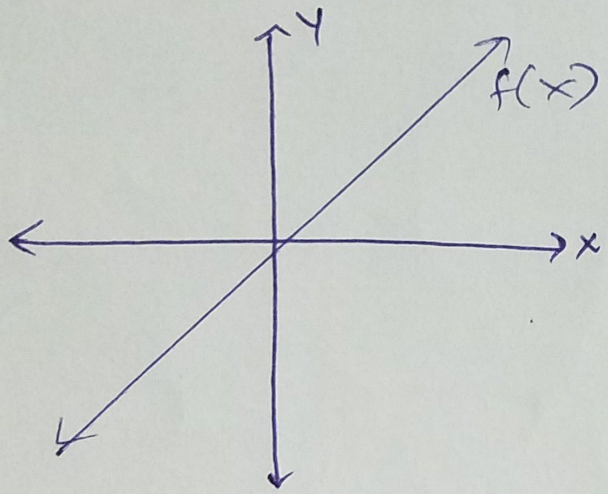
1.3 Twelve Basic Functions

Identity Function

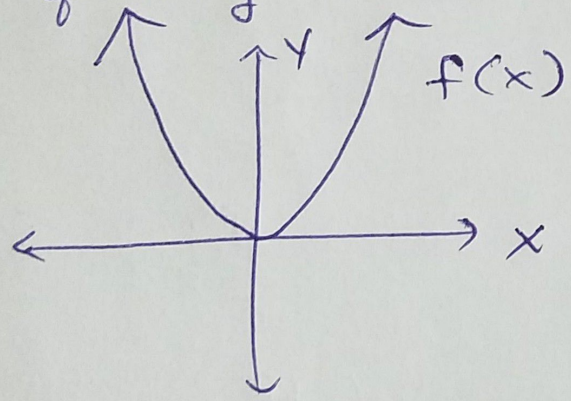
$f(x) = x$



D: $(-\infty, \infty)$ R: $(-\infty, \infty)$
Continuous
Increase: $(-\infty, \infty)$ Decrease: None
Odd Unbounded
Extrema: None
HA: None VA: None
$\lim_{x \to -\infty} f(x) = -\infty$ $\lim_{x \to \infty} f(x) = \infty$

Squaring Function

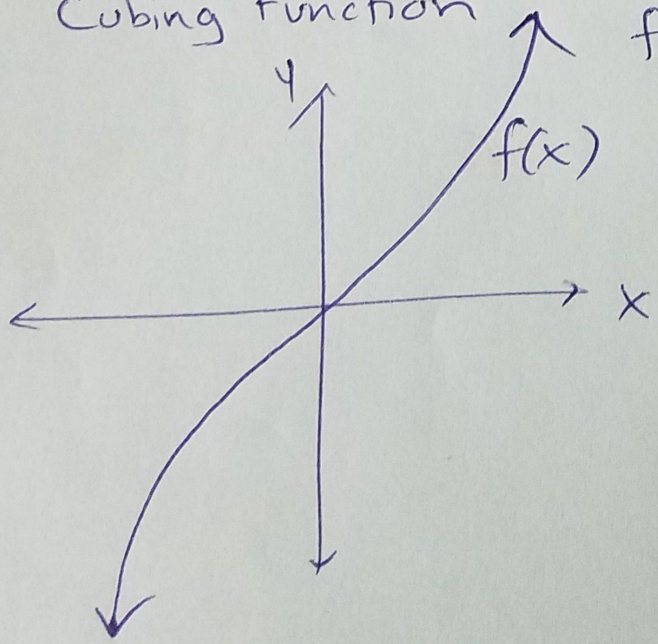
$f(x) = x^2$



D: $(-\infty, \infty)$ R: $[0, \infty)$
Continuous
Increase: $[0, \infty)$ Decrease: $(-\infty, 0]$
Even Bounded below
Extrema: Absolute min @ $x = 0$
HA: None VA: None
$\lim_{x \to -\infty} f(x) = \infty$ $\lim_{x \to \infty} f(x) = \infty$

