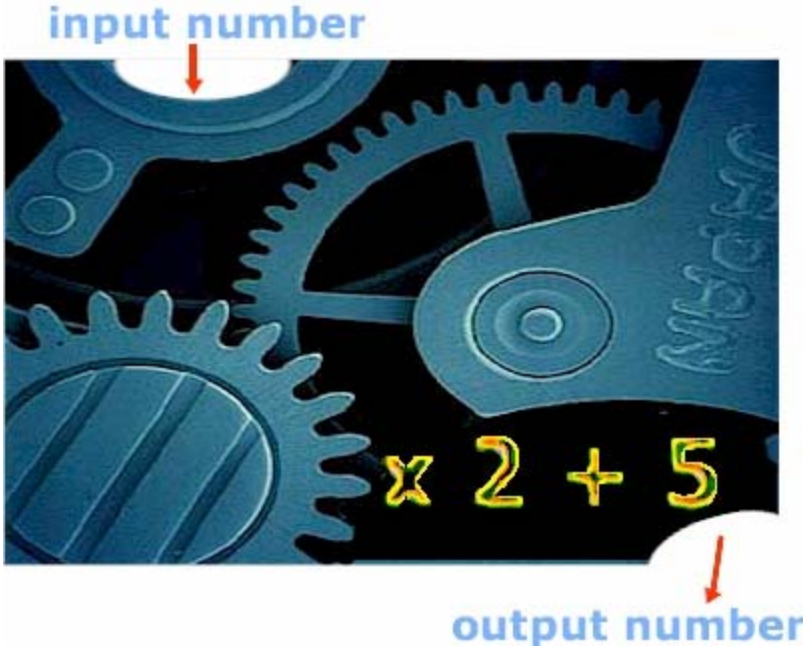
Déjà Vu, It's Algebra 2!

Lesson 27

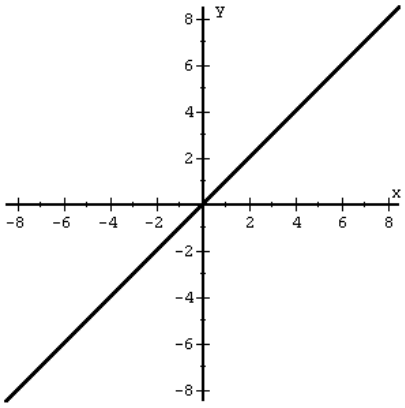
Building Functions from Functions

A parent function is a basic representative of a particular type of function from which all others of that type can be created.

We can create NEW functions from these parent functions by using a sequence of transformations.

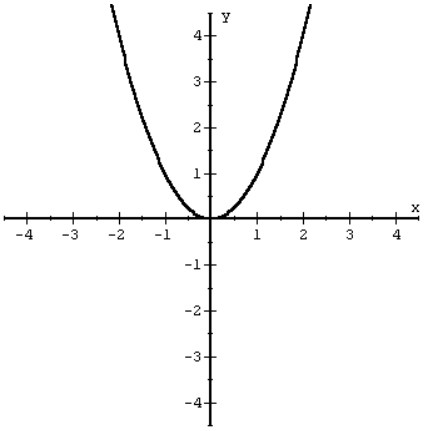


Examples of parent functions.



