

1.2

Two tools for understanding a function better.

Table

input values x	output values $f(x)$
⋮	⋮
⋮	⋮
⋮	⋮
⋮	⋮

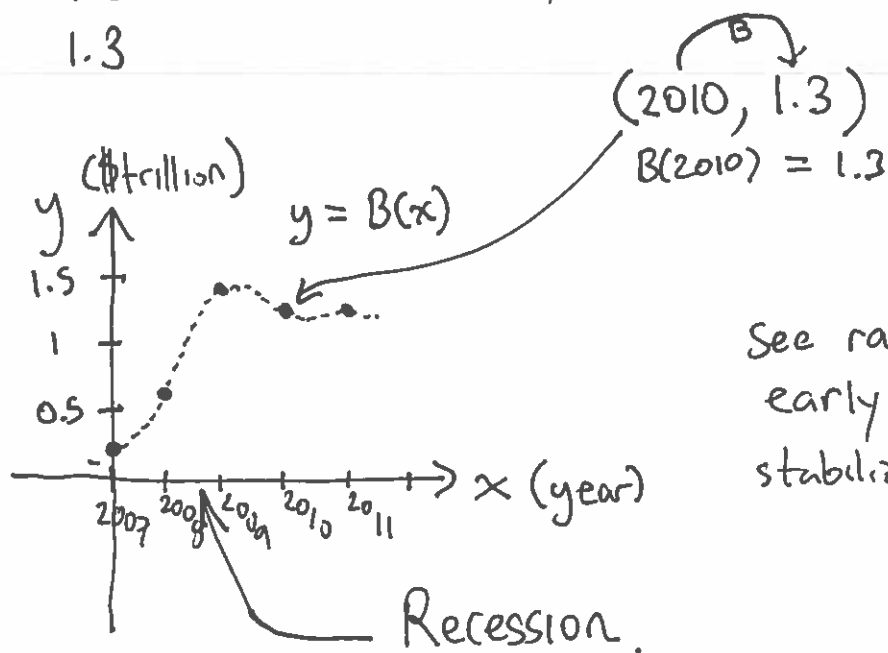
Ex $B(x)$ = budget deficit in year x .

x (year)	$B(x)$ (\$trillions)
2007	0.2
2008	0.6
2009	1.4
2010	1.3
2011	1.3

steady increase ↓

deficit increased... then eventually stabilized...

A graph



Ex $f(x) = \sqrt{x}$ (no context)

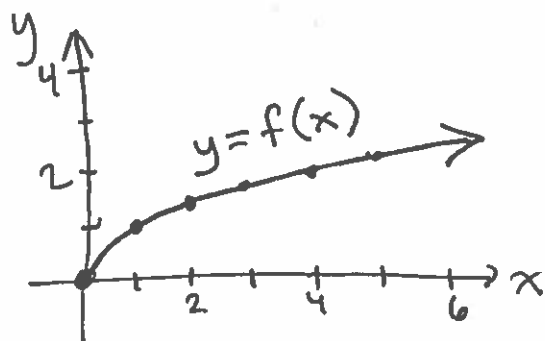
Table:

chaotic!

x	$f(x)$
4	2
16	4
25	5
2	1.41...

x	$f(x)$
0	0
1	1
2	1.41...
3	1.73...
4	2
5	2.23...

Graph



Observations: As x increases $f(x)$ increases; but by smaller and smaller amounts

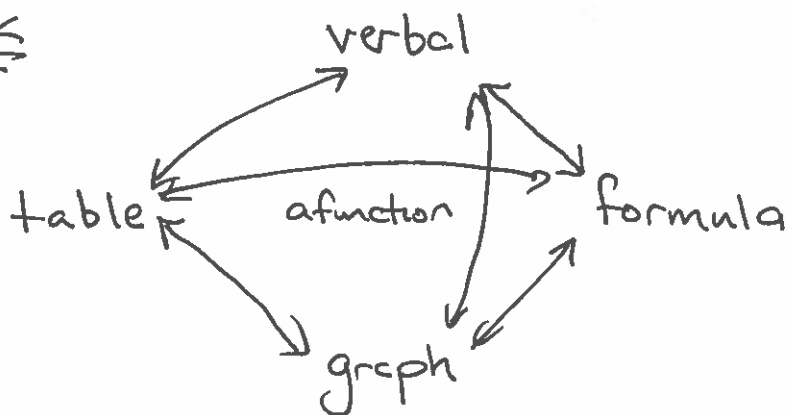
Can see increasing ... and more slowly later on ...

