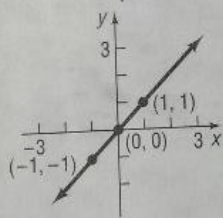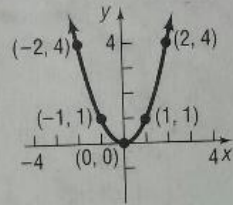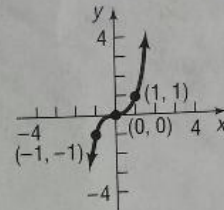# LIBRARY OF FUNCTIONS

Identity Function $f(x) = x$
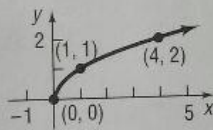
Square Function $f(x) = x^2$

Cube Function $f(x) = x^3$

Identity Function graph with points $(1, 1)$, $(0, 0)$, $(-1, -1)$, x-axis marks at -3 and 3, y-axis mark at 3.

Square Function graph with points $(-2, 4)$, $(2, 4)$, $(-1, 1)$, $(1, 1)$, $(0, 0)$, x-axis marks at -4 and 4, y-axis mark at 4.

Cube Function graph with points $(1, 1)$, $(0, 0)$, $(-1, -1)$, x-axis marks at -4 and 4, y-axis marks at 4 and -4.
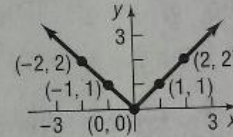
Square Root Function $f(x) = \sqrt{x}$

Reciprocal Function $f(x) = \dfrac{1}{x}$

Absolute Value Function $f(x) = |x|$

Square Root Function graph with points $(1, 1)$, $(4, 2)$, $(0, 0)$, x-axis marks at -1 and 5, y-axis mark at 2.

Reciprocal Function graph with points $(2, \frac{1}{2})$, $(1, 1)$, $(-1, -1)$, x-axis marks at -2 and 2, y-axis mark at 2.

Absolute Value Function graph with points $(-2, 2)$, $(2, 2)$, $(-1, 1)$, $(1, 1)$, $(0, 0)$, x-axis marks at -3 and 3, y-axis mark at 3.

Exponential Function $f(x) = e^x$

Natural Logarithm Function $f(x) = \ln x$

Exponential Function graph with points $(2, 7.39)$, $(1, 2.72)$, $(0, 1)$, $(-1, 0.37)$, y-axis marks at 3 and 6, x-axis mark at 3.

Natural Logarithm Function graph with points $(3, 1.10)$, $(2, 0.69)$, $(1, 0)$, $(\frac{1}{2}, -0.69)$, y-axis mark at 3, x-axis mark at 3.
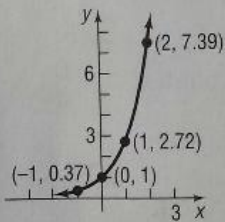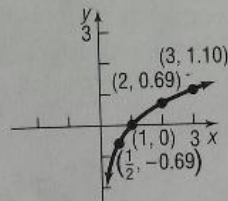
Know your Library

Least familiar:
Greatest-Integer Function, also known as "floor"

f(x) = the greatest integer less than or equal to x

f(3.4) = 3

f(-3.4) = -4

Piecewise functions:

The potential domain is cut up into pieces.
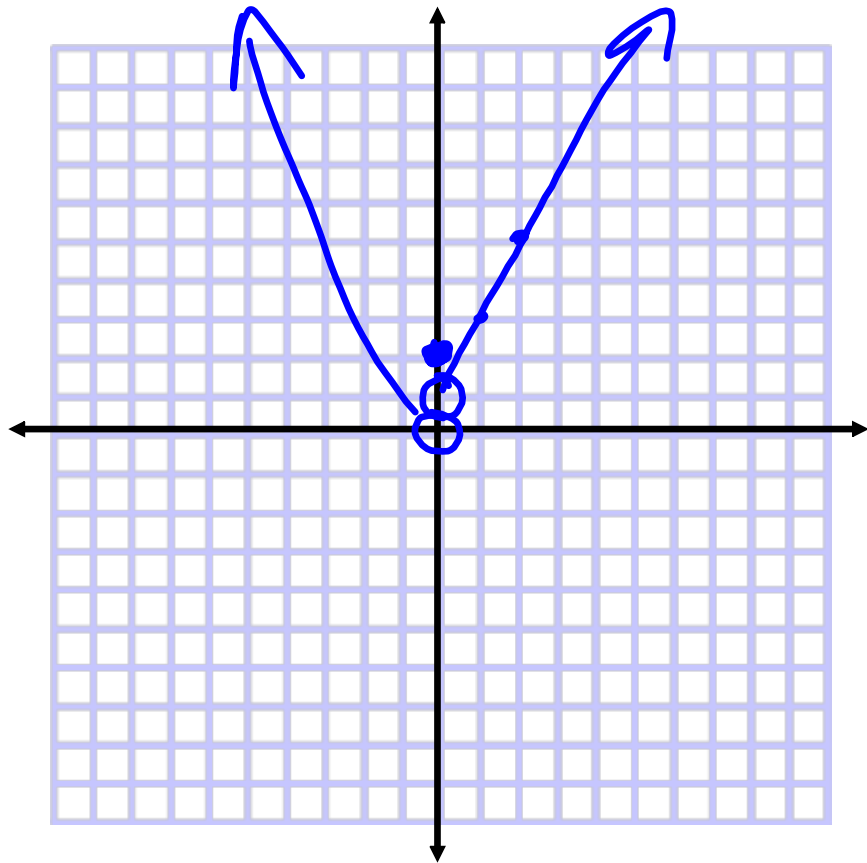
The function is defined differently for different pieces.

