Introductions

Saturday, August 22, 2015 7:08 PM

Connect Math cost?

Examples

1) $-8y + 6 = 22 \to y = -2$
2) $11 = 7 - 2(50 - 2) \to y = 0$
3) $\frac{1}{3} - \frac{4}{3t} = \frac{7}{t} \to t = 25$
4) $\frac{7}{d-7} - \frac{7}{8} = \frac{d}{d-7} \to d \neq 7$
5) $\frac{4}{x^2 - 2x - 8} - \frac{1}{x^2 - 16} = \frac{2}{x^2 + 6x + 8} \to x = -22$

Functions

Wednesday, August 26, 2015 1:58 PM

Functions are a new notation & a new concept based upon things like

$$y = 3x - 7$$

before we wrote the following

when $x = -1$, $y = 3(-1) - 7$
$= -3 - 7 = -10$

when $x = 3$, $y = 3(3) - 7$
$= 9 - 7 = 2$

the difference in y-values from $x = -1$ to $x = 3$ is

$$\underbrace{\overset{x=3}{2}}_{y=} - \underbrace{\overset{x=-1}{(-10)}}_{y=} = 12$$

this is clumsy, wordy, ineffcient notation how about this

$y(-1) =$ y-value when $x = -1$

so $y(-1) = -10$

$y(3) =$ y-value when $x = 3$

so $y(3) = 2$

$y(3) - y(-1) = 2 - (-10) = 12$
difference in y-values

Notation

$y(\#)$ means the y-value when $x = \#$

$y(x)$ represents the y-value at an arbitrary/unknown x-value

$y(x) = 3x - 7$
means that we're defining $y(x)$ to be $3x-7$
you don't need to solve for anything we I use ':='

Ex Evaluating functions

Let $f(x) := x^2 - 3x - 10$

Compute the following

- $f(-4) = (-4)^2 - 3(-4) - 10$
  $= 16 + 12 - 10$
  $= 18$
- $f(1) = (1)^2 - 3(1) - 10$

$= 1 - 3 - 10$

$= -12$

- $f(a) = (a)^2 - 3(a) - 10$

$= a^2 - 3a - 10$

- $f(x+h) = \underbrace{(x+h)^2}_{(x+h)(x+h)} - 3(x+h) - 10$

$= x^2 + xh + hx + h^2 - 3x - 3h - 10$

$= x^2 + 2xh + h^2 - 3x - 3h - 10$

What are functions

x-values go in here

$f(\ \ ) =$ → y-values come out here

Functions are like machines on conveyor belts, taking inputs (x-values) and on the other side produces outputs (y-values)

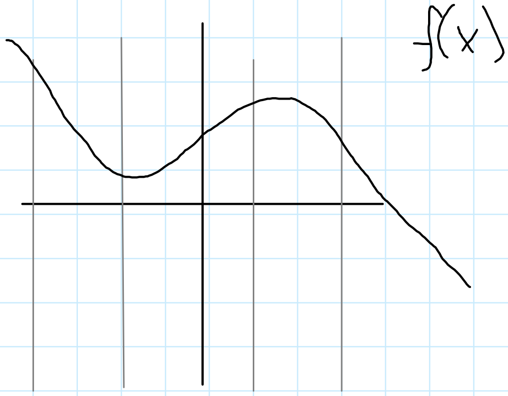
More formally functions associate/map inputs (x-values) to outputs (y-values) in such a way that each input can only be associated with/mapped <u>to exactly one output</u>

This constraint, that every input be mapped to one and only one output, has a graphical interpretation

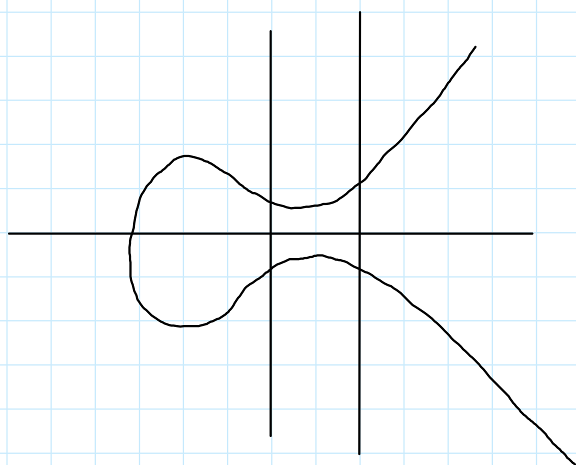
It is the <u>vertical line test</u>.

