Graph Analysis

Note Title 8/11/2009

Objective: To analyze the parent functions

$f(x) = x$ $f(x) = x^2$ $f(x) = x^3$ $f(x) = |x|$

$f(x) = [x]$ $f(x) = \frac{1}{x}$ $f(x) = \sqrt{x}$ $f(x) = \sqrt[3]{x}$

for domain, range, roots, increasing, decreasing, continuity and end behavior.

Analysis

Domain: what x can be? INPUT

Range: y-values, OUTPUT, how high/low can you go?

Roots: occur when f(x) crosses or touches the x axis.
(double roots)

Inc/Dec: x-values, interval notation

strictly inc or dec : montonic

End Behavior: how a graph will continue to behave

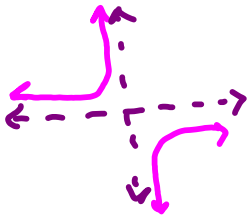
$x \to \infty$
$y \to$

$x \to -\infty$
$y \to$

Continuity

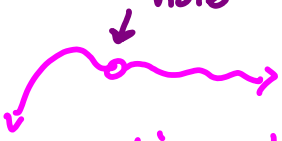
Continuous

trace, never lift pencil



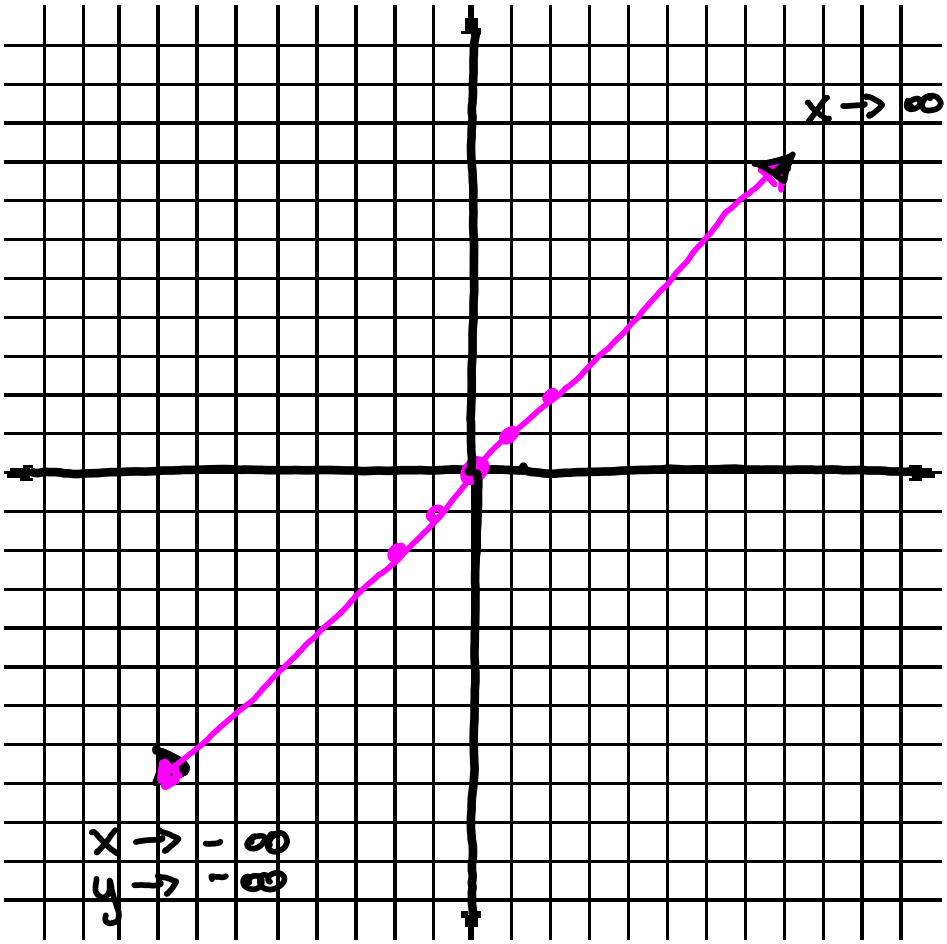