Ex Which is bigger? $\sqrt{72} - \sqrt{71}$ or $\sqrt{738} - \sqrt{737}$

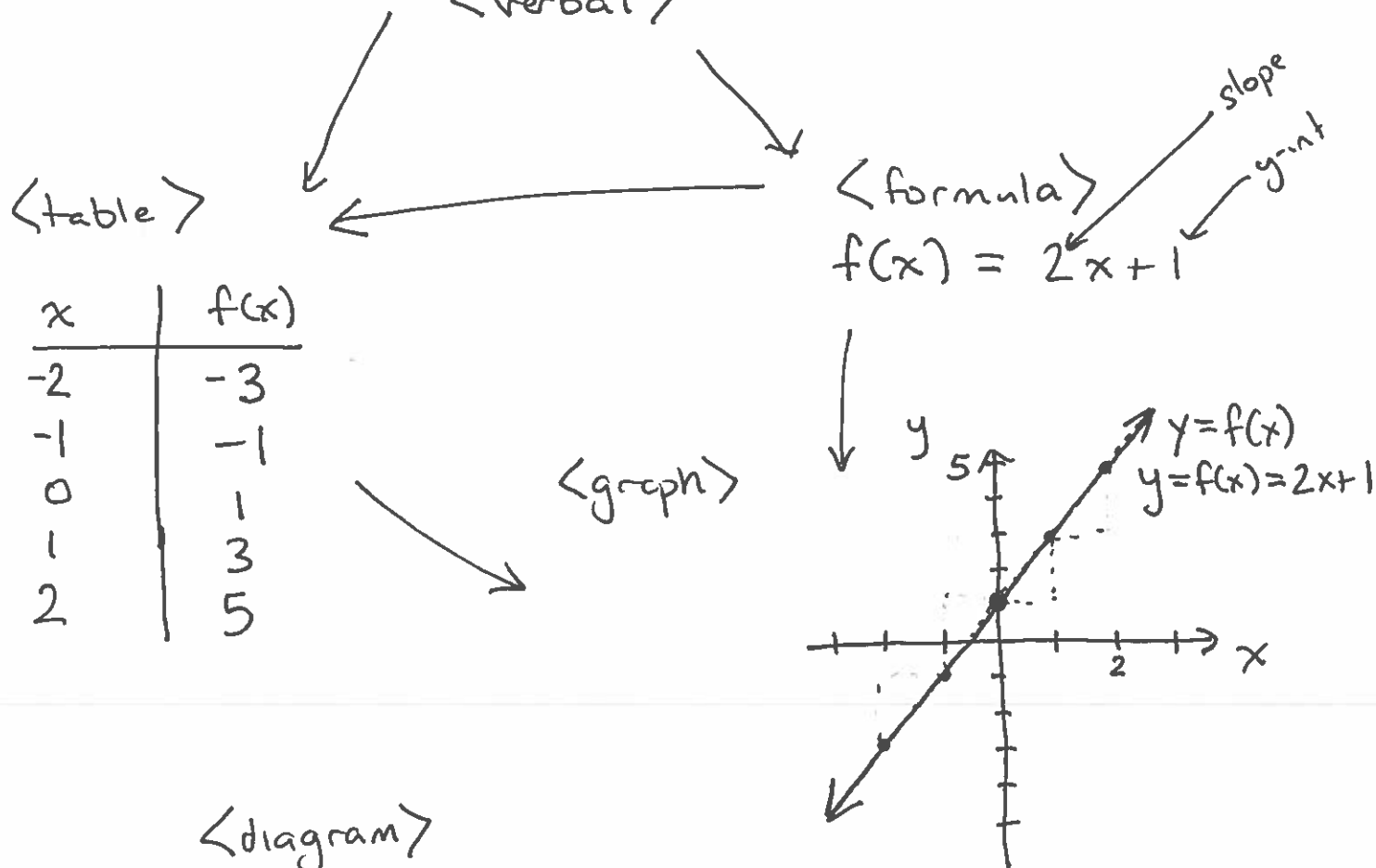
bigger since
it's an earlier
difference...

