

Parent Functions

Domain

Range

Continuous

Increasing

Decreasing

Constant

Left End

Right End

Symmetry

x-intercepts

y-intercepts

VA

HA

Bounded

Extrema

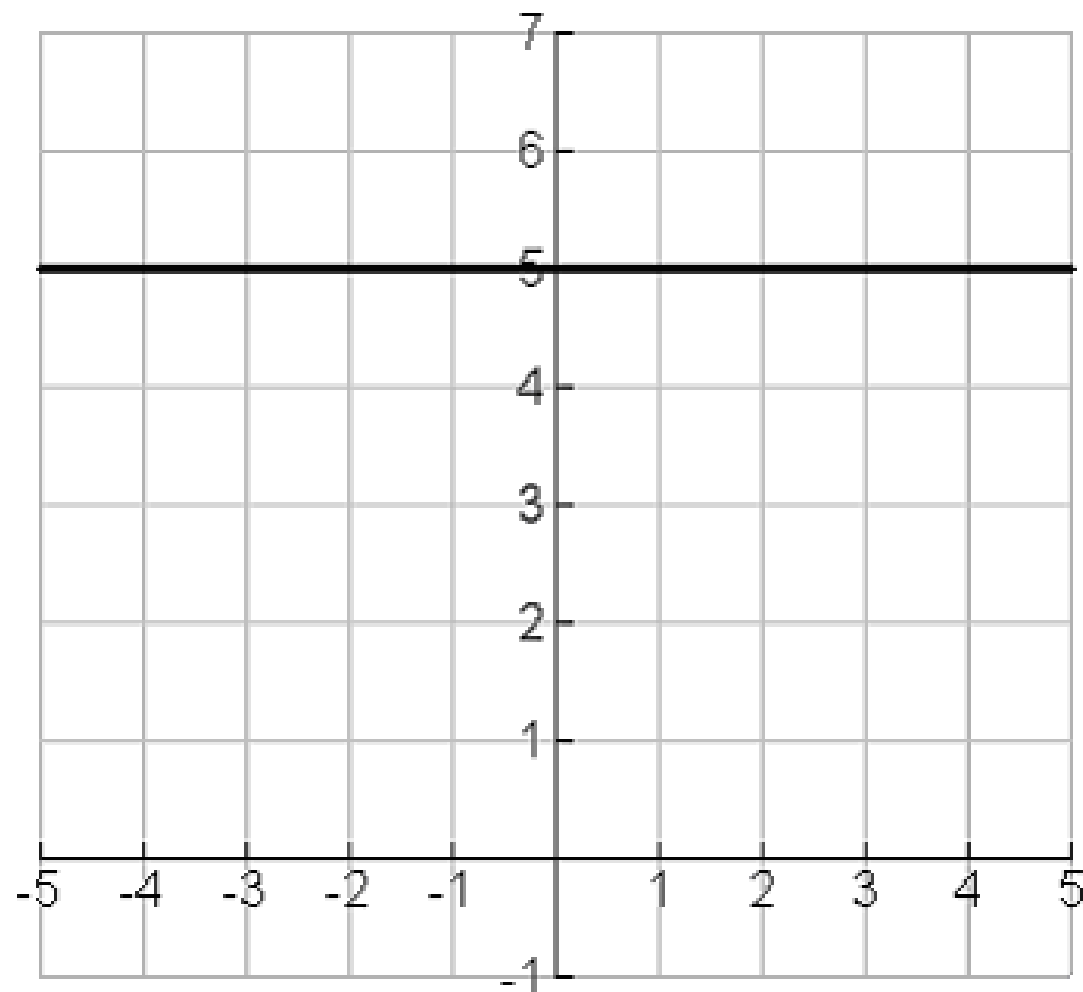
Constant

$$y = k$$
$$f(x) = k$$

where k is R

* a horizontal line

$$f(x) = 5$$



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Bounded

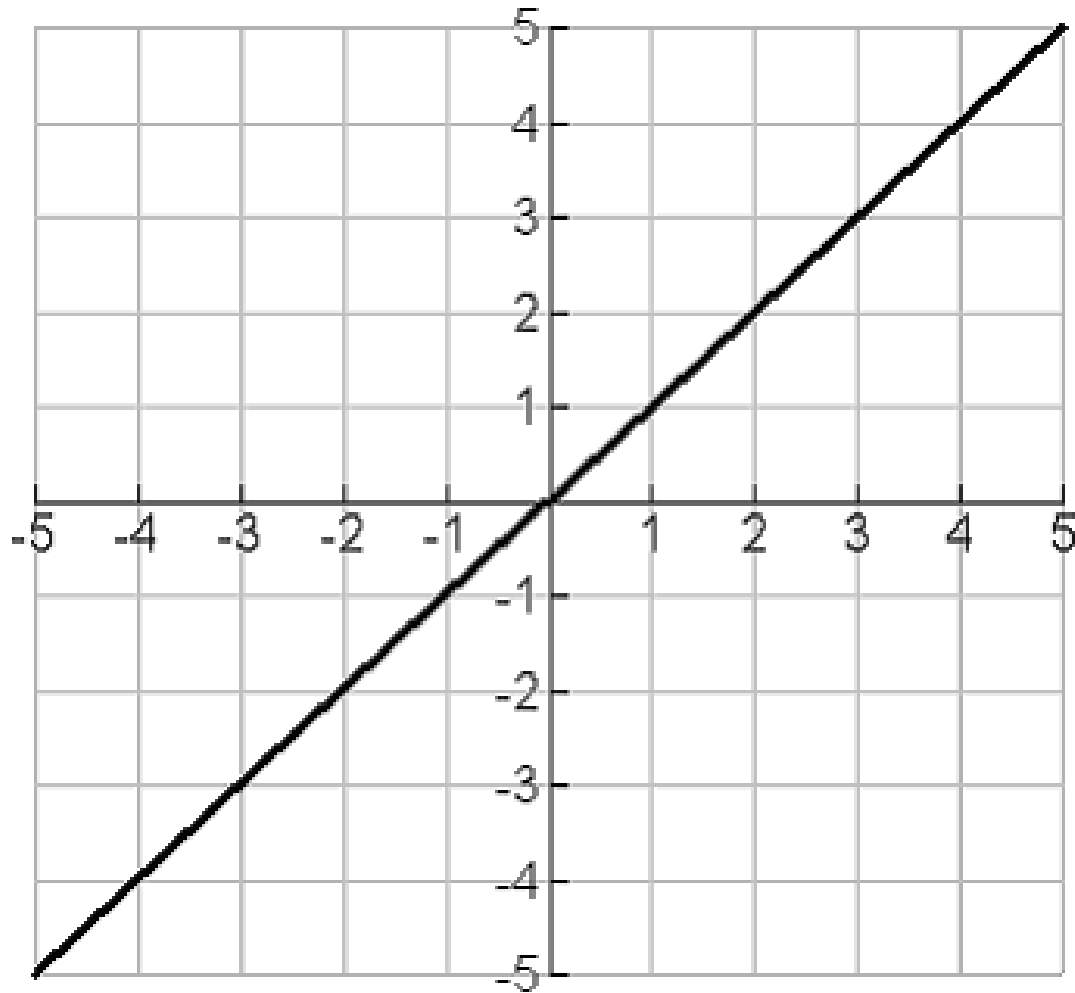
Extrema

Identity (Linear)