Discontinuous

point discontinuity
hole



jump discontinuity

infinite discontinuity
asymptotes



$f(x) = x^1$

Identity $f(x)$

x	y
-2	-2
-1	-1
0	0
1	1
2	2

D: $(-\infty, \infty)$
are real numbers

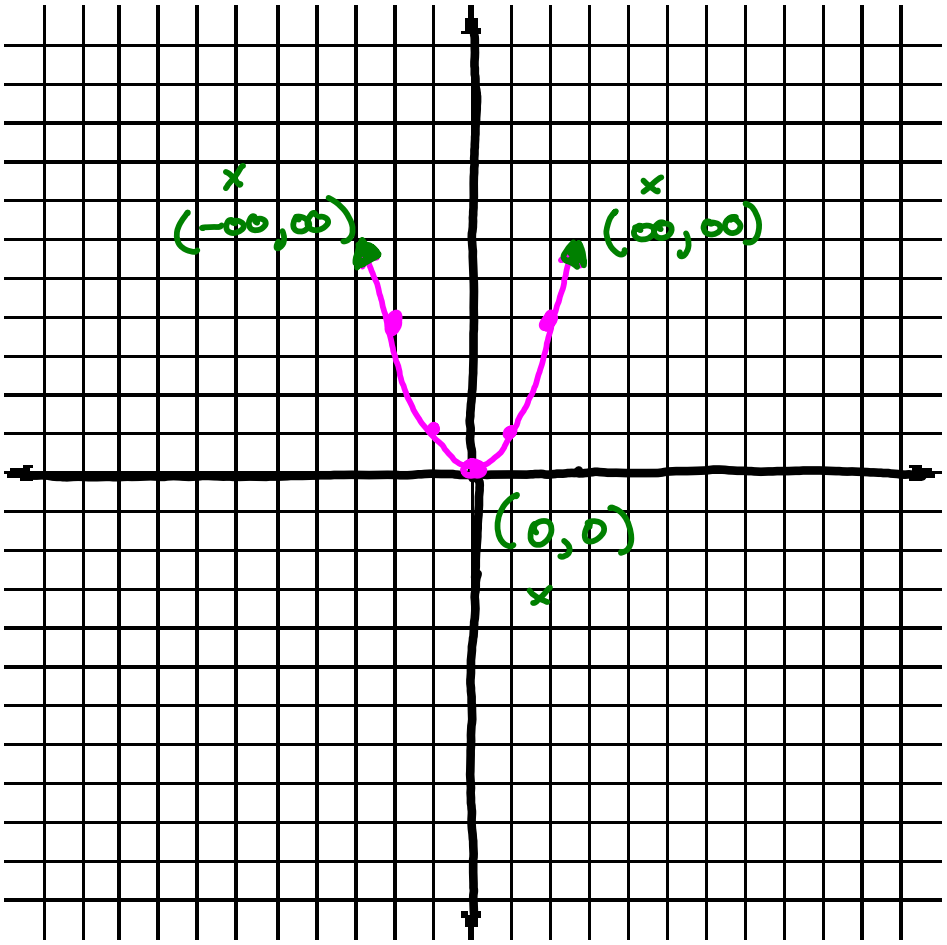
R: $(-\infty, \infty)$
are real numbers

Roots: $x = 0$ or $(0,0)$

Increasing $(-\infty, \infty)$

EB: $x \to -\infty$ $x \to \infty$
$y \to -\infty$ $y \to \infty$

Continuous



$f(x) = x^2$

name: quadratic

x	y
-2	4
-1	1
0	0
1	1
2	4

D: $(-\infty, \infty)$

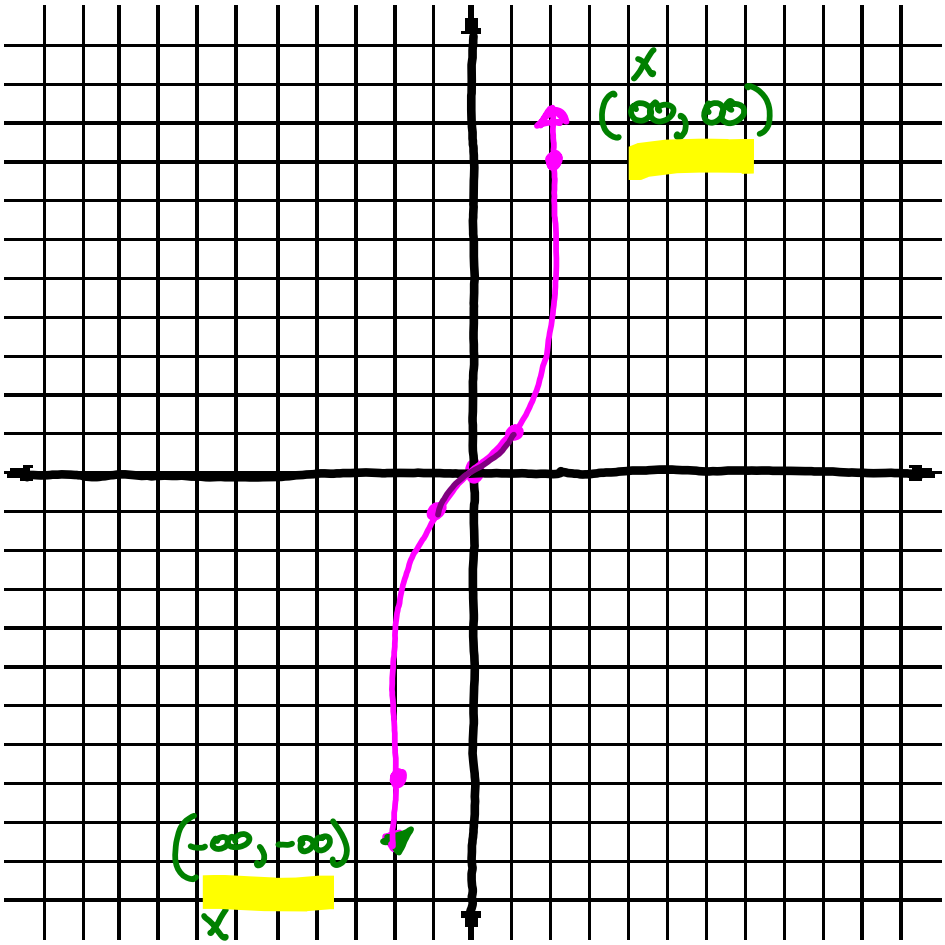
R: $[0, \infty)$

roots: $x = 0$
double root

Inc: $(0, \infty)$
Dec: $(-\infty, 0)$
x values

EB: $x \to -\infty$ $x \to \infty$
$y \to \infty$ $y \to \infty$

continuity:
continuous



$f(x) = x^3$

cubic f(x)