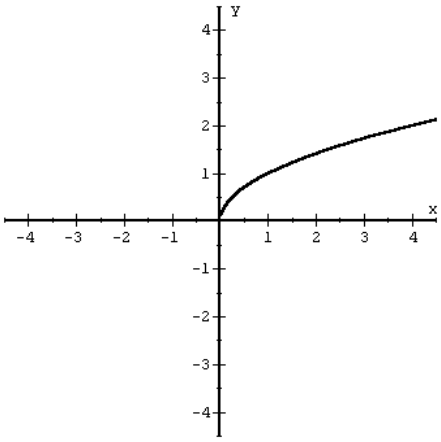
$f(x) = x$

Linear



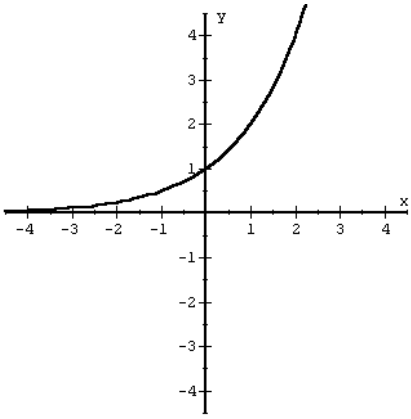
$f(x) = x^2$

Quadratic



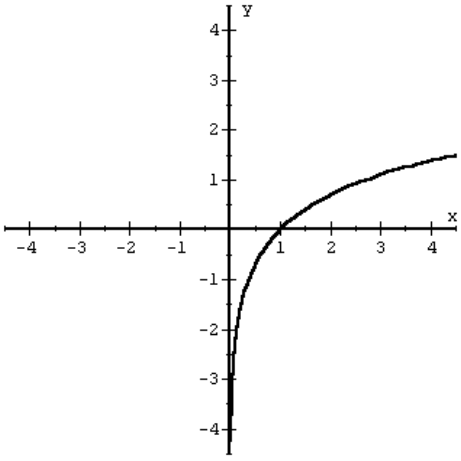
$f(x) = \sqrt{x}$

Square Root



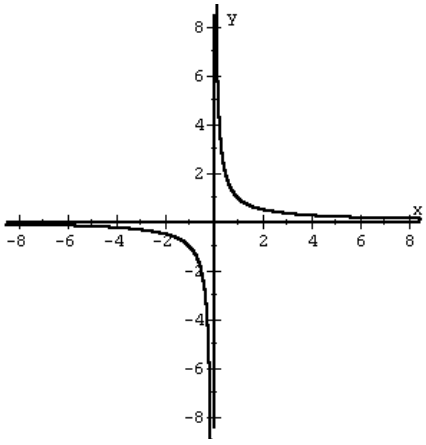
$f(x) = b^x$

Exponential



$f(x) = \log_b x$

Logarithmic

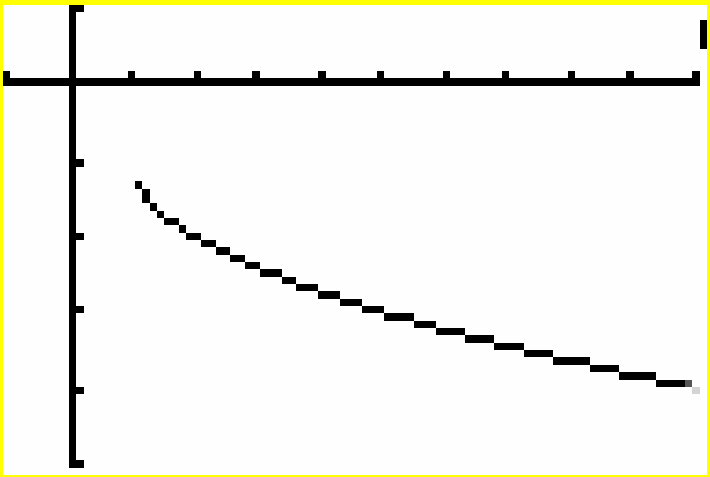


$f(x) = \frac{1}{x}$

Reciprocal (Rational)

Example:

Sketch $f(x) = -\sqrt{x-1} - 1$, then list domain and range.

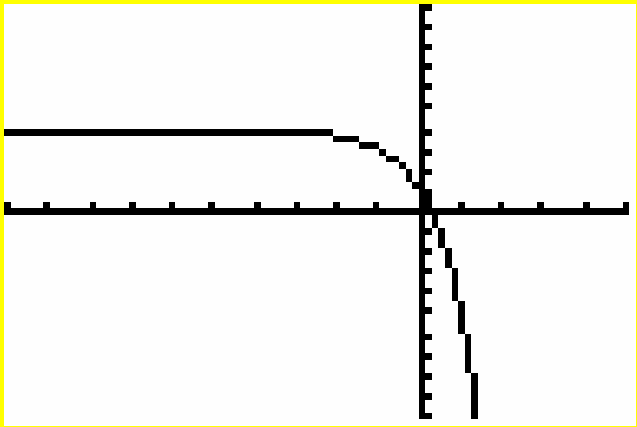


$D: x \geq 1$

$R: y \leq -1$

Example:

Sketch $g(x) = 4 - 3^{x+1}$, then list domain and range.



