2.1

Relations

Say you are paid by the hour. The amount you get paid depend on how long you work. So there is a relation between $ and hours.

(ex) If you get paid $10 per hr and work for 5 hours, you'll get paid $50.

in Math, we write this $(\underset{\text{hrs.}}{5}, \underset{\$}{50})$

If you work 8 hours

$(\underset{\text{hrs}}{8}, \underset{\$}{80})$

If you work 40 hours

$(40, 400)$

etc.

Domain - all possible "first" numbers
Range - all possible "second" numbers

(domain, range)

(ex) At your job (the $10/hr one) all employees must work at least 20 hours per week and no more than 40 hours per week. (Assume everyone works whole hrs ... no 32 hrs & 36 min)

The possible relations are:

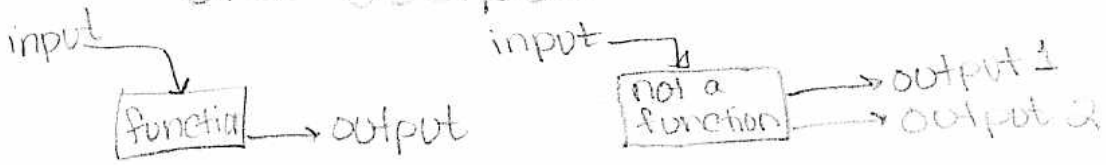
(20, 200)
(21, 210)
(22, 220)
(23, 230)
⋮
(38, 380)
(39, 390)
(40, 400)

This means that the domain is
$\{20, 21, 22, 23, 24, 25, \ldots, 38, 39, 40\}$
and the range is
$\{200, 210, 220, 230, \ldots, 380, 390, 400\}$

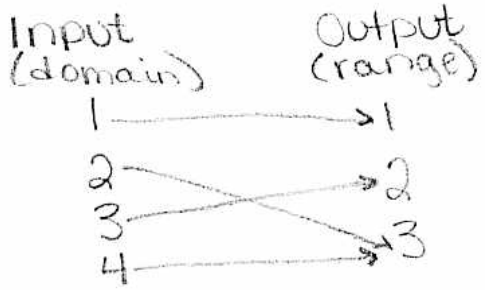
Functions

function – relation from a domain to a range, such that each element in the domain corresponds to exactly one element in the range.

the idea: for each input there is only one output



ex $\{(1,1),(2,3),(3,2),(4,3)\}$



function

ex $\{(1,1),(2,3),(3,2),(1,3)\}$

. not a function

ex Age is a function of birthday

input (domain) = birthday output (range) = age

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Always say

range is a function of domain
(output) (y) (input) (x)

Functions as Equations

ex $y = x + 2$ is a function

note: for every value of x (domain) there is only one y (range)

non-ex $y^2 = x^2$ is not a function

why?

if $x = 2$ then $x^2 = 4$

so y could be 2 ($2^2 = 4$) or -2 ($(-2)^2 = 4$)

independent variable - the variable you choose (domain, usually x)

dependent variable - the variable that depends on the other variable. (range, usually y)

Function Notation

Instead of writing out
"$y = x+2$ is a function"
we came up w/ a shortcut! It's
$f(x) = x+2$
the $f(x)$ tells us that the equation is a function. read "f of x"
note: doesn't have to be f, could be $g(x)$, $h(x)$

Evaluating a function

(ex) Let $f(x) = x+2$
Say, we want to know the value of the function when $x=10$. So we want $f(x=10)$. But we're lazy so instead we write $f(10)$

$f(10) = 10+2$
$= 12$ so $f(10) = 12$

(ex.) Let $f(x) = x^2 - 3$
find $f(-2) = (-2)^2 - 3 = 1$
$f(x-2) = (x-2)^2 - 3$
$= x^2 - 4x + 1$

Graphs of functions

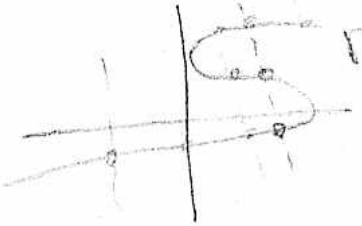
ex) $f(x) = x + 2$

on calculator: Y= x+2 GRAPH

Vertical Line Test

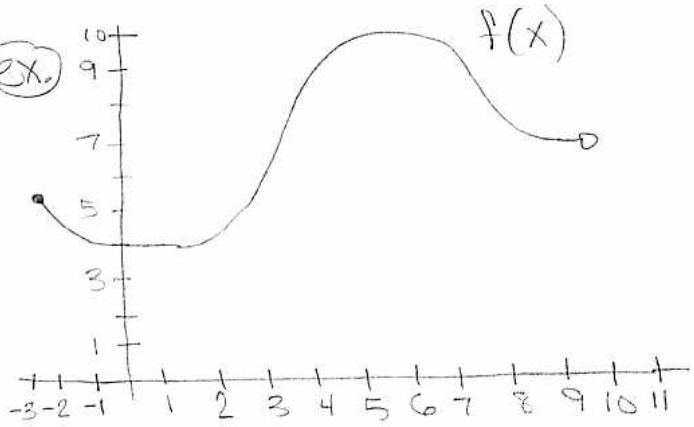
Any vertical line will hit the graph of a function at most once.

ex)  function

 not a function

Information from Graphs

ex.



a. find $f(5)$?
$f(5) \cong 10$

b. when is $f(x) = 9$
$x \approx 4$ and 7.5

c. what are x & y intercepts?
x-int. → none
y-int → $y = 4$

d. find domain & range of $f(x)$?
domain: $[-3, 10)$ set notation $\{x \mid -3 \le x < 10\}$
range: $[4, 10]$ $\{y \mid 4 \le y \le 10\}$