$$f(x) = x$$

or

$$y = x$$

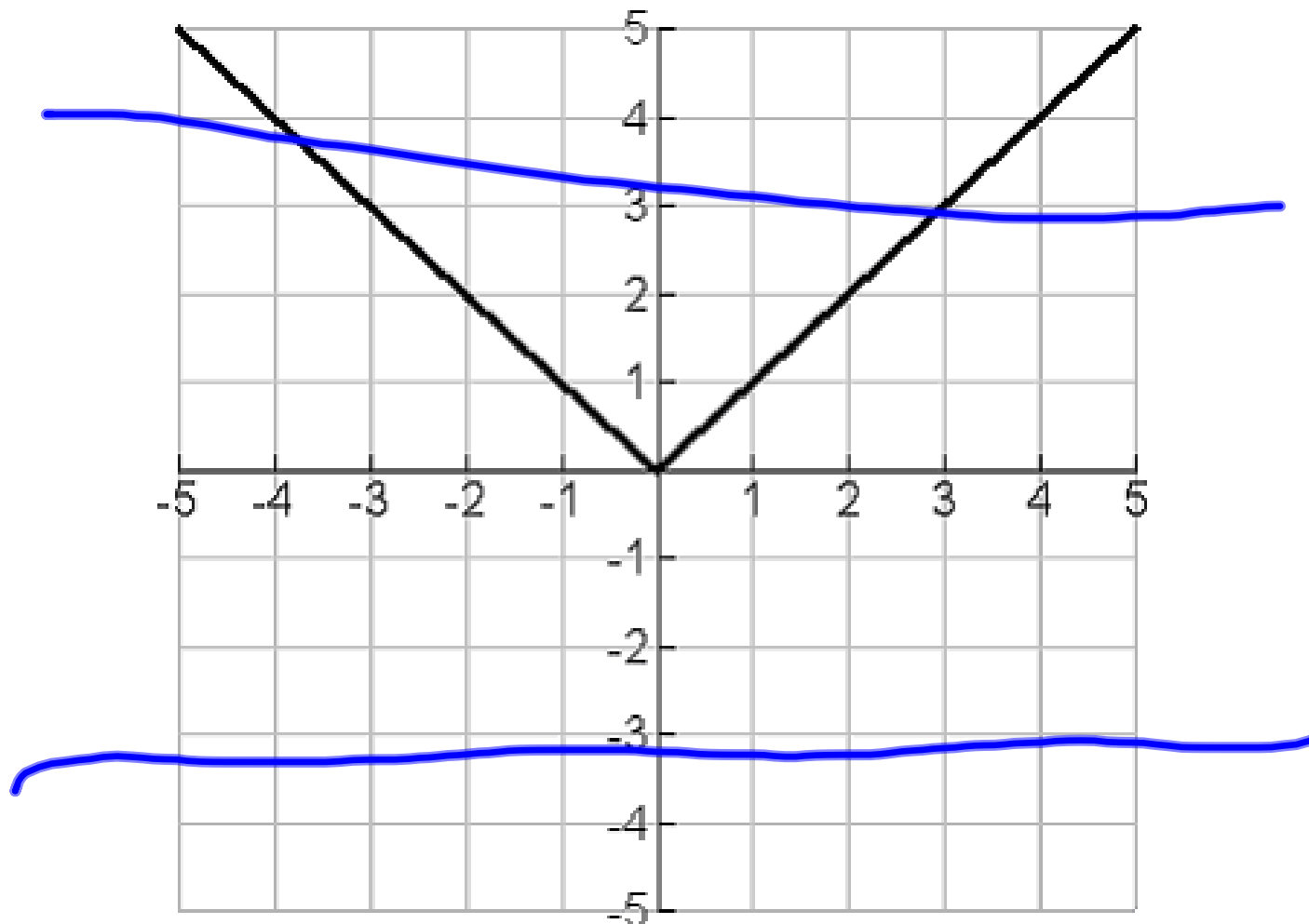


Domain $(-\infty, \infty)$
 Range $(-\infty, \infty)$
 Continuous *yes*
 Increasing $(-\infty, \infty)$
 Decreasing —
 Constant —
 Left End *to $-\infty$*
 Right End *∞*
 Symmetry *odd*
 x-intercepts $(0, 0)$
 y-intercepts $(0, 0)$
 VA —
 HA —
 Bounded —
 Extrema —

Absolute Value

$$f(x) = |x|$$

.



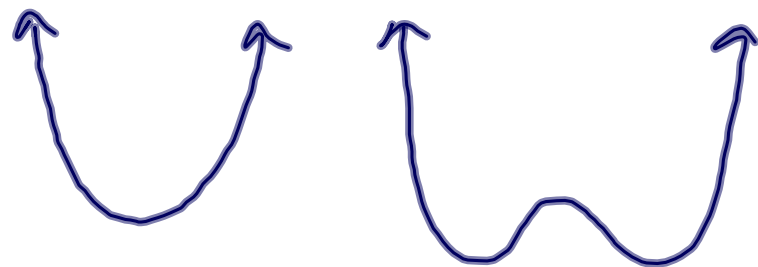
Domain $(-\infty, \infty)$
 Range $[0, \infty)$
 Continuous yes
 Increasing $[0, \infty)$
 Decreasing $(-\infty, 0]$
 Constant
 Left End to ∞
 Right End to ∞
 Symmetry even
 x-intercepts $(0, 0)$
 y-intercepts $(0, 0)$
 VA
 HA
 Bounded below
 Extrema

Power Functions

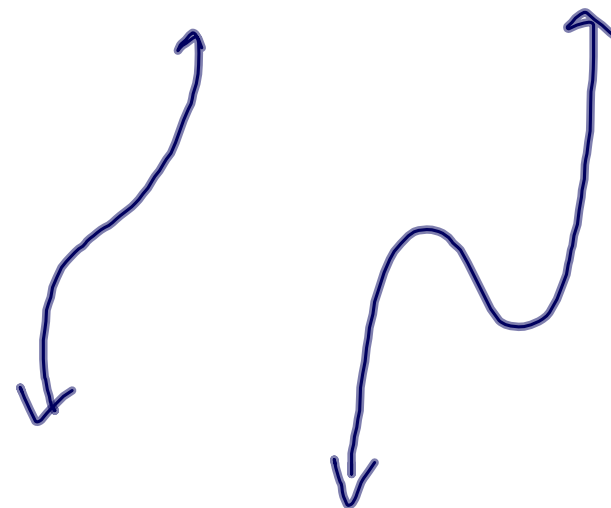
2 example parents: $f(x) = x^2$ quadratic
 $f(x) = x^3$ cubic

other examples:

