Functions and Relations

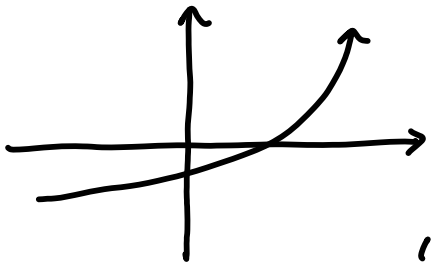
Chapter Review

Introduction to Functions and Relations

- Relations are a collection of ordered pairs, (x, y) points.
- Functions are a special type of relation, one that pairs one x value with only one y value

Functions and relations have various forms to include

graphs



Sets

$\{(1,4), (2,5), (3,9)\}$

Tables

x	y
-1	6
4	7
3	10
2	-1

Equations $(y = f(x))$

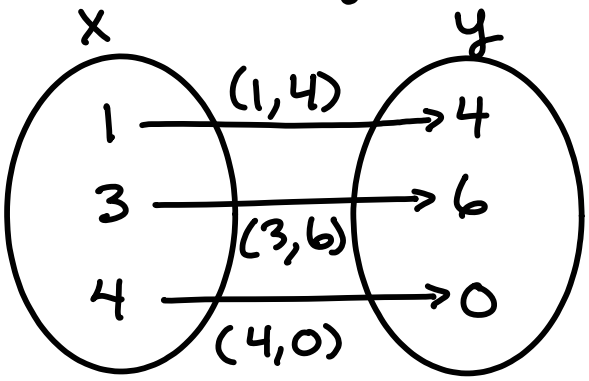
$y = 2x + 1$

or $f(x) = 2x + 1$

"f of x"

↑ Function Notation

Mapping

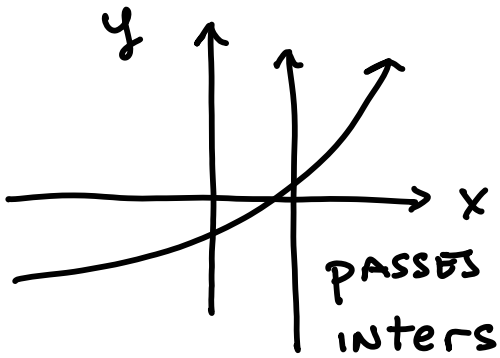


Note:
We call the x-numbers the **Domain** and y-numbers the **Range**

Test a relation to determine if it is a function -

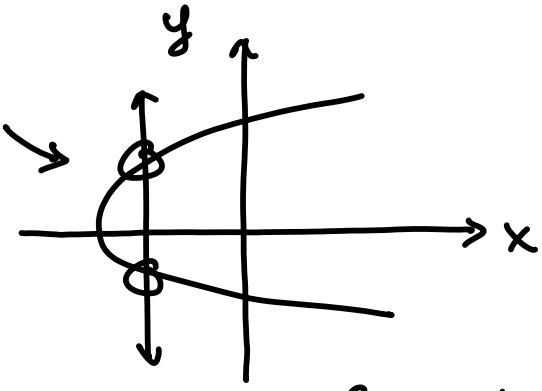
- Can use the VLT- Vertical Line Test
- Or use a mapping diagram

Example using VLT



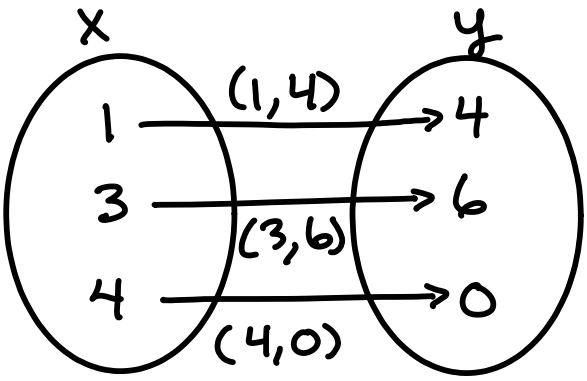
passes VLT - only intersects once (Function)