Cubing Function

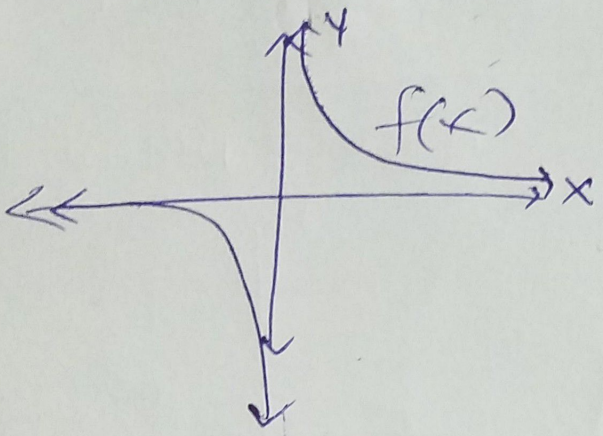
$f(x) = x^3$



D: $(-\infty, \infty)$ R: $(-\infty, \infty)$
Continuous
Increase: $(-\infty, \infty)$ Decrease: None
Odd Unbounded
Extrema: None
HA: None VA: None
$\lim_{x \to -\infty} f(x) = -\infty$ $\lim_{x \to \infty} f(x) = \infty$

Reciprocal Function

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



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

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

*Discontinuous @ $x = 0$ (infinite discontinuity)

but this is a continuous function b/c it is continuous on its domain.