$$y = x^4$$
$$y = x^6$$
$$y = x^8$$



$$y = x^5$$
$$y = x^7$$
$$y = x^9$$

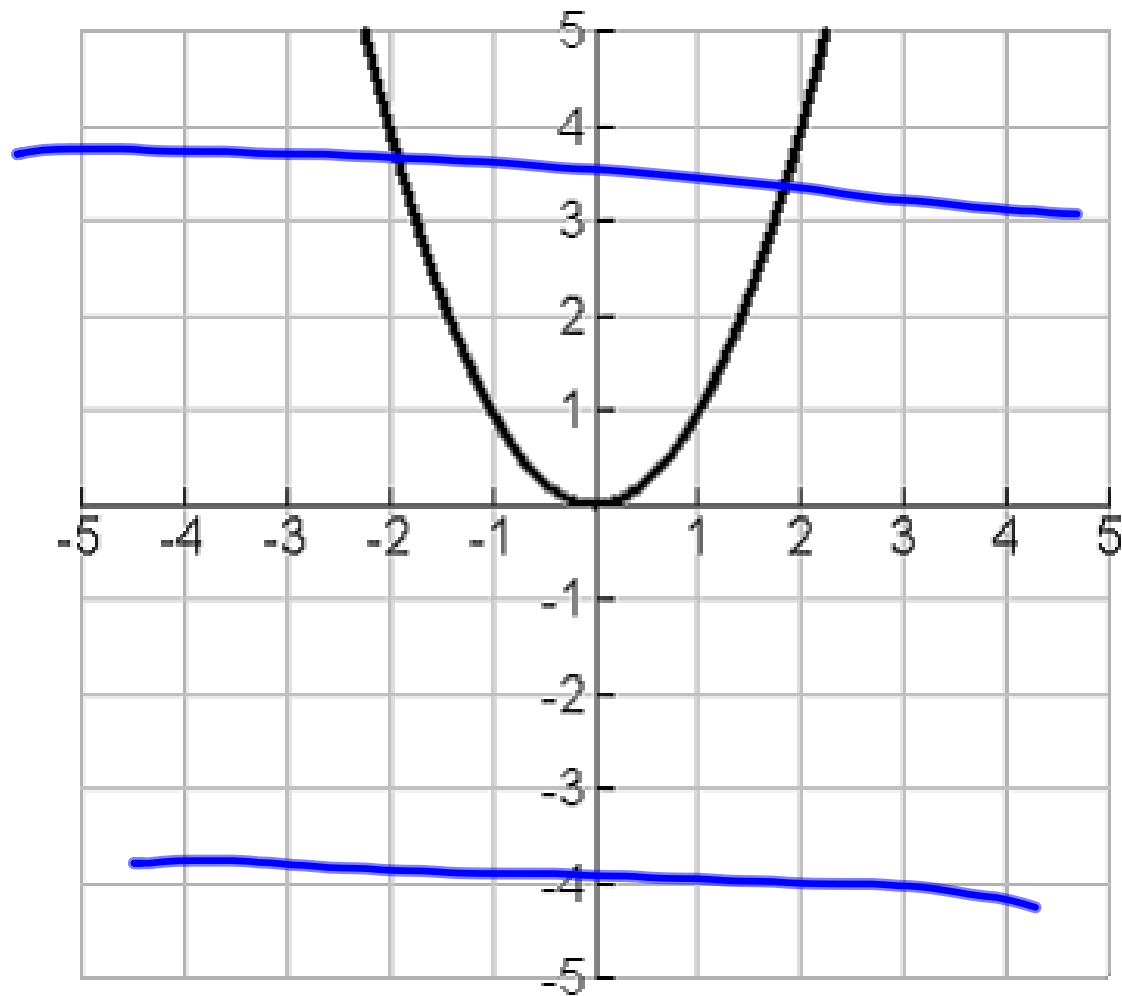


Even Powered Parent

Quadratic

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

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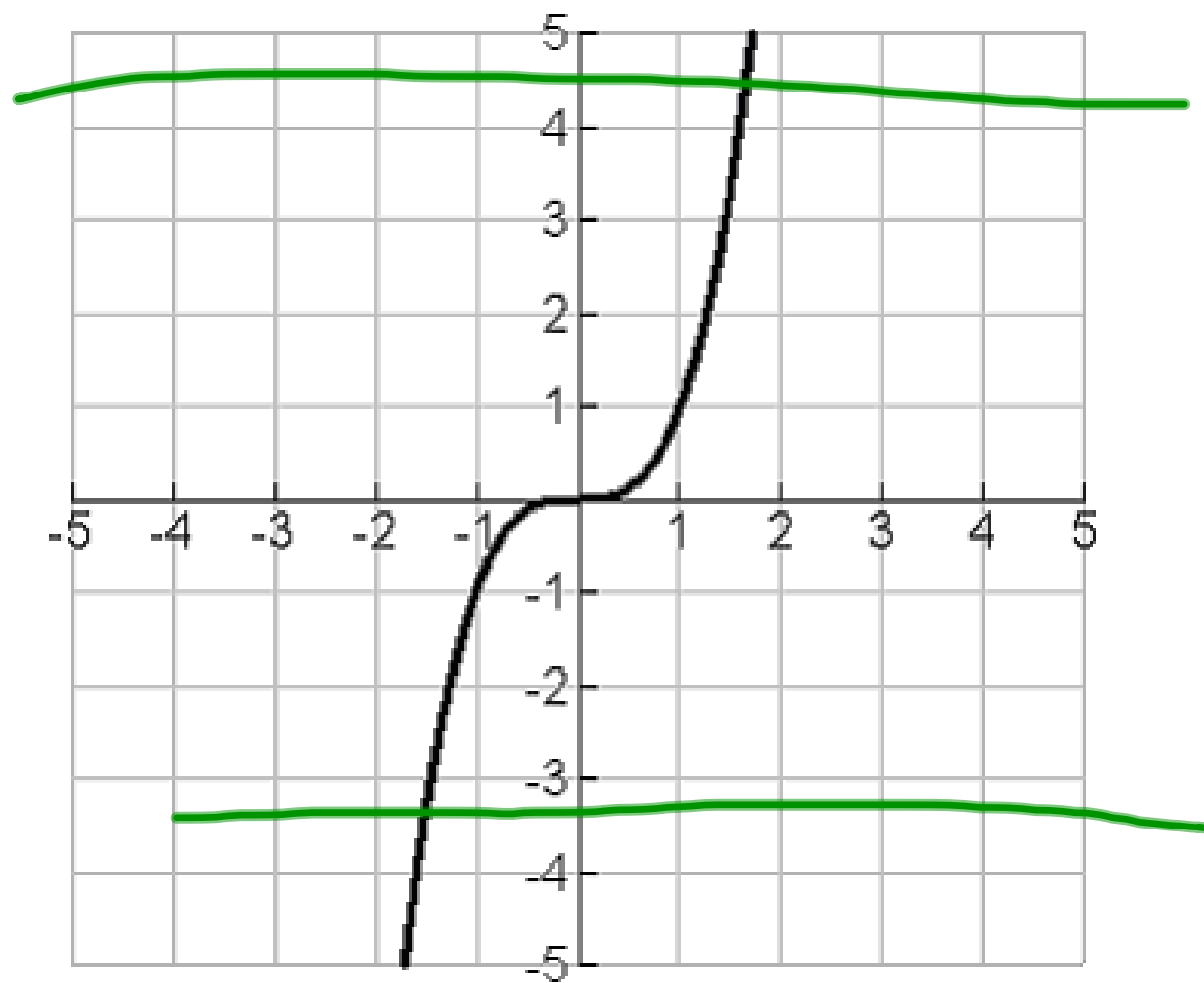


Domain $(-\infty, \infty)$
 Range $[0, \infty)$
 Continuous yes
 Increasing $[0, \infty)$
 Decreasing $(-\infty, 0)$
 Constant
 Left End ∞
 Right End ∞
 Symmetry even
 x-intercepts $(0, 0)$
 y-intercepts $(0, 0)$
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 HA
 Bounded Below

Odd Powered Parent

Cubic

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



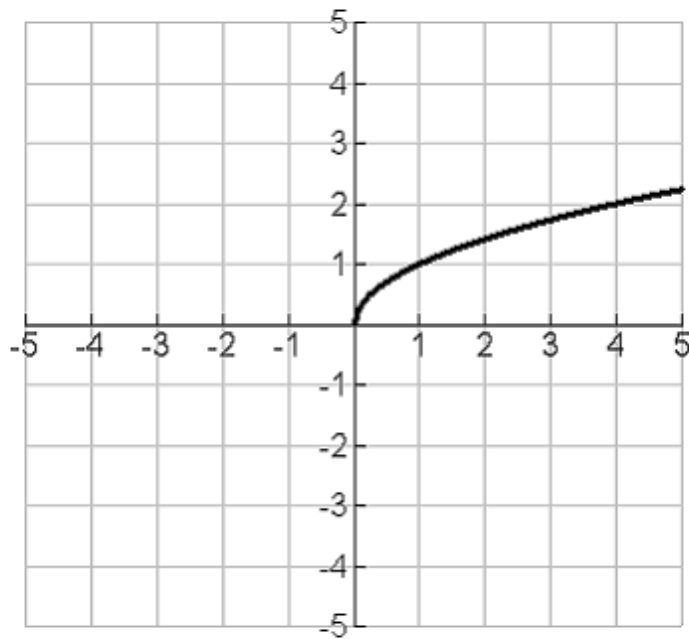
Domain $(-\infty, \infty)$
 Range $(-\infty, \infty)$
 Continuous yes
 Increasing $(-\infty, \infty)$
 Decreasing —
 Constant —
 Left End $-\infty$
 Right End ∞
 Symmetry odd.
 x-intercepts $(0, 0)$
 y-intercepts $(0, 0)$
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 Bounded —
 Extrema —

