5)$

Use the function to evaluate the indicated expression.

$$f(x) = 3x - 1; f(2x), 2f(x)$$

Find $f(a)$, $f(a + h)$, and the difference quotient $\frac{f(a+h)-f(a)}{h}$

$$f(x) = x^2 + 1$$