~~Ex~~

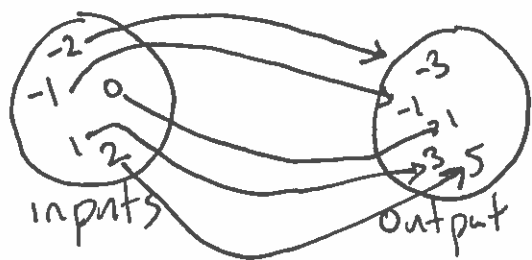
Task



Ex f takes its input, doubles it, adds 1.



<diagram>



Ex C finds the Celsius temperature based on a Fahrenheit temp.
<verbal>

<table>

x ($^{\circ}\text{F}$)	$C(x)$ ($^{\circ}\text{C}$)
32	0
212	100
98.6	37
-40	-40

<formula>

$$y = mx + b$$

$$y = \frac{5}{9}x + b$$

$$0 = \frac{5}{9}(32) + b$$

$$0 = \frac{160}{9} + b$$

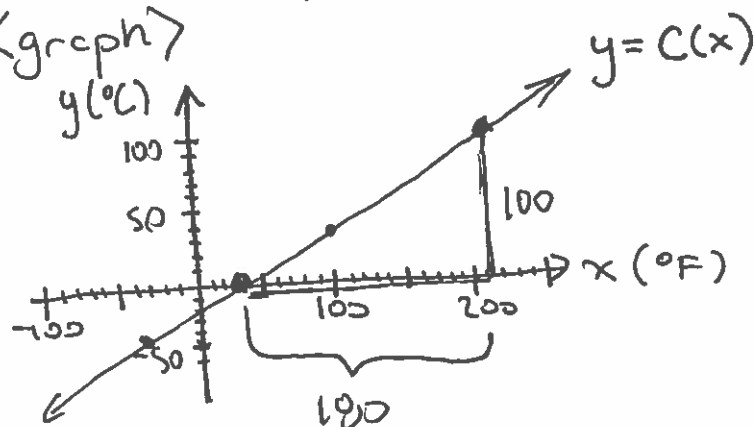
$$b = -\frac{160}{9}$$

$$m = \frac{100}{180} = \frac{5}{9}$$

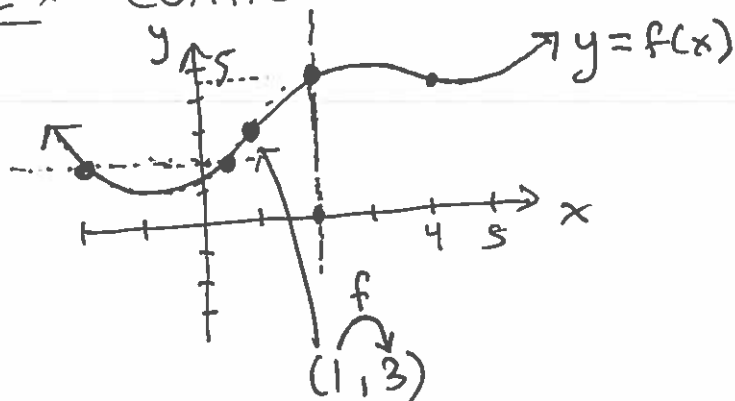
$$y = \frac{5}{9}x - \frac{160}{9}$$

$$C(x) = \frac{5}{9}x - \frac{160}{9}$$

<graph>



Ex Confronted with:



tells us $f(1) = 3$

Ex Find $f(2)$.