Radical Functions

Even Index

$$f(x) = \sqrt[4]{x}$$

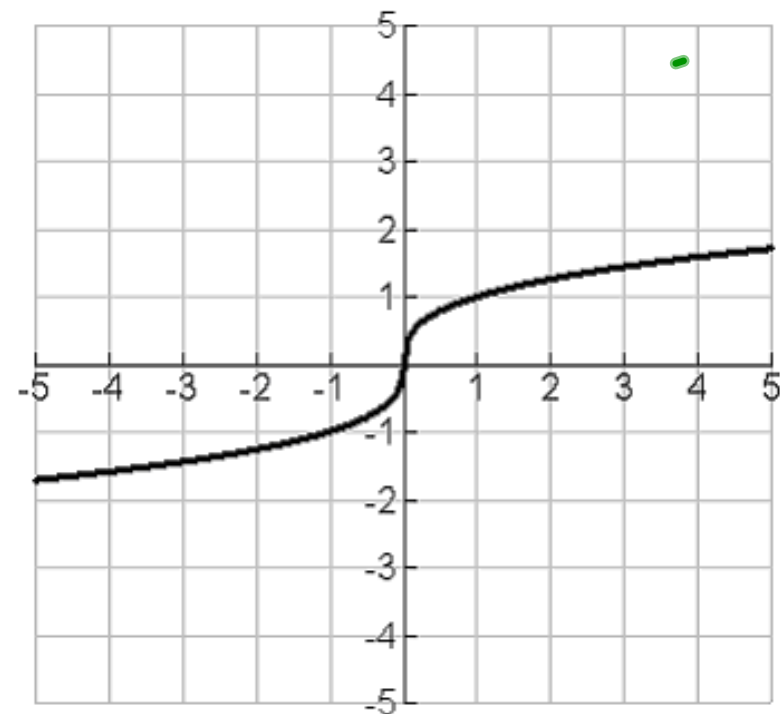
$$f(x) = \sqrt[6]{x}$$



Odd Index

$$f(x) = \sqrt[5]{x}$$

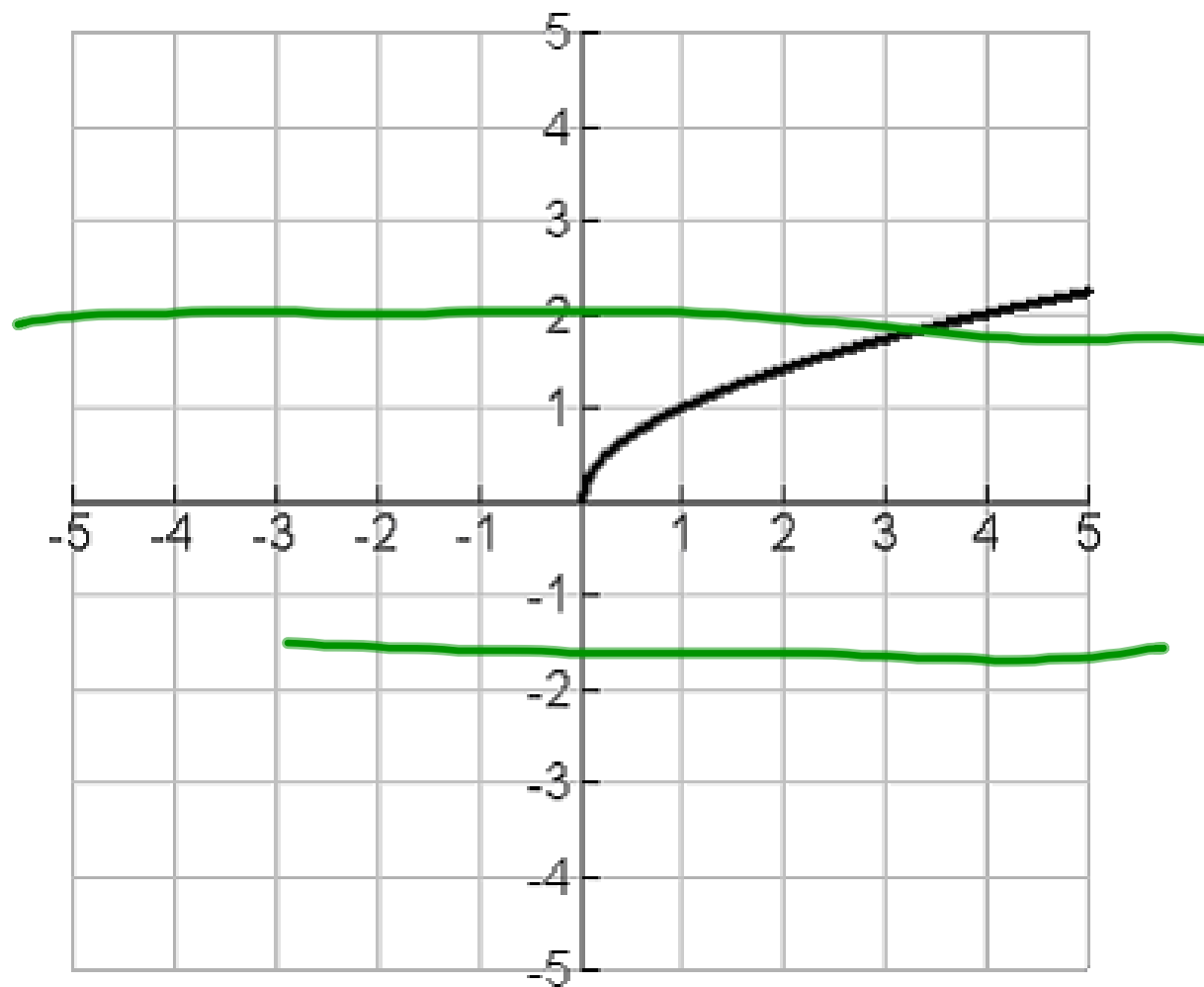
$$f(x) = \sqrt[7]{x}$$



Square Root

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

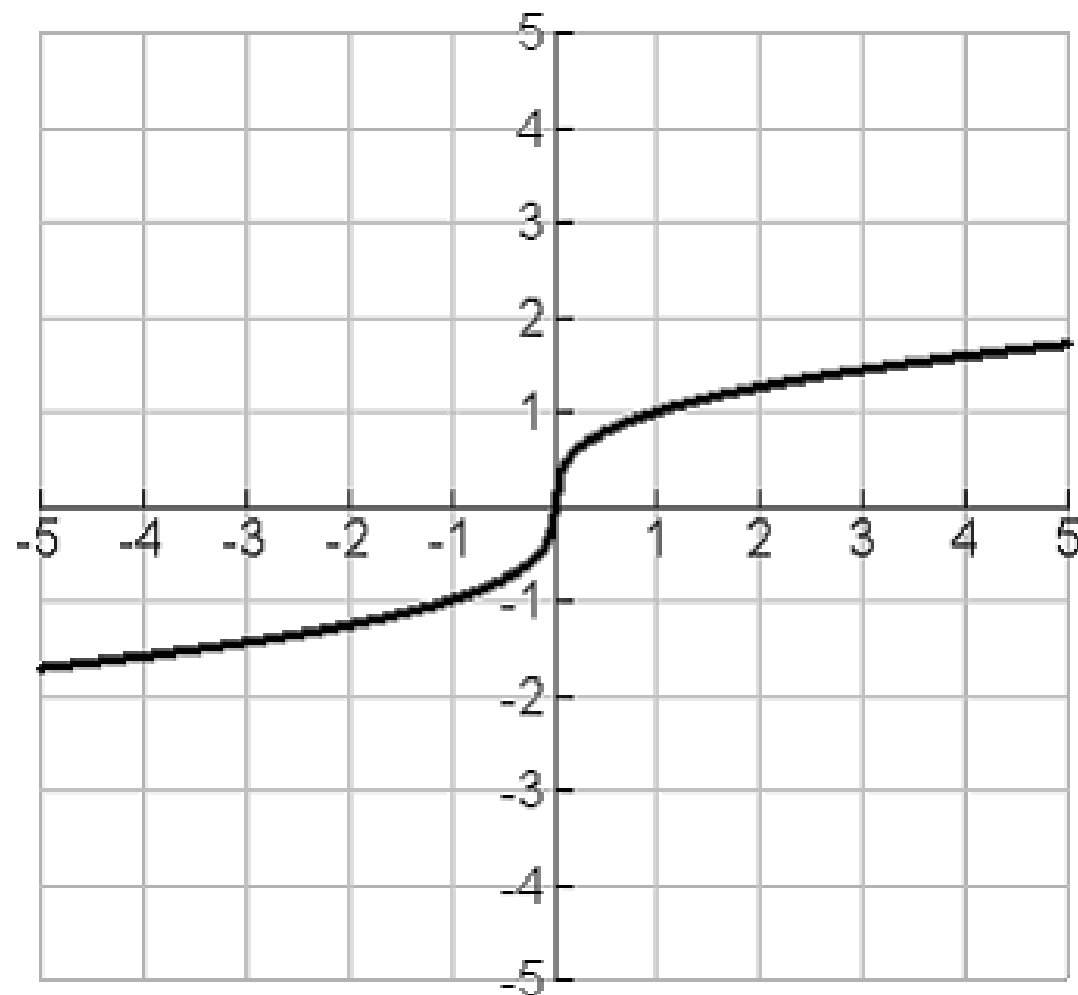
.