Fails - crosses twice

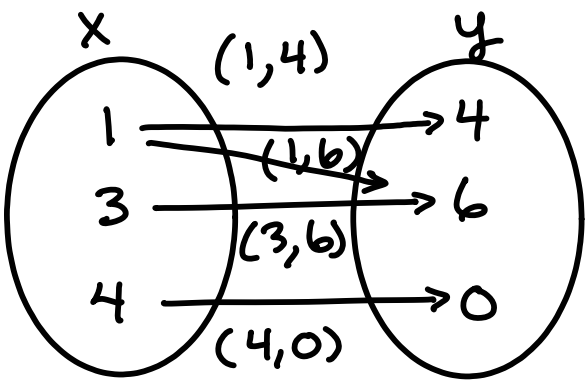


(Not a function)

Example using mapping



passes each x goes to only one y (Function)



Fails 1 is paired with 4 and 6; (Not a function)

Function Operations

Given functions you can $+, -, \times, \div$ them

Examples, $f(x) = 3x \quad g(x) = x + 2$

$f(x) + g(x) = 3x + x + 2 = 4x + 2$

$f(x) - g(x) = 3x - (x+2) = 2x - 2$

$f(x) \cdot g(x) = 3x(x+2) = 3x^2 + 6x$

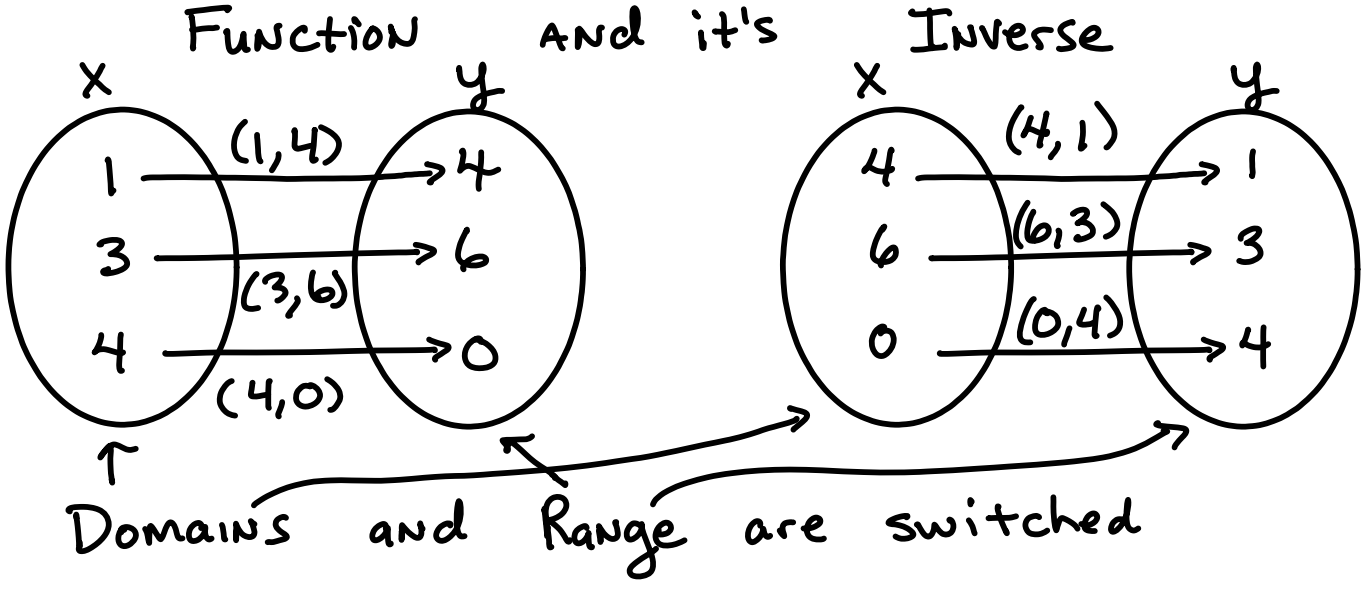
$$\frac{f(x)}{g(x)} = \frac{3x}{x+2}$$

Evaluating a function – plug in value and simplify

Example, $f(x)\ 2x^2$

say "f of 3" $\longrightarrow f(3) = 2(3)^2 = 2 \cdot 9 = 18$

Inverse Functions



Find an inverse function

Steps

1. replace the $f(x)$ with y
2. switch the x and y in equation
3. Solve for y

Example

$$f(x) = 2x + 4$$

Step 1 → $y = 2x + 4$

step 2 → $x = 2y + 4$

Step 3

$$2y + 4 = x$$
$$2y = x - 4$$
$$y = \frac{x-4}{2} \leftarrow \text{inverse function}$$