D: $(-\infty, \infty)$

R: $(-\infty, \infty)$

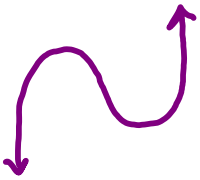
x	y
-2	-8
-1	-1
0	0
1	1
2	8

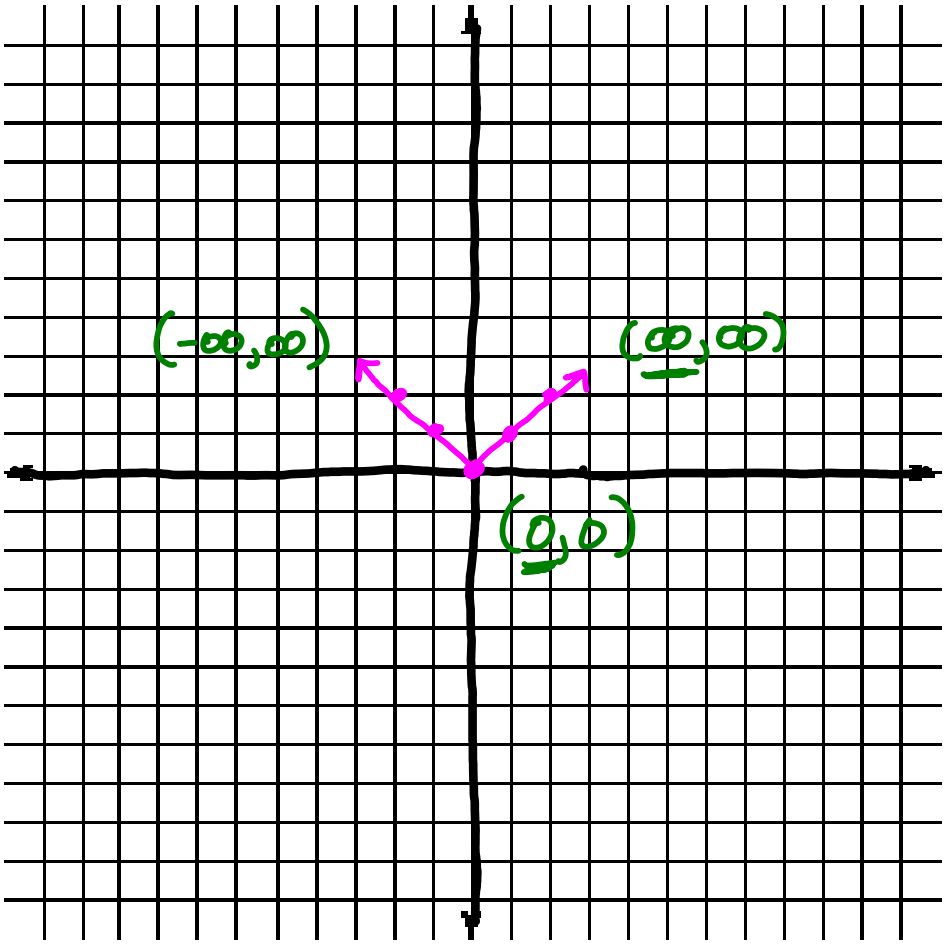
Roots: triple root
$x = 0$

Inc/Dec: monotonic increasing $(-\infty, \infty)$

EB: $x \to -\infty$ $x \to \infty$
$y \to -\infty$ $y \to \infty$

Cont: continuous





$f(x) = |x|$

absolute value f(x)

x	y
-2	2
-1	1
0	0
1	1
2	2

D: $(-\infty, \infty)$

R: $[0, \infty)$