Domain $[0, \infty)$
 Range $[0, \infty)$
 Continuous yes
 Increasing $[0, \infty)$
 Decreasing
 Constant
 Left End ends @ 0
 Right End ∞
 Symmetry
 x-intercepts $(0, 0)$
 y-intercepts $(0, 0)$
 VA
 HA
 Bounded Below
 Extrema $(0, 0)$ min

Cube Root

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



Domain

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Constant

Left End

Right End

Symmetry

x-intercepts

y-intercepts

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Extrema

Rational Functions

the ratio of 2 polynomial functions

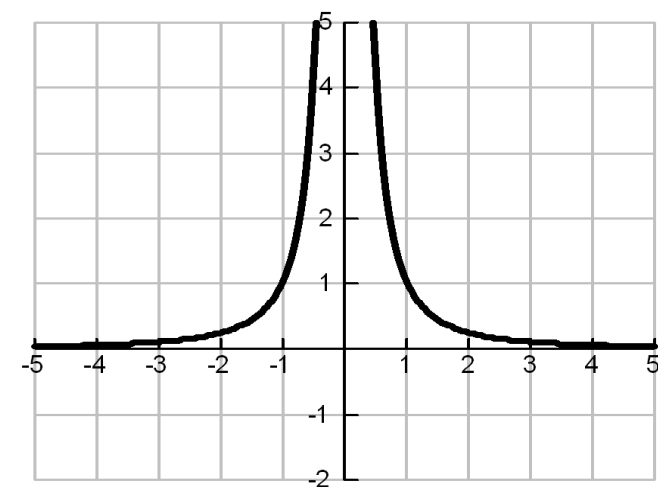
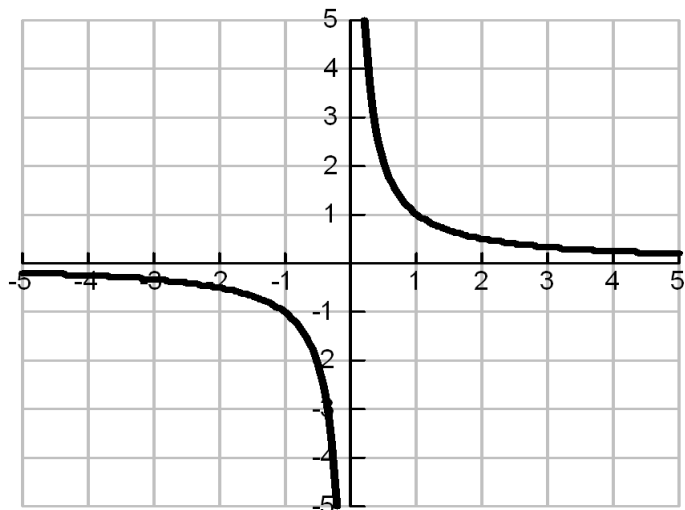
$$y = \frac{1}{x} \quad y = \frac{1}{x^2} \quad x \neq 0$$

$$y = \frac{1}{x^3}$$

$$y = \frac{1}{x^5}$$

$$y = \frac{1}{x^4}$$

$$y = \frac{1}{x^6}$$

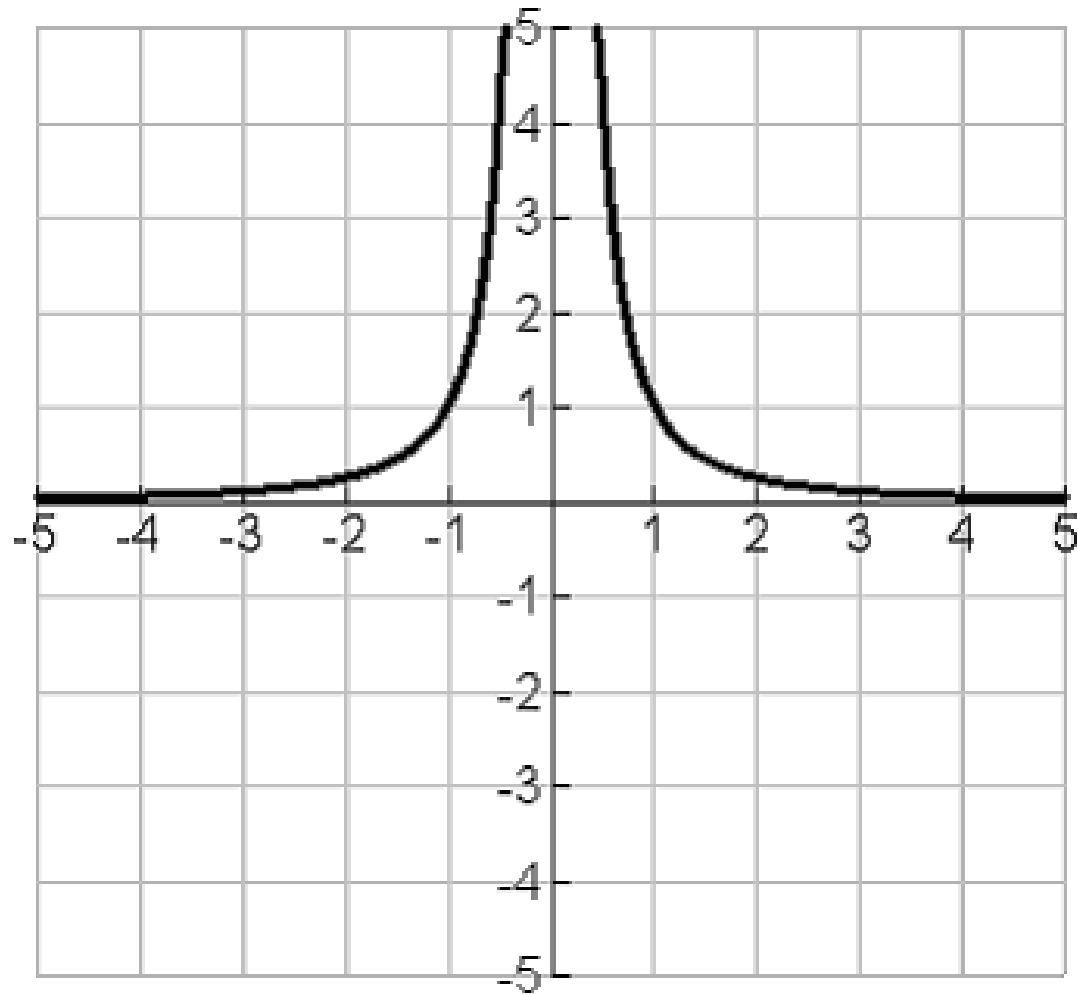


Odd Power in Den.

$$f(x) = \frac{1}{x} \quad x \neq 0$$

Even Power in Den.

$$f(x) = \frac{1}{x^2} \quad x \neq 0$$



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x-intercepts

y-intercepts

VA

HA

Bounded

Extrema

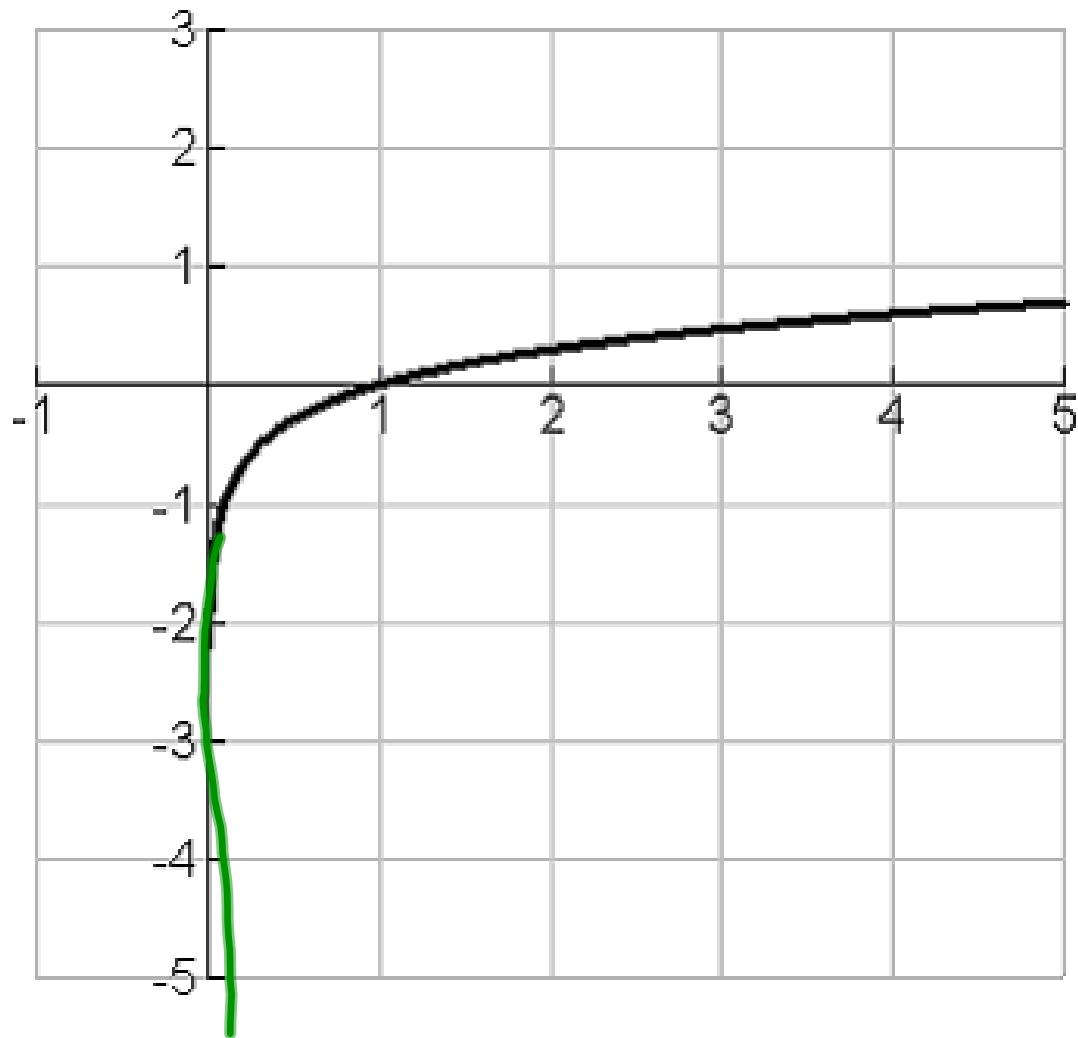
Exponential

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

.