inverse notation → $f^{-1}(x) = \frac{x-4}{2}$

$f(f^{-1}(x)) = f^{-1}(f(x)) = x$ the composite of these functions are equal to x

$$f(f^{-1}(x)) = 2\left(\frac{x-4}{2}\right) + 4$$
$$= x - 4 + 4$$
$$= x$$

↑ Showing this is how you verify an inverse function

$f(x) = 2x + 4$

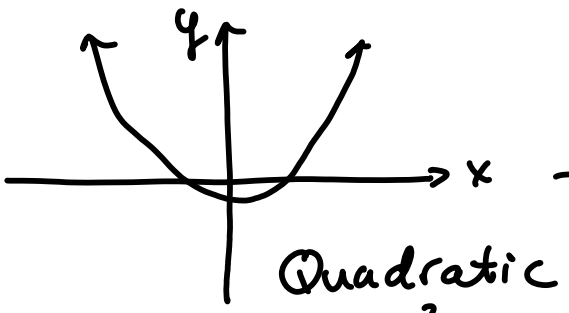
$f^{-1}(x) = \frac{x-4}{2}$ →

Graphing Functions

- Algebra students already have been graphing many functions - to include,
  - lines
  - Absolute value
  - Quadratic

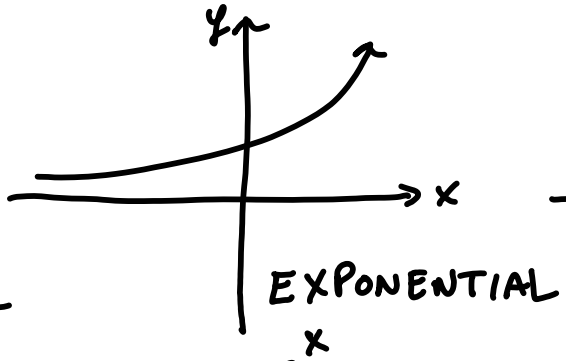
Linear and Nonlinear Functions

- Linear functions are lines, $y = mx + b$
- Some non-linear functions are



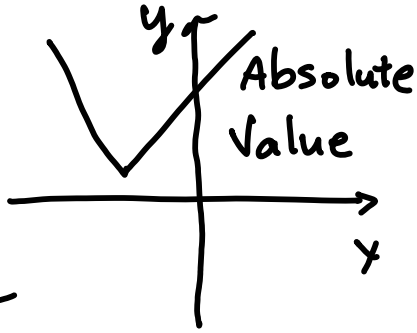
Quadratic

$y = a(x-h)^2 + k$



EXPONENTIAL

$y = a^x$



$y = |x-h| + k$

Composite Functions

When you evaluate a function with another function

Example, $f(x) = 2x + 1$ $g(x) = 3x$

$f(g(x)) = 2(3x) + 1$

$= 6x + 1$

Special Functions

- Piecewise functions
- Recursive
- Greatest Integer