The function's domain is the pieces it is defined for.

$$f(x) = \begin{cases} \cdots\cdots x & (-\infty, 0) \quad x < 0 \\ \cdots\cdots x^2 & 0 \le x < 3 \\ \cdots\cdots x^3 & 3 \le x \end{cases}$$
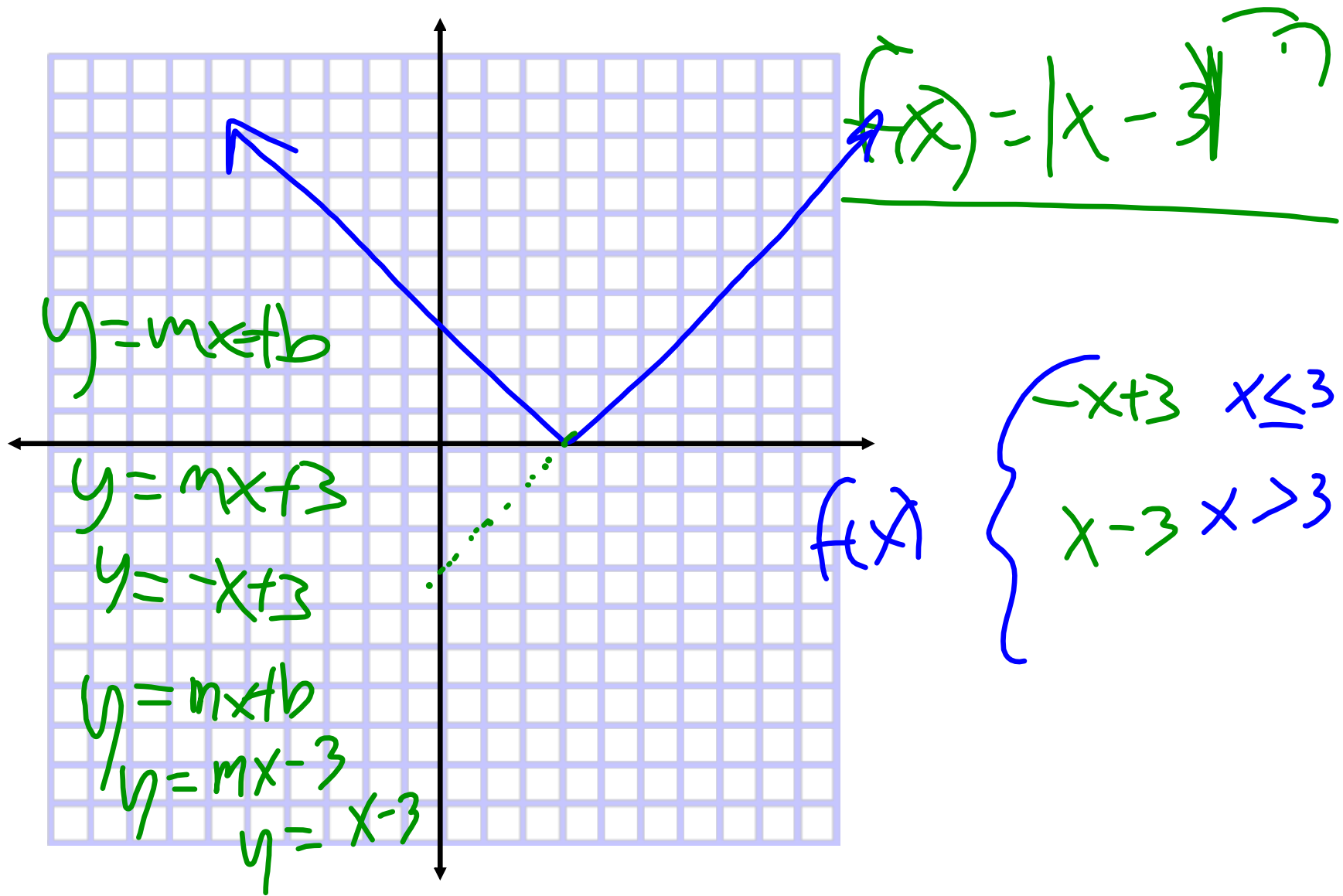
Each line has two parts: The operation for an interval & the interval
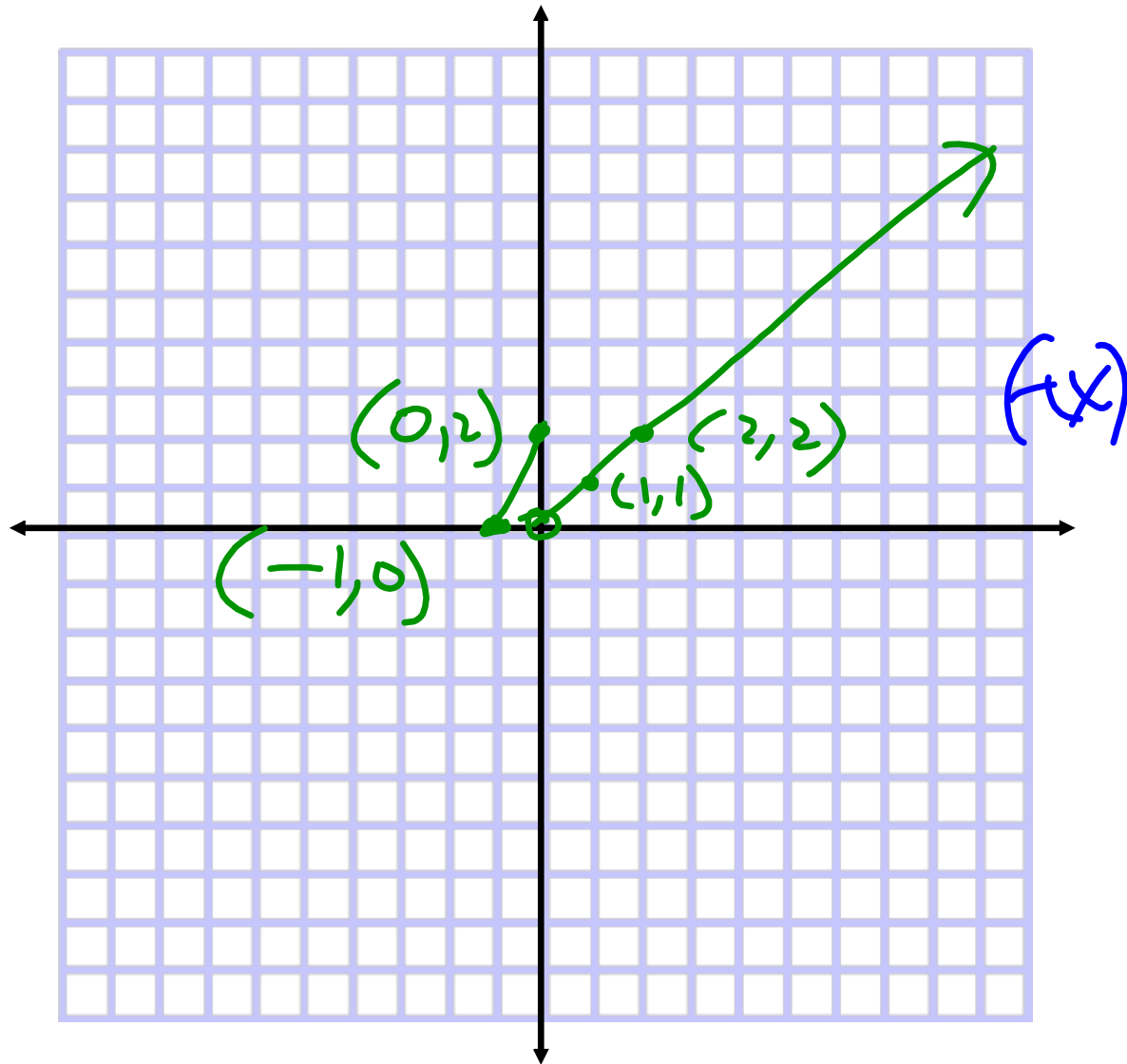
Usual rules for endpoints apply $\le, \ge, >, <$