Logarithmic

$$f(x) = \ln x$$



Domain

$(0, \infty)$

Range

$(-\infty, \infty)$

Continuous

Yes

Increasing

$(-\infty, \infty)$

Decreasing

—

Constant

—

Left End

$-\infty$

Right End

∞

Symmetry

—

x-intercepts

$(1, 0)$

y-intercepts

—

VA

~~$x = 0$~~

HA

—

Bounded

—

Extrema

—

Step-Functions

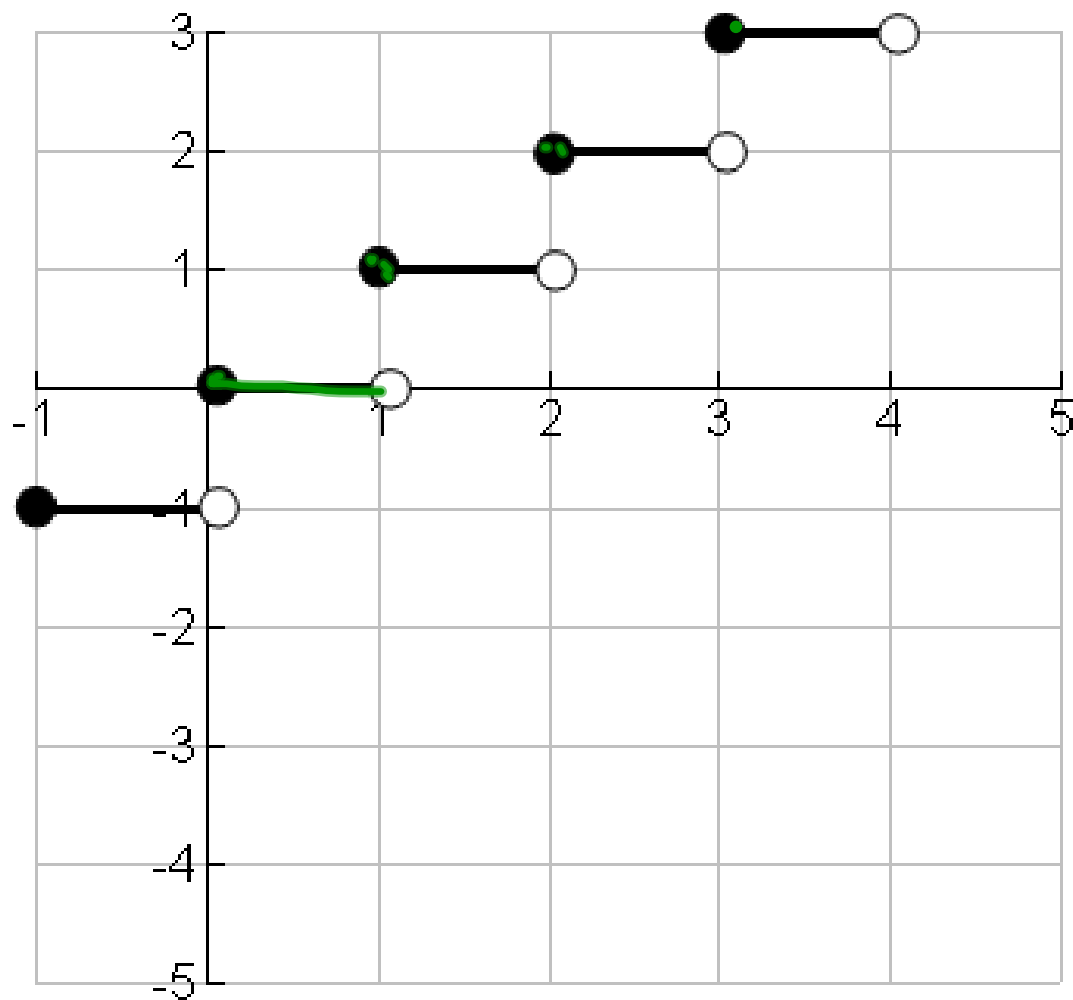
Greatest Integer - one of several step functions

(converts a real number x into the largest integer that is less than or equal to x)

$$f(x) = \lfloor x \rfloor$$

$$f(x) = \text{int}(x)$$

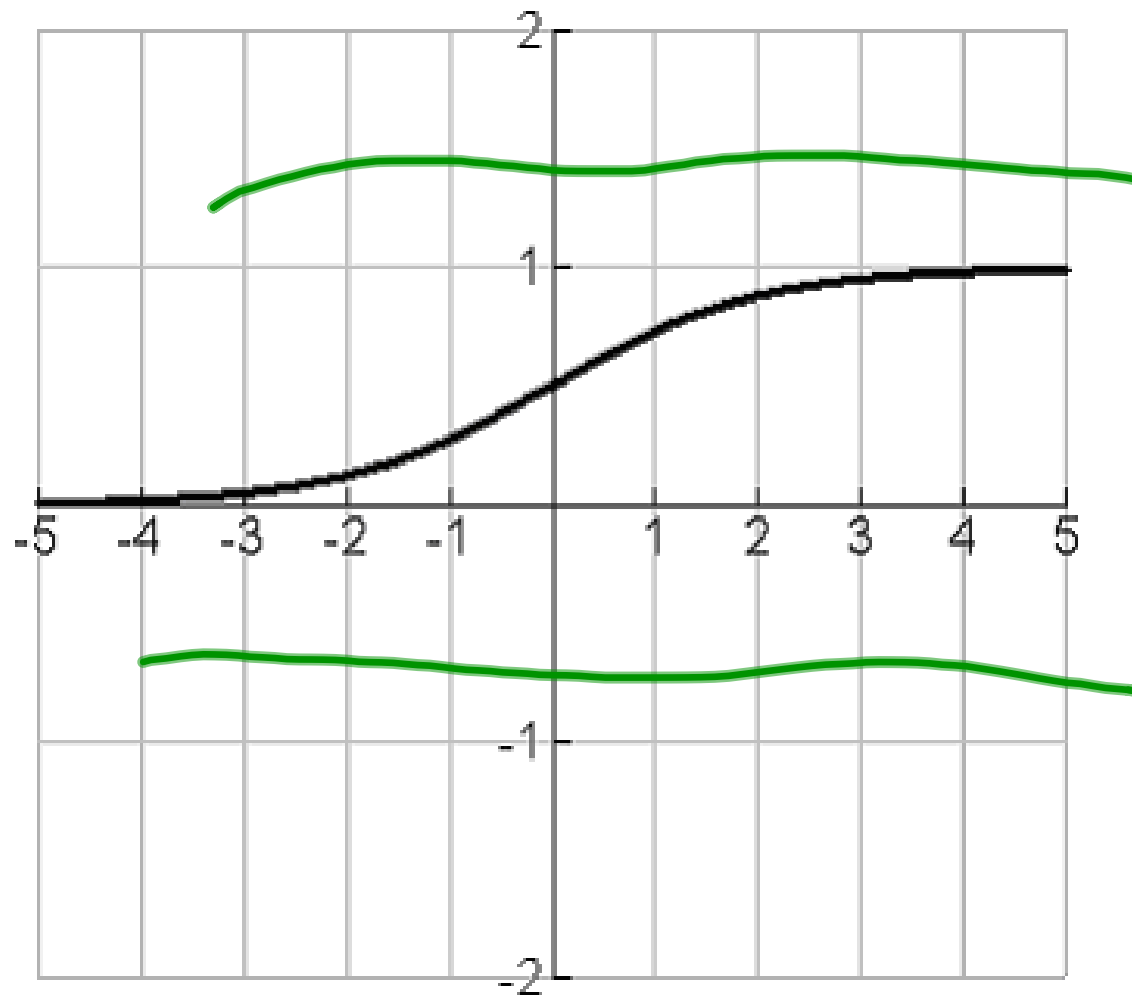
$$f\left(\frac{1}{2}\right) = 0$$



- Domain $(-\infty, \infty)$
- Range Integers
- Continuous No
- Increasing on the steps
- Decreasing
- Constant between jumps
- Left End $-\infty$
- Right End ∞
- Symmetry odd.
- x-intercepts $([0, 2), 0)$
- y-intercepts
- VA \sim
- HA \sim
- Bounded \sim
- Extrema \sim