2 is input
→ x-value

We see (2, 4.5)

So $f(2) = 4.5$.

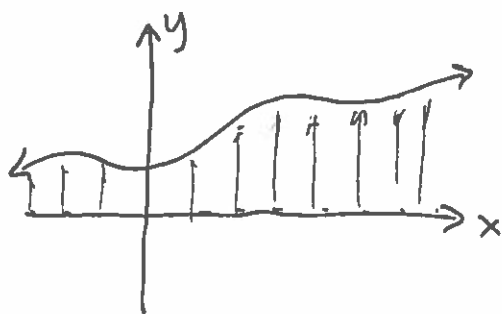
Ex Solve $f(x) = 2$.

← output: y-value

We see (-2, 2) and (0.5, 2)

So $x = -2$ or $x = 0.5$.

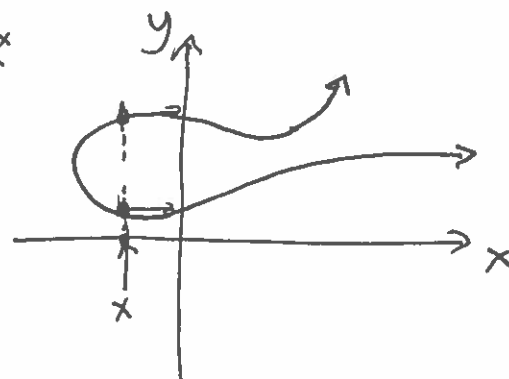
Ex



Can this graph
be used to see y
as a function of x ?

Yes

Ex

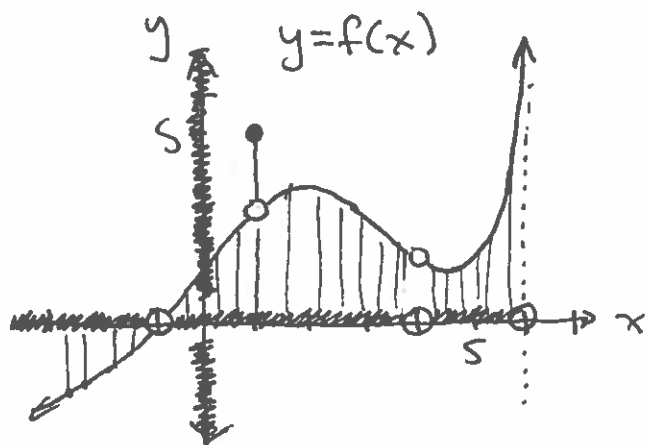


Same question.

many x -values give
more than one y -value.

(Vertical Line Test : See book)

Ex



$$f(1) = 5$$

$$f(1.0000001) \approx 3 + \text{a little bit.}$$

Find f 's domain.

$$\Rightarrow (-\infty, -1) \cup (-1, 4) \cup (4, 6)$$

The range of a function
is the collection of
all possible outputs

Interval
notation

Find f 's range... $(-\infty, 0) \cup (0, \infty)$

Ex

x	$f(x)$
3	5
7	2
8	2
11	1

Find f 's domain...



$$\{3, 7, 8, 11\}$$

and range... $\{1, 2, 5\}$

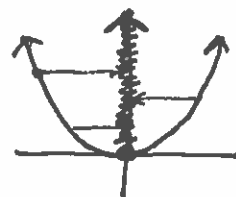
set
notation

Ex $f(x) = x^2$

What's f 's domain? $(-\infty, \infty)$

What's f 's range?

↓
In MTH 111, use a graph
for determining range.



$[0, \infty)$

Ex $f(x) = x \cdot 2^x$

What is f 's range?

↓
use a graph...

range = $[-0.53..., \infty)$