Increase: None Decrease: $(-\infty, 0) \cup (0, \infty)$

Odd Unbounded

Extrema: None

HA: $y = 0$ VA: $x = 0$

$\lim_{x \to -\infty} f(x) = 0$ $\lim_{x \to \infty} f(x) = 0$

$f(-x) = \frac{1}{-x}$ ←

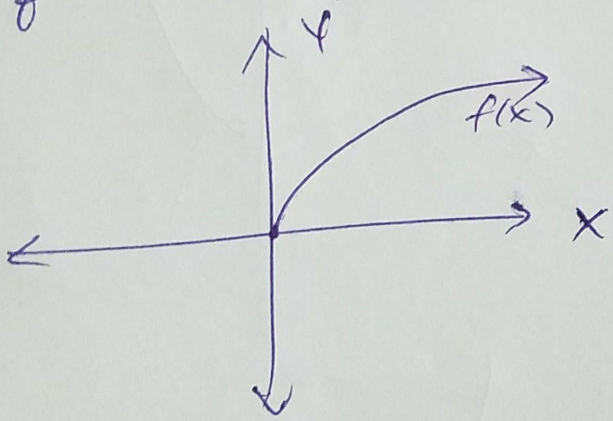
$= -\frac{1}{x}$

$f(-x) = -f(x)$ odd

$f(-x) = f(x)$ Even

Square Root Function

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



D: $[0, \infty)$ R: $[0, \infty)$

Continuous for $x \geq 0$

Increase: $[0, \infty)$ Decrease: None

Neither Bounded below

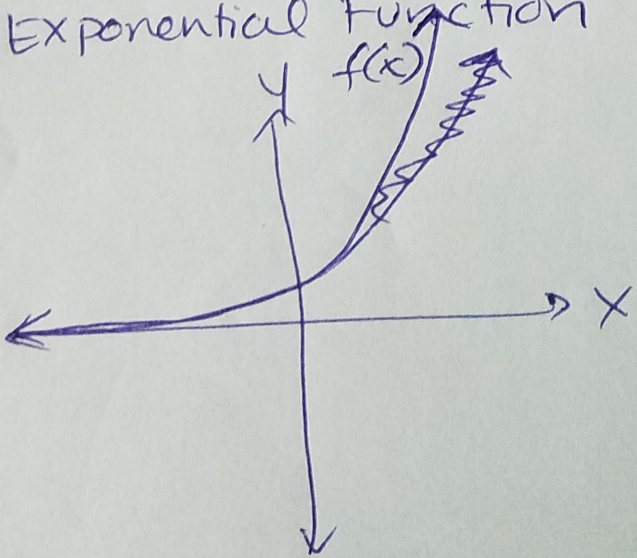
Extrema: Absolute min @ $x = 0$

HA: None VA: None

$\lim_{x \to -\infty} f(x)$ DNE $\lim_{x \to \infty} f(x) = \infty$

Exponential Function

$f(x) = e^x$



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

Continuous

Increasing: $(-\infty, \infty)$ Decrease: None

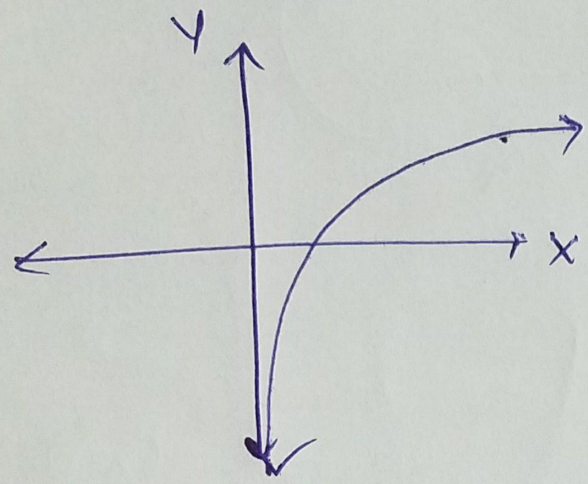
Neither Bounded below

Extrema: None

HA: $y = 0$ VA: None

$\lim_{x \to -\infty} f(x) = 0$ $\lim_{x \to \infty} f(x) = \infty$

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



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

Continuous for $x > 0$
(Infinite discontinuity)

Increase: $(0, \infty)$ Decrease: None

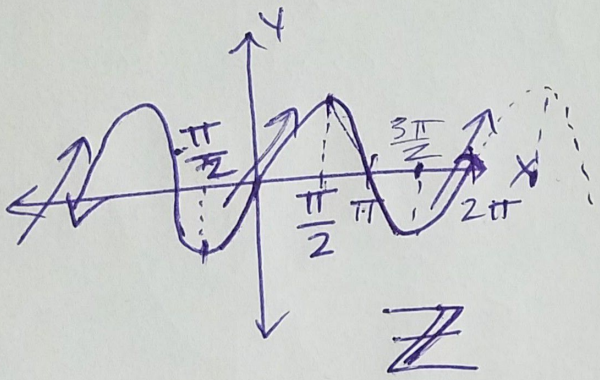
Neither Unbounded

Extrema: None

HA: None VA: $x = 0$

$\lim_{x \to -\infty} f(x)$ DNE $\lim_{x \to \infty} f(x) = \infty$

Sine Function



$f(x) = \sin x$

D: $(-\infty, \infty)$ R: $[-1, 1]$

Continuous

Increase: $\left[-\frac{\pi}{2} + 2\pi n, \frac{\pi}{2} + 2\pi n\right]$ $n \in \mathbb{Z}$

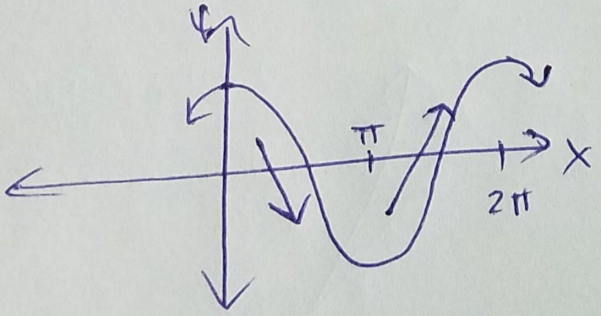
Decrease: $\left[\frac{\pi}{2} + 2\pi n, \frac{3\pi}{2} + 2\pi n\right]$ $n \in \mathbb{Z}$