roots: $x = 0$

Inc/Dec: dec $(-\infty, 0)$
inc $(0, \infty)$

EB: $x \to -\infty$ $x \to \infty$
$y \to \infty$ $y \to \infty$

cont: continuous

$y = [x]$ the greatest integer function ($f(x)$) no greater than x

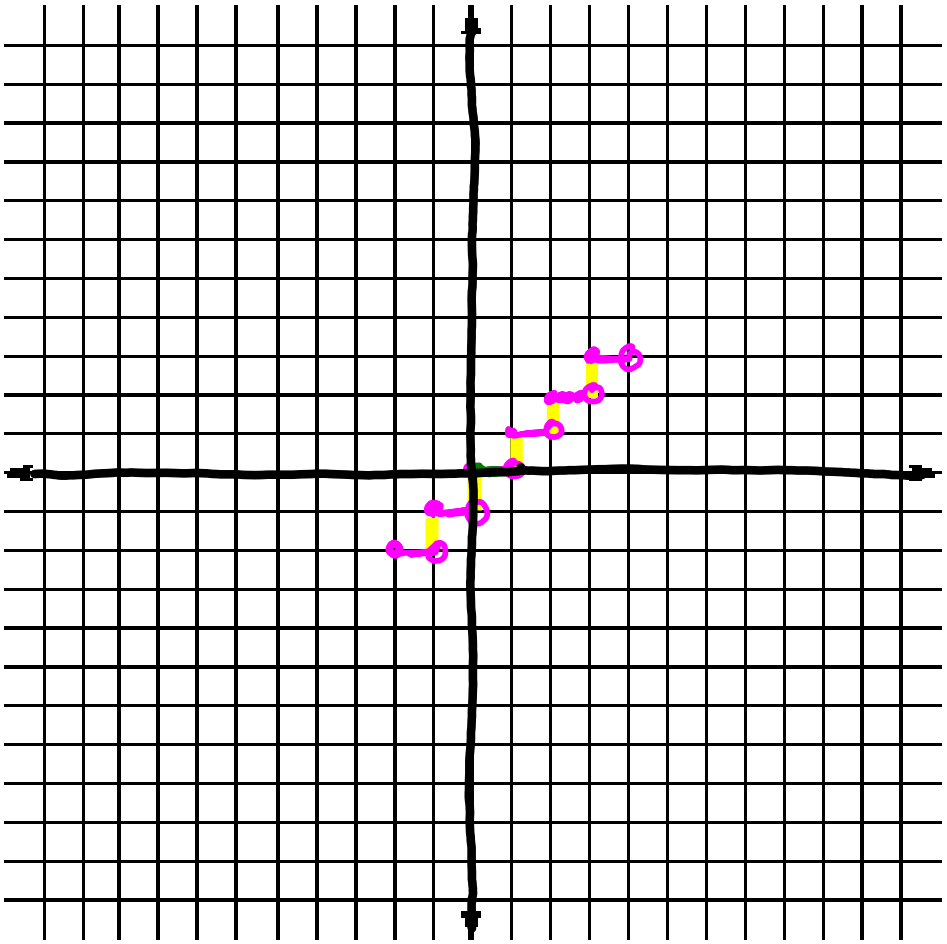
integer : ? positive or neg. whole numbers

x	y
-2	-2
-1	-1
0	0
1	1
2	2
2.1	2
2.5	2

x	y
2.9	2
-2.1	-3
-2.3	-3
-2.7	-3

2 2.1 3

-3 -2.1 -2



$f(x) = [x]$

greatest integer f(x)