a graph is the graph of a function if every vertical line you could draw crosses the graph no more than one

<u>Ex</u> Vertical Line Test



all vertical lines cross at most once so this is a function



there is a vertical line (many actually) but one is enough) which crosses more than once so this is not a function

Domain of a function

is the list of "good" inputs (x-values)
for the function

By good, I mean inputs (x-values)
that avoid any $\div 0$ or any $\sqrt{-\#}$

Ex Domain of function

- $f(x) := \dfrac{x}{x+3}$

Domain of f(x) is what?

* we could have $\div 0$ b/c we have a denom
* no way to have $\sqrt{-\#}$, no $\sqrt{\ }$ in f(x)

to find when denom is 0
set denom = 0 & solve

$$x + 3 = 0$$
$$x = -3$$

this is a bad x-value
this input cause denom of f(x) to be 0
so good inputs are everything else

$$x \neq -3$$

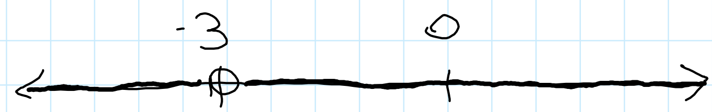
all x-values other than -3

Domain of $f(x) = \dfrac{x}{x+3}$ is
$x \neq -3$ all x-values other than -3

Interval Notation

The textook likes it's sets & intervals

$x \neq -3$ on number line looks like



in interval notation this is

$(-\infty, -3) \cup (-3, +\infty)$

all values between $-\infty$ and -3 not including either endpoint

join together

all values between -3 and $+\infty$ not including either endpoint

So book wants us to say

Domain of $f(x) = \dfrac{x}{x+3}$ is
$(-\infty, -3) \cup (-3, +\infty)$

More Ex of Domain of a Function

- $g(t) = \sqrt{2 - t}$

Domain of $g(t)$

no denoms in $g(t)$ so no $\div 0$ here

is a $\sqrt{\ }$, so inside of $\sqrt{\ }$
could be negative

if $2-t$ is negative, then

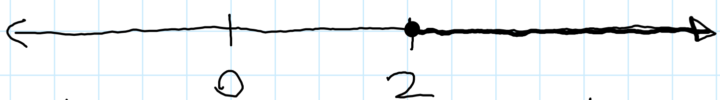
$$2-t<0$$
$$2<t$$
$$t>2$$

these inputs are bad b/c they force a $\sqrt{-\#}$

good inputs are everything else

$$t \geq 2$$

interval notation



include endpoint → $[2, +\infty)$ ← exclude endpoint

all values between
2 and $+\infty$ only
including endpoint at 2

$\boxed{\text{Domain of } g(t) \text{ is } t \geq 2 \quad [2, +\infty)}$

same notation

interval notation

- $h(x) = \dfrac{x}{x^2+4}$

Domain of $h(x)$

could have zero in denom of $h(x)$

no $\sqrt{\ }$s in $h(x)$

(don't think ahead just look at the function)

so only bad inputs are the following

denom $= 0$ → cannot happen

$x^2 + 4 = 0$ cannot happen

$x^2 = -4$ cannot happen

$x = \pm\sqrt{-4}$ → can't happen

cannot take $\sqrt{-\#}$

it cannot happen that denom $= 0$

it's always true that denom $\neq 0$

so there cannot be any bad x-values

every x-value is good

Domain of $h(x)$ is all x-values

$(-\infty, +\infty)$

all values btwn $-\infty$ & $+\infty$ excluding both endpoints

Interval notation summary

This is a list of equivalences between interval notation & number line graphs

Int Notat	# line	meaning	used with
( )	o (open dot)	exclude endpoint	$x < \#$ $x > \#$ $x \neq \#$
[ ]	● (closed dot)	include endpoint	$x \leq \#$ $x \geq \#$
$\cup$	—	join together intervals	—

Domain & Range Graphically

Domain is list of good inputs/x-values
Range is list of outputs/y-values

To read domain from graph of function
smash graph onto x-axis
the part of the x-axis covered by graph is the domain of function

To read range from graph of function
smash graph onto y-axis
the part of the y-axis covered by

graph is the range of the function

[≥ 2 examples]