$D: \mathbb{R}$

$R: y < 4$

We can also create new functions by combining functions using the following operations:

1. Addition
2. Subtraction
3. Multiplication
4. Division
5. Composition

For the following examples, let

$f(x) = 6x^2 - x - 12$, $g(x) = 2x - 3$, and $h(x) = \sqrt{x}$

Find . . .

i) $f(x) + g(x) = (f + g)(x) =$

$6x^2 + x - 15$

ii) $g(x) - f(x) = (g - f)(x) =$

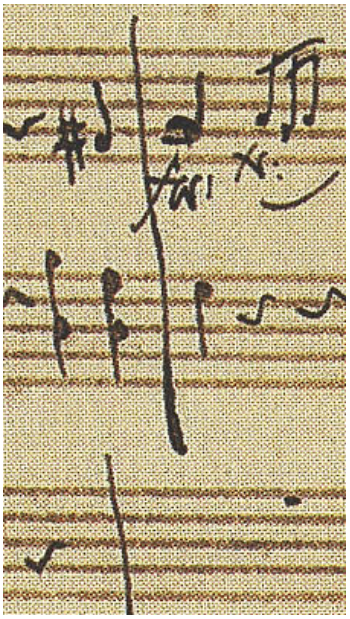
$-6x^2 + 3x + 9$

iii) $f(x) \cdot g(x) = (fg)(x) =$

$12x^3 - 20x^2 - 21x + 36$

iv) $\dfrac{f(x)}{g(x)} = \left(\dfrac{f}{g}\right)(x) =$

$3x+4,\ x \neq 1.5$



A Mozart Composition

v) $f(g(x)) = (f \circ g)(x) =$

$6(2x-3)^2 - (2x-3) - 12$

vi) $h(g(f(x)) = (h \circ g \circ f)(x) =$

$\sqrt{2(6x^2 - x - 12) - 3} = \sqrt{12x^2 - 2x - 27}$

vii) $h(g(f(-1)) = (h \circ g \circ f)(-1) =$

$\sqrt{12 + 2 - 27} = \sqrt{-13} =$ *undefined*

viii) $h(g(f(-2)) = (h \circ g \circ f)(-2) =$

$\sqrt{12 \cdot 4 + 4 - 27} = \sqrt{52 - 27} = \sqrt{25} = 5$

Déjà RE-Vu

A local automobile dealer is offering the following deal on a new car:

1. A 5% rebate on the purchase price

AND

2. $1000 cash back on purchase price.

He'll allow you to take either offer in any order you specify. If the selling price of the new car is $30,000, in which order should you request your "deals?"

Let $r(x) = .95x$, where .95 = 95% of the purchase price after 5% rebate off the purchase price of x dollars.

Let $c(x) = x - 1000$, where $c(x)$ is the price after the $1000 cash back of the purchase price x

We are now interested in which is smaller:

$r(c(30000))$ or $c(r(30000))$

$$r(c(30000)) = r\left(30000 - 1000\right) = r\left(29000\right) = \left(.95\right)\left(29000\right) = \$27{,}550$$

$$c(r(30000)) = c\left(28500\right) = \$27{,}500$$

So, by taking the rebate first, you will be saving $50 more than if you took the discount first.

Math is everywhere!

References:

http://www.infantilescoliosis.org/images/parent_and_Child_holding_hands_icon.jpg
http://library.thinkquest.org/18713/media/images/function=machine.jpg
http://rmc.library.cornell.edu/mozart/pics/illustrations/compose.jpg
http://www.clipartof.com/images/clipart/thumbnail2/2813_cool_guy_driving_a_convertible_car.jpg