Odd Bounded

Extrema: local max: $x = \frac{\pi}{2} + 2\pi n, n \in \mathbb{Z}$
local min: $x = -\frac{\pi}{2} + 2\pi n, n \in \mathbb{Z}$

oscilates between -1 & 1

Cosine Function



$f(x) = \cos x$

D: $(-\infty, \infty)$ R: $[-1, 1]$

continuous

Increases: $[\pi + 2\pi n, 2\pi + 2\pi n]$ $n \in \mathbb{Z}$

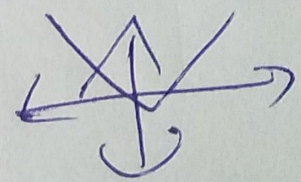
Decrease: $[2\pi n, \pi + 2\pi n]$ $n \in \mathbb{Z}$

Even Bounded

Extrema: local max: $x = 2\pi n, n \in \mathbb{Z}$
local min: $x = \pi + 2\pi n, n \in \mathbb{Z}$

oscilates between -1 & 1

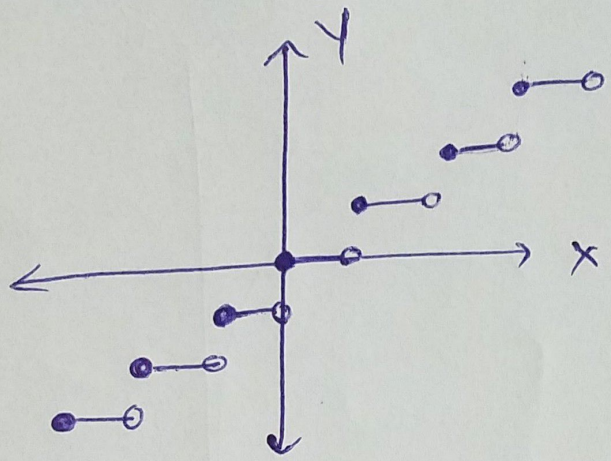
Absolute Value Function



Greatest Integer Function

$f(x) = [x]$

$= int(x)$



D: $(-\infty, \infty)$ R: $\mathbb{Z}$

~~continuous~~ discontinuous function

constant pieces

Neither Unbounded

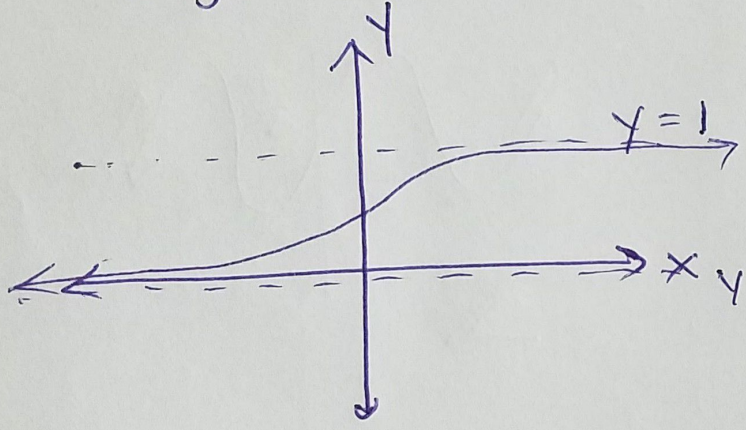
Extrema: None

HA: None VA: None

$\lim_{x \to -\infty} f(x) = -\infty$ $\lim_{x \to \infty} f(x) = \infty$

Logistic Function

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



D: $(-\infty, \infty)$ R: $(0, 1)$

Continuous

Increase: $(-\infty, \infty)$ Decrease: Never

Neither Bounded

Extrema: None

HA: $y = 0$ & $y = 1$ VA: None

$\lim_{x \to -\infty} f(x) = 0$ $\lim_{x \to \infty} f(x) = 1$