Section 1.1

Recall $\sqrt{\ }$

You know $\sqrt{9} = 3$

$\sqrt{\frac{1}{4}} = \frac{1}{2}$

$\sqrt{2} = 1.41\ldots$

$\sqrt{\ }$ takes numbers, turns them into other numbers.

A <u>function</u> is a process for turning #s into other #s

$\sqrt{\ }$ is not on a keyboard...

Well sqrt(25) = 5

- sqrt: name of a function
- (25): input for the function
- 5: output (for 25 as input)

So f(x)

- f: stand for a function
- (x): stands for a number

When we write "f(x)"

"f of x"

f: function

x: input

f(x): output

Ex A function w takes a mass (in kg) and converts it into the weight (in lb).

$w(100) = 220$ "100 kg is equivalent to 220 lb on Earth"

this is 100 kg since kg is input type

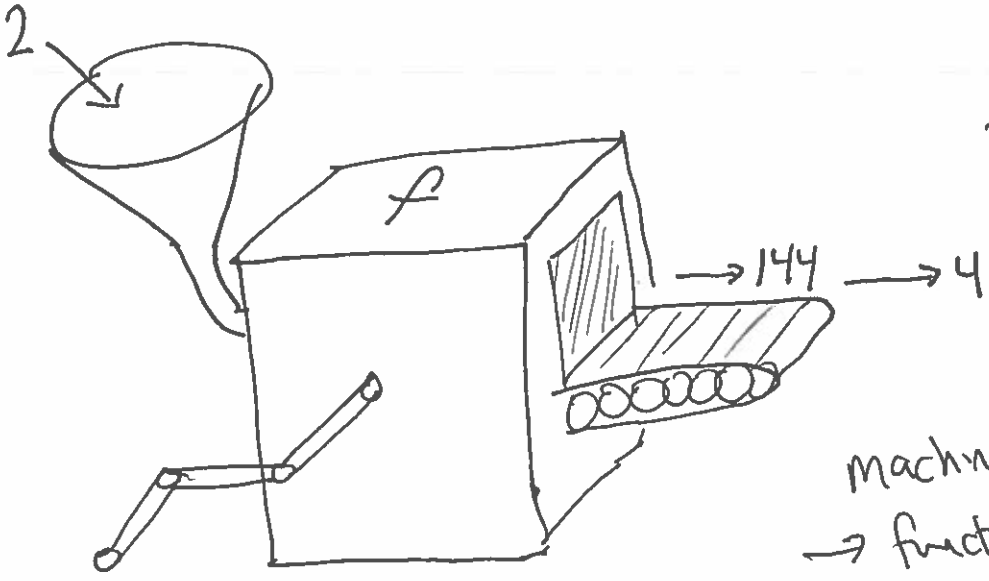
$w(0) = 0$

Ex A function B, has $B(x)$ is fed. budget deficit in year x.

$B(2009) = 1,400,000,000,000$

look up online

12 → ⟨not all functions have formulas⟩

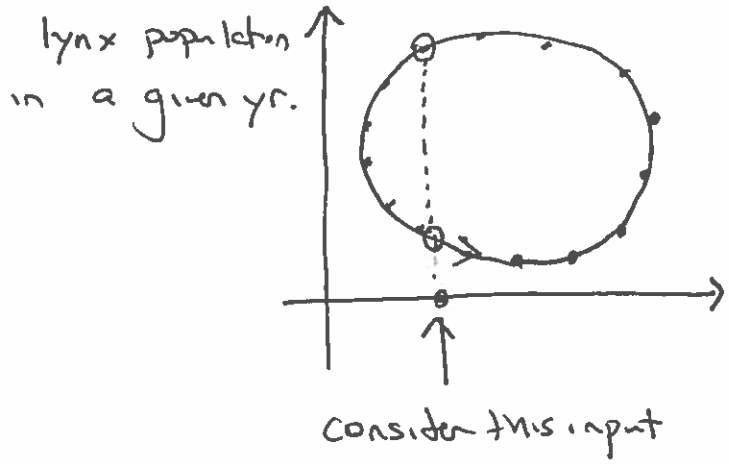


$f(x) = x^2$

machine metaphor → functions are complicated!

Functions and Relations

Ex Out in Canadian wilderness...



this shows a relation between x & y.

Can I make a fncton out of this?

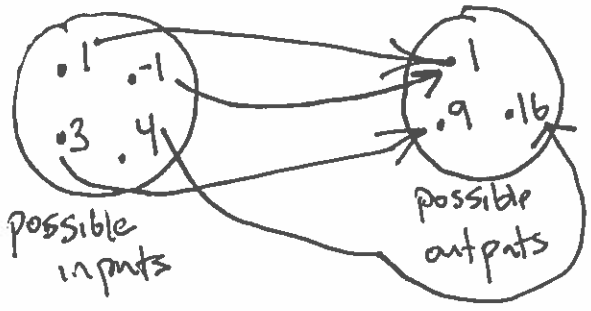
No, because there's no single y-value attached to each x-value...