Logistic

$$f(x) = \frac{1}{1 + e^{-x}}$$

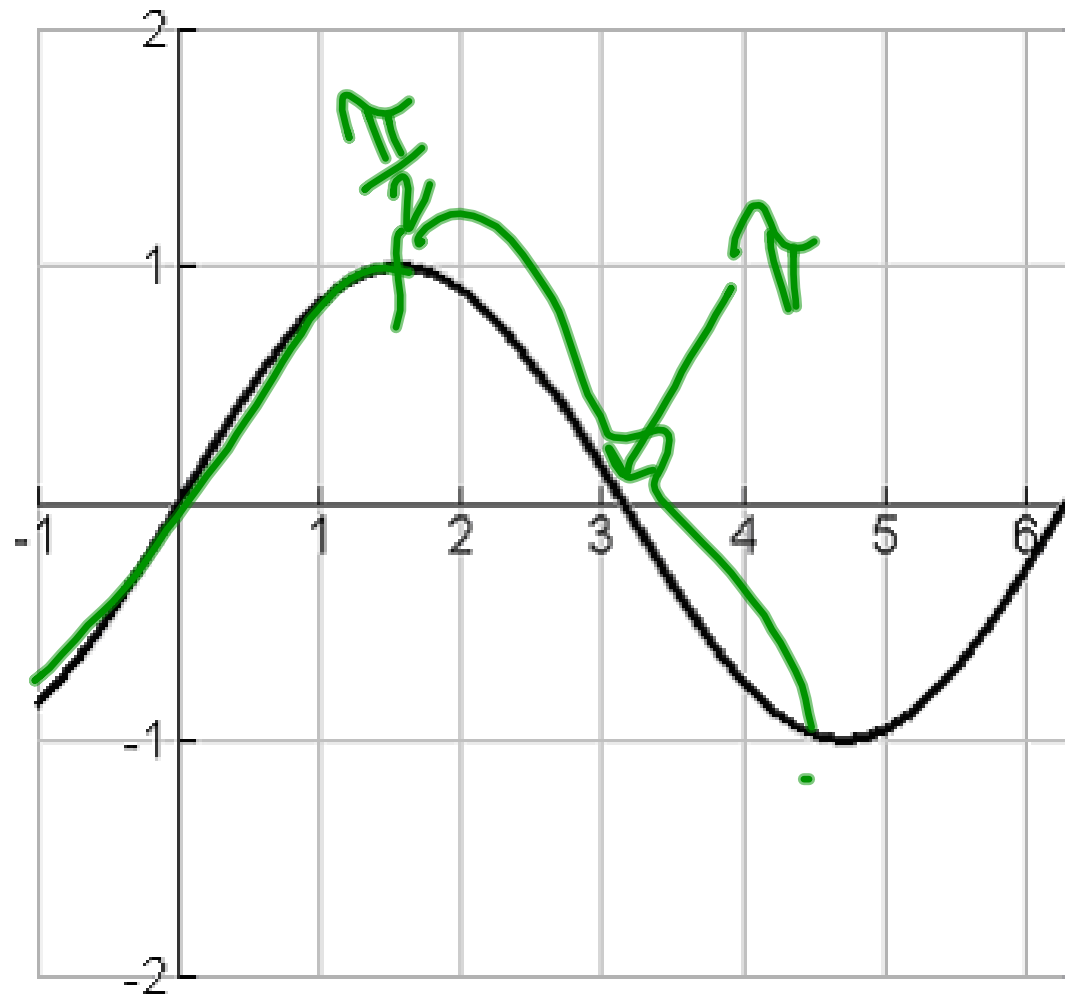


- Domain $(-\infty, \infty)$
- Range $(-1, 1)$
- Continuous $y \in \mathbb{R}$
- Increasing $(-\infty, \infty)$
- Decreasing —
- Constant —
- Left End 0
- Right End 1
- Symmetry —
- x-intercepts —
- y-intercepts $(0, 1/2)$
- VA —
- HA $y = 0, y = 2$
- Bounded below, above
- Extrema

Sine

$$f(x) = \sin x$$

.