D: $(-\infty, \infty)$

R: $\mathbb{Z}$ (integers)

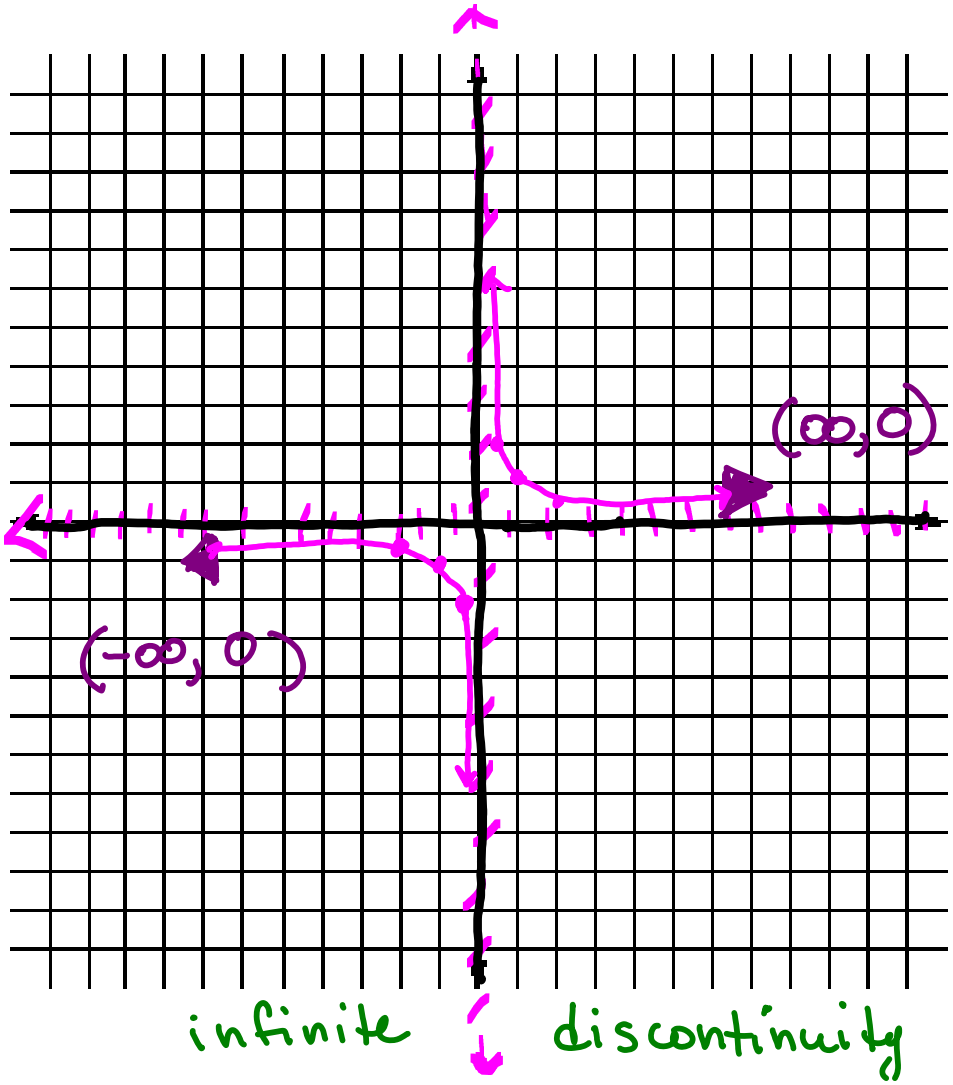
roots: $x = [0, 1)$

Inc/Dec:

inc $(-\infty, \infty)$

EB: $x \to -\infty$ $x \to \infty$
$y \to -\infty$ $y \to \infty$

cont: jump discontinuity



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

reciprocal function

x	y
-2	$-\frac{1}{2}$
-1	-1
$-\frac{1}{2}$	-2
$\frac{0}{1}$	$\frac{1}{0}$ undefined
1	1
2	$\frac{1}{2}$
$\frac{1}{2}$	2

D: $(-\infty, 0) \cup (0, \infty)$

R: $(-\infty, 0) \cup (0, \infty)$

no real roots

Dec $(-\infty, 0) \cup (0, \infty)$

EB: $x \to -\infty$ $x \to \infty$
$y \to 0$ $y \to 0$