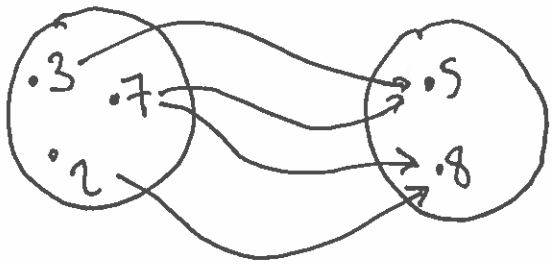
Relation: collection of x-values and y-values
"inputs" "outputs"

Function: same thing, but each input must have exactly one output

Ex Diagrams

$f(x) = x^2$





relation ✓
function, no.

Equations *might* give functions...

Ex $y + 2x = 3$

Does this make y be a function of x?

x is input

$y + 2x = 3$

would you be able to determine y with no ambiguity?

imagine subbing in a value

e.g $y + 2x = 3$ (7 → x)

$y + 2(7) = 3$

$y + 14 = 3$

$y = -11$

$x = 7 \longrightarrow y = -11$

We can do this for any x, so... yes!

Ex $x^2 + y^2 = 169$

Does this make y be a function of x?

$x^2 + y^2 = 169$

imagine subbing in x...

will you know y?

e.g. $x^2 + y^2 = 169$ (5 → x)

$25 + y^2 = 169$

$y^2 = 144$

$\sqrt{y^2} = \sqrt{144}$

$|y| = 12$

$y = 12$ or $y = -12$

$x = 5 \longrightarrow y = 12$, $y = -12$

Not a function!

Ex $x^2 + 2y^3 = 7x$ Does this make y be a function of x?

...try to isolate y...

$$2y^3 = 7x - x^2$$

$$y^3 = \frac{7x - x^2}{2}$$

$$\sqrt[3]{y^3} = \sqrt[3]{\frac{7x - x^2}{2}}$$

$$y = \sqrt[3]{\frac{7x - x^2}{2}}$$

clearly, plug in an x we'll know y...

So yes!

$\sqrt[n]{x^n} = x$ n odd

$\sqrt[n]{x^n} = |x|$ n even

Ex Let $P(t)$ be the pop. of PDX in year t.

$P(2011) = 593820$

$P(1990) = 487849$

$P(1700)$ doesn't make sense!

good input

bad input

Ex Let $w(m)$ ~~was~~ be the ~~one~~ weight of an object whose mass is m kg.

$w(100) = 220$

$w(0) = 0$

$w(-40)$ doesn't make sense!

good input

bad input

can't have negative mass!

Ex $f(x) = \frac{1}{x-3}$

$f(0) = \frac{1}{0-3} = -\frac{1}{3}$

$f(5) = \frac{1}{5-3} = \frac{1}{2}$

$f(3) = \frac{1}{3-3} = \frac{1}{0}$ um... no!

has no meaning

good input

bad

Ex $h(x) = \sqrt{2x-3}$

good input

$h(2) = \sqrt{2(2)-3} = \sqrt{1} = 1$

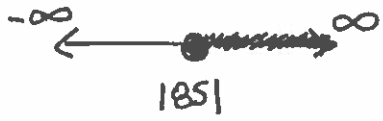
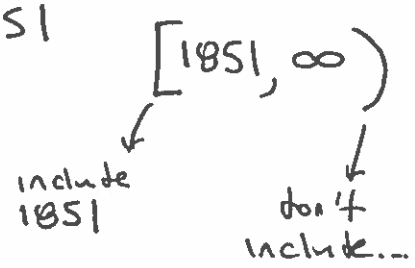
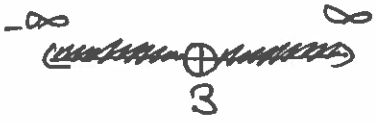
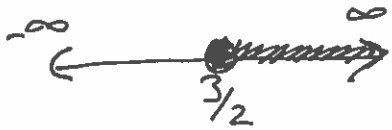
$h(6) = \sqrt{2(6)-3} = \sqrt{9} = 3$

$h(\frac{1}{2}) = \sqrt{2(\frac{1}{2})-3} = \sqrt{-2}$!!

$h(-1) = \sqrt{2(-1)-3} = \sqrt{-5}$!!!

bad input

The <u>domain</u> of a function is the collection of all its valid inputs.

function	domain in words	domain in picture	domain in symbols	domain in interval notation
p	every years since 1851 when PDX became a city.		$t \geq 1851$	$[1851, \infty)$ 
w	any number 0 or above		$x \geq 0$	$[0, \infty)$
f	all real numbers except 3		$x \neq 3$	union symbol $(-\infty, 3) \cup (3, \infty)$
h			$x \geq 3/2$	$[3/2, \infty)$

side work

$h(x) = \sqrt{2x-3}$

We <u>need</u>: $2x - 3 \geq 0$

$2x \geq 3$

$x \geq 3/2$

Task: Given a formula for a fuction, find its domain

Ex $p(x) = \dfrac{x^2+2x-3}{x^2+6x+5}$ Find p's domain

the thing to worry about is divison by 0...

Need $x^2+6x+5 \neq 0$

try to factor: $(x+5)(x+1) \neq 0$

$\Longrightarrow$ $x \neq -5$ and $x \neq -1$

$(-\infty, -5) \cup (-5, -1) \cup (-1, \infty)$