Prof. Tinca de

February 20 — This will be all of 3.1 and 3.2

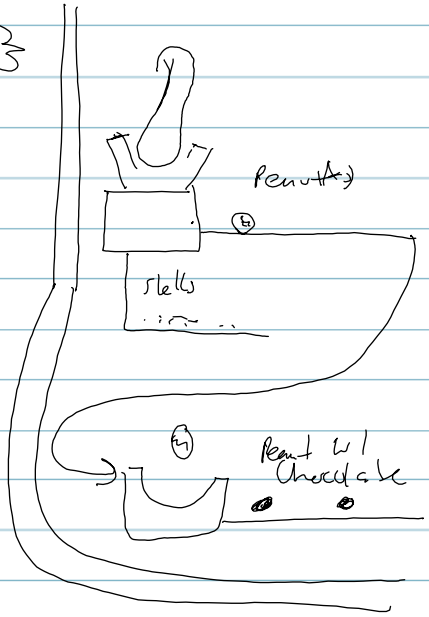
- Functions!

→ What is a function? ⇒ #1 → Relation → Any set of ordered pairs

★ "Basic definition"

- {set of elements} , {set of elements}
  "x" "y"
  In Out

"For each input, there is a single output"



- ⚠ No repeating input values!
- Domain → Set of all input values
- Range → Set of all (y) output values

$A = \{(1,2), (3,4), (5,6)\}$

Ⓐ Is it a function? → Are there repeating values of x?
★ No! ⇒ This is a function!

Ⓑ Domain? → All x's ⇒ $\{1, 3, 5\}$

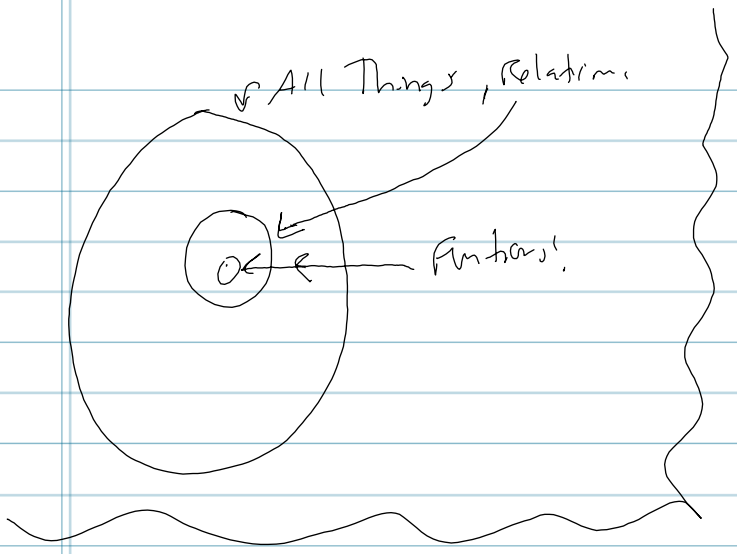
Ⓒ Range? → All y's ⇒ $\{2, 4, 6\}$

x	y
1	-4
2	8
3	-5

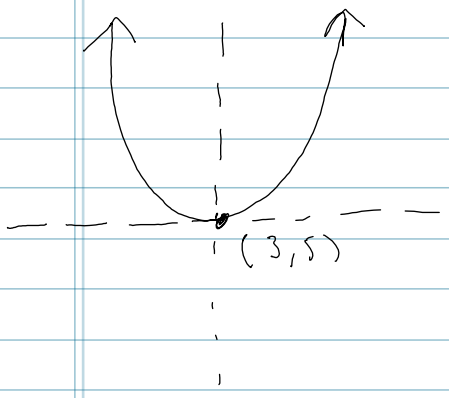
Ⓐ Function? ⇒ (1, 4), (2, 8), (3, -5)
★ Yes, it is a function!

Ⓑ Domain? $\{1, 2, 3\}$

Ⓒ Range? $\{4, 8, -5\}$



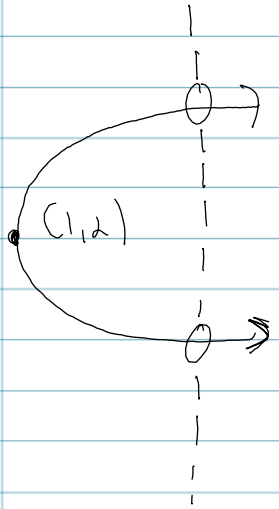
★ Vertical Line Test



⇒ 1 line, 1 point ⇒ Function!

⇒ Domain: ⇒ Can you plug any x into this function?
★ Yes! ⇒ $(-\infty, \infty)$

⇒ Range: ⇒ Are any outputs excluded from your possibilities?
⚠ Yes! Because '5' is the lowest point on the graph, it is also the smallest value one can expect to retrieve from the function.
Thus ⟶ $[5, \infty)$



⇒ 1 line, 2 points ⇒ NOT a function!

⇒ Domain: $[1, \infty)$ {Any $x \geq 1$ gives output
⇒ Range: $(-\infty, \infty)$ {Any y can be obtained with a specific x.

Function Notation

$f(x)$ { What does it MEAN?!