Domain $(-\infty, \infty)$

Range $[-1, 1]$

Continuous *yes*

Increasing

Decreasing

Constant

Left End

Right End

Symmetry *odd*

x-intercepts $(0, 0)$

y-intercepts $(0, 0)$

VA

HA

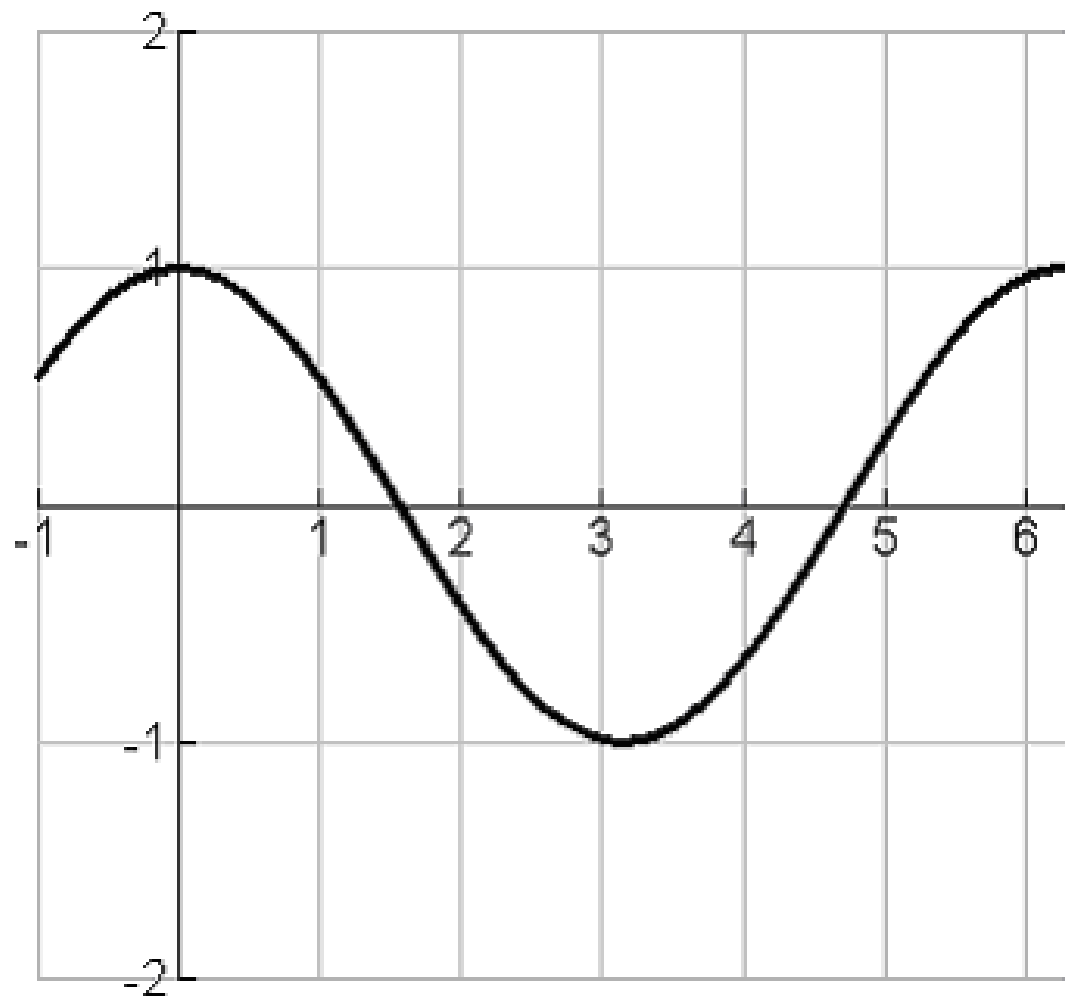
Bounded *above & below*

Extrema

Cosine

$$f(x) = \cos x$$

$$f(x) = \cos(x)$$



Domain $(-\infty, \infty)$
Range $[-1, 1]$
Continuous

Increasing

Decreasing

Constant

Left End

Right End

Symmetry *even*

x-intercepts

y-intercepts

VA

HA

Bounded

Extrema

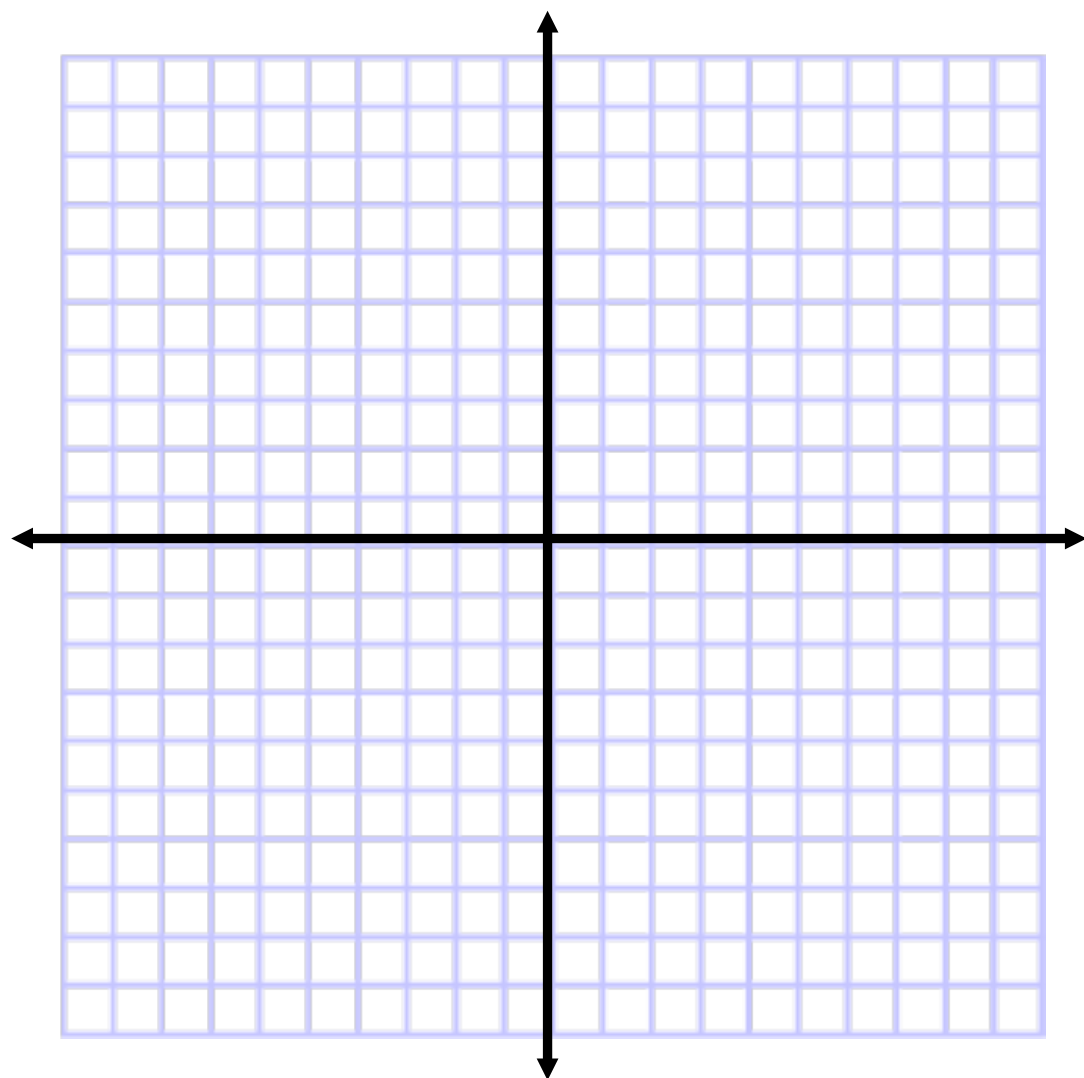
Piecewise Functions

certain pieces of the function have specific behavior

frequently: intervals (parts) of the domain are associated with different functions (related to continuity)

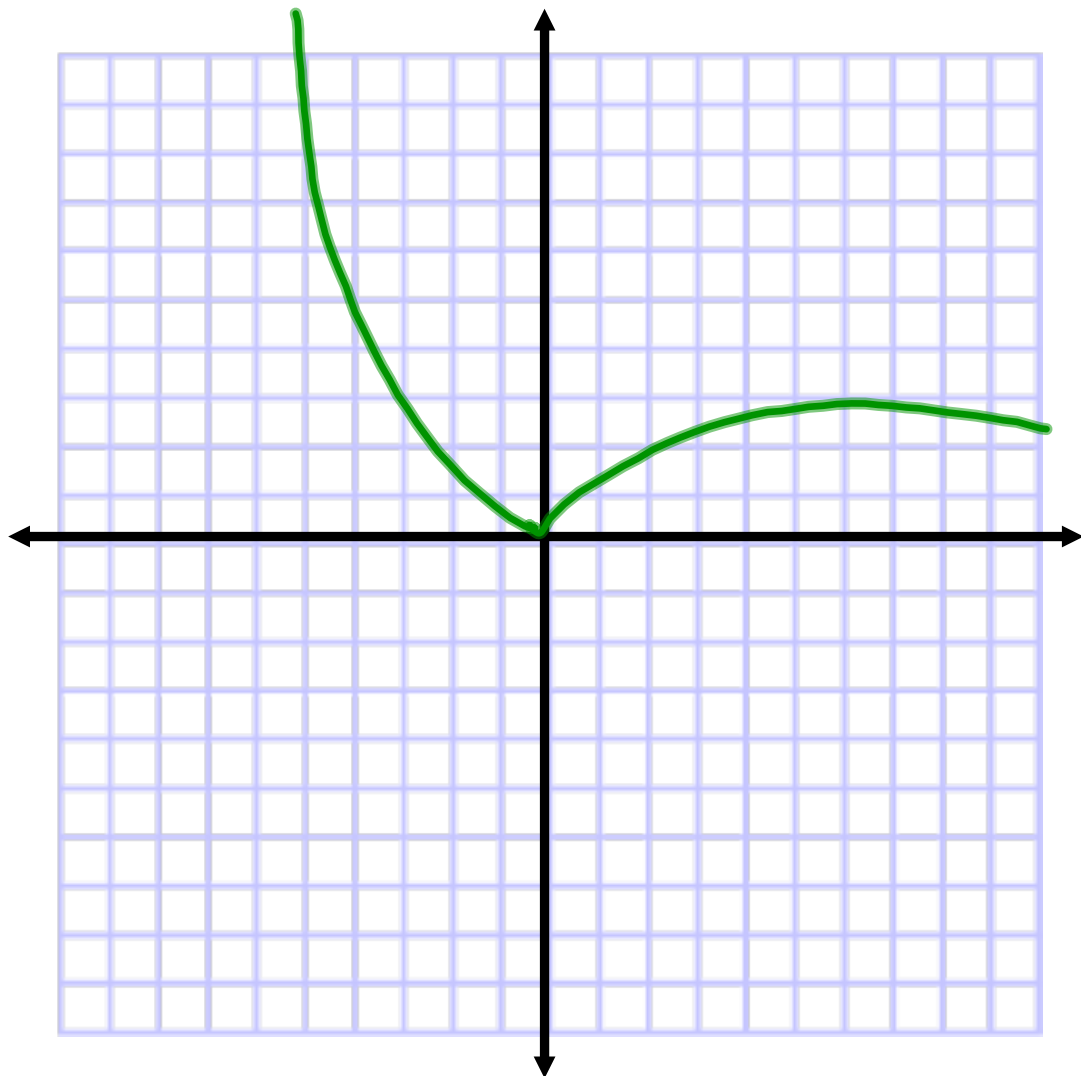
$$f(x) = \begin{cases} x + 1 & \text{if } x \leq 0 \\ x & \text{if } x > 0 \end{cases}$$

$$f(x) = \begin{cases} x + 1 & \text{if } x \leq 0 \\ x & \text{if } x > 0 \end{cases}$$



Characteristics will vary for each piecewise function

$$f(x) = \begin{cases} x^2 & \text{if } x \leq 0 \\ \sqrt{x} & \text{if } x > 0 \end{cases}$$



Characteristics will vary for each piecewise function