Think of a story of critical values:

$$f(x) = \begin{cases} x^2 & x < 0 \\ 2 & x = 0 \\ 2x+1 & x > 0 \end{cases}$$

$f(x) = |x - 3|$

$y = mx + b$

$y = mx + 3$

$y = -x + 3$

$y = mx + b$

$y = mx - 3$

$y = x - 3$

$f(x) \begin{cases} -x + 3 & x \leq 3 \\ x - 3 & x > 3 \end{cases}$

$(0,2)$

$(-1,0)$

$(1,1)$ $(2,2)$

$f(x) \begin{cases} 2x+2 & -1 \le x \le 0 \\ |x| \propto^x \end{cases}$

Pick an interval
Pick a function

Linear   f(x)=2x-3

Constant   f(x)=5

Identity   f(x)=x

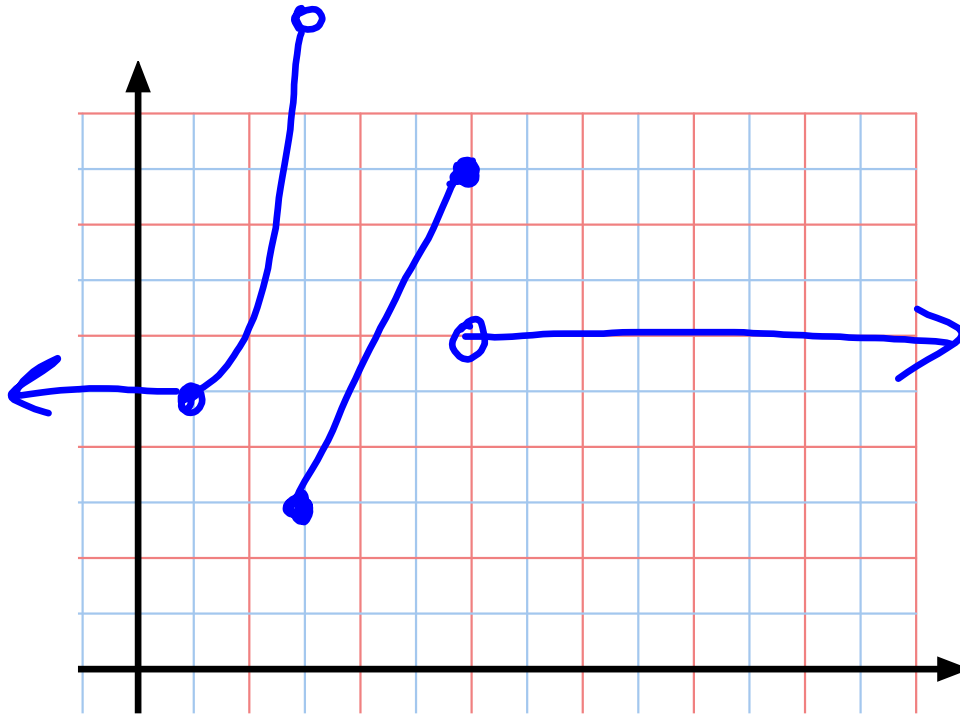Square   f(x)=x²+4

Cube   f(x)=x³-5

Square Root $f(x) = \sqrt{2x - 3}$

Reciprocal   f(x)=1/x

Absolute Value   f(x)=|x|

Greatest integer   f(x)=int(x)

$$f(x) \begin{cases} 5 & x < 1 \\ x^2+4 & 1 \le x < 3 \\ 2x-3 & 3 \le x \le 6 \; \checkmark \\ x & x > 6 \end{cases}$$

Using a piecewise function:

Evaluating f(c)
    Use both parts: Restriction tells you which line to use, then use that line.

Graphing by hand
    Use both parts: Use restriction to identify critical values, connect the dots

Graphing by calculator
    Use both parts: Put both on each Y line, multiplying them

$$f(x) = \begin{cases} 2x+2 & -3 \le x < 0 \\ -3 & x = 0 \\ \sqrt{x} - 3 & x > 0 \end{cases}$$

$$Y1 = ((-3 \le x) and (x < 0)) * (2x + 2)$$

$$Y2 = (x = 0) * (-3)$$

$$Y3 = (0 < x) * (\sqrt{x} - 3)$$

Attachments

library8.ggb

library9.ggb