"f of x"

f: The name of the function

x: The variable that the function is describing

★ $y = x^2 + 2 \Rightarrow f(x) = x^2 + 2$

$f(2) = (2)^2 + 2 = 6 = y \Rightarrow (2, 6)$ (x, y)

★ So where does this all come together?

Domains: What makes sense to "put into" the machine? (function)

Range: What makes sense as a "product" of the machine? (functions)

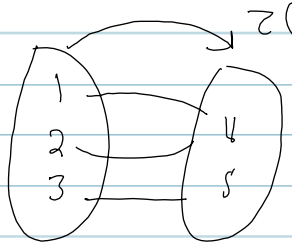
Put in plastic (10 lbs) = Get out bottles (f(plastic pounds))

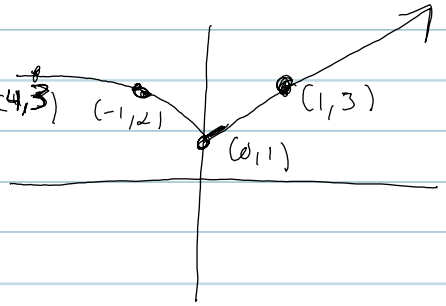
$f(x) = x^2 - 3x + 1$

$g(x) = x + 4$

$h(x) = 12$

x	h(x)
1	4
2	5
3	6





$f(3) \Rightarrow (3)^2 - 3(3) + 1$

$= 9 - 9 + 1 = 1$

$f(R) = (R)^2 - 3(R) + 1$

$= R^2 - 3R + 1$

$f(x+4) = (x+1)^2 - 3(x+4) + 1$

$(x^2 + 8x + 16) - 3x - 12 + 1$

$x^2 + 5x + 5$

★ Difference Quotient!!

$\frac{h(x+h)}{h}$

- $g(4) = (4)+4 = 8 \rightarrow \{(4, 8)$

$(f+g)(x) = (x^2-3x+1) + (x+4)$
$= x^2 - 2x + 5$

(x^2-3x+1) $(x+4)$

$(f+g)(3) = f(3) + g(3) \Rightarrow 1 + 7 = \boxed{8}$
$\hookrightarrow (3)^2 - 2(3) + 5 = 9 - 6 + 5 = \boxed{8}$

$(f-g)(x) = f(x) - g(x) \Rightarrow (x^2-3x+1) - (x+4)$
$x^2 - 3x + 1 - x - 4$

$\boxed{x^2 - 4x - 3}$

$(f \cdot g)(x) \Rightarrow (x^2-3x+1)(x+4)$

$\left(\frac{f}{g}\right)(x) \Rightarrow \frac{x^2-3x+1}{x+4} \rightarrow x \neq -4$, because we cannot divide by 0!

★ $h(6) = 12$
... $h(1,000,000) = 12$!

★ $k(2) = 5$ { This is just an ordered pair, remember that!
$k(8) \Rightarrow$ does not exist! It is not in our given domain!

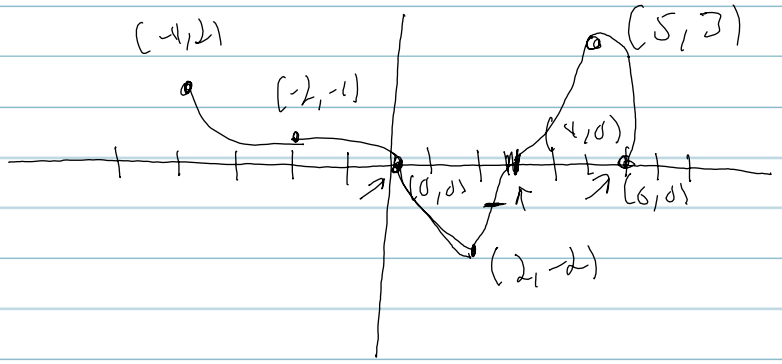
★ $z(1) = 1$
$z(6) \Rightarrow$ D.N.E.
$z(4) \Rightarrow$ D.N.E.!

$L(1) = 3$ { This the same concept as our table, but...
$L(1) = 2$

$L(1) \Rightarrow$ it DOES exist, it just $\Rightarrow$ isn't labeled!

$\boxed{4\ 1/2}$

#10, 3.2



b) $f(2) = -2 \Rightarrow (2,-2)$
$f(-2) = 1 \Rightarrow (-2,1)$

m) For what values of x does $f(x) = 3$? $\Rightarrow (\_\_, 3) \Rightarrow x = 5$

c) Is f(3) positive or negative? $\Rightarrow$ Negative {It i.e. between $x=2$, $x=11$, which is below the x-axis.

e) For what values of x is $f(x) = 0$? $\Rightarrow$ $x=0$, $x=4$, $x=6$
$(0,0)$, $(4,0)$, $(6,0)$

f) For what values of x is $f(x) < 0$? $\Rightarrow$ Where is the graph below the x-axis?

$(0, 4)$ ← Interval notation!
from $x=0$ to $x=4$

g) For what values of x is $f(x) > 0$? $\Rightarrow$ from $x=-4$ to $x=0$ AND from $x=4$ to $x=6$
$(-4, 0) \cup (4, 6)$

if $f(x) \geq 0$ $\Rightarrow$ $[-4, 0] \cup [4, 6]$