FUNCTIONS

$f(x) = 2x^2 + 3x + 4$ → GIF → F diff ← Advanced Analysis

functional Graphs..

Graph Based Analysis

$f(x) = 3x^2 + 7$ Short Run function

$f(0) = 7$ → Constant

if no variable

$f(x) = 3x^2 + 7x$ Long Run function

$f(0) = 0$

India 2011 → World cup 2023

1, 1, 1
ODI Test T20

England

Ruth → 2

$f(a,b,c,d,e) = a^2 + 3b^2 + \alpha d^2 + \ln e^4$

Indeterminable variable → 1 time play

determinable variable → 1 time play

T20 world cup

Pak vs Ind

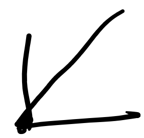
multiple variable

14th Feb
25th Dec
Marriage Season
Punjab

$f(x_1, x_2) = x_1^2 + x_2^2$

$f(x_1, x_2, x_3) = x_1^2 + 3x_1x_2 + 4x_3^3$

$y = x$



on @ 1

Linear $\quad y = f(x) = 2x^1 + 3$

Non-linear $\quad y = \frac{1}{x}$

2 is prime $\quad -2$ is not a prime

Non-linear $\quad y = \ln x$

$y = e^x$

Polynomial $\quad y = x^{10} + 9x^9 + 3x^7 \ldots$

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Descartes' Rule of Sign

Descarte's Rule of Sign

$f(x) = y = +x^4 - 3x^3 + 8x^2 + 7x - 3$

find the sign changes..

$\boxed{\text{3 sign changes}}$

$+ \to -$

3 +ve Real Root..

$y = f(-x) = x^4 + 3x^3 + 8x^2 - 7x - 3$

1 sign change

1 -ve Real Root

$y = +x^{10} - 9x^2 + 7x$

2 +ve

$y = +x^{10} - 9x^2 - 7x$

1 -ve

7 imaginary

2.

$\boxed{\text{DOMAIN}}$ vs $\boxed{\text{RANGE}}$

$y = 2x + 7$

$\boxed{0 \le x \le 4}$

Domain

$y(0) = 7$

$y(4) = 15$

$\boxed{7 \le y \le 15}$

Domain...

Range...

$\sqrt{5\cdot\infty - 3} = \sqrt{5\infty} = \sqrt{\infty} = \infty$

$y = \sqrt{5x-3}$

$y = \sqrt{5\cdot\frac{3}{5} - 3} = \sqrt{0} = 0$

$(5x-3) \ge 0$

$5x \ge 3$

$x \ge 3/5$

Domain $(3/5, \infty)$

Range $\underline{0 \text{ to } \infty}$

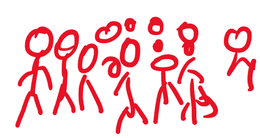
$y = \frac{1}{(x-1)(x-2)}$

Domain

$(x-1)(x-2) \ne 0$

$x \ne 1, x \ne 2$

All Real Numbers except $\underline{1,2}$...

family tree 

of functions...

$y = 2x^2 + 7x$

Algebraic

Monomial $y = x$

Polynomial < Constant $y = 3x+7$; Identity $y = 3x + 9x^2$

Rational $y = 2x^2 + 7$

Irrational $y = \sqrt{7x+9}$

Transcendental

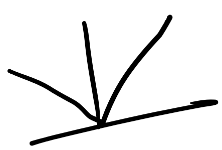
Exponential $y = e^{x^2}$

Logarithm $y = \ln x$

Trigonometric $y = \cos x$

Inverse-Trigo $y = \cos^{-1} x$

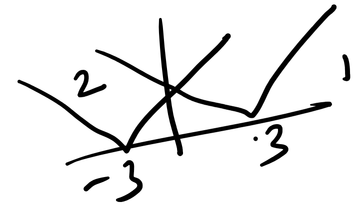
Piece-wise



y (1) modulus $y = |x+3|$

$x + 3 = 0$

$x = -3$



(2) Signum $y = \operatorname{sgn}(x)$

(3) GIF $y = [x]$

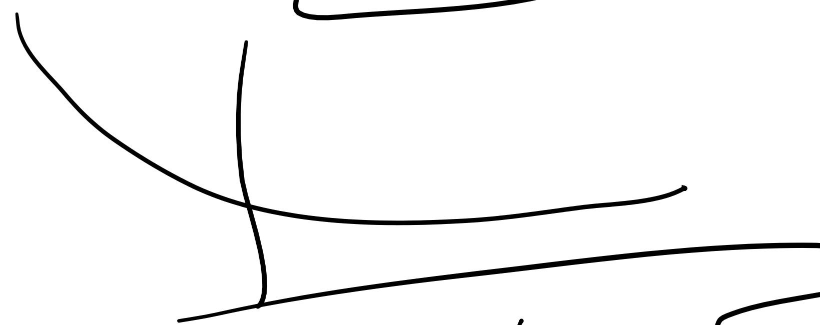
(4) FPF $y = \{x\}$

(5) Least integer functions ...

Most impt are the

Piece wise functions

$y = a^x$ $\boxed{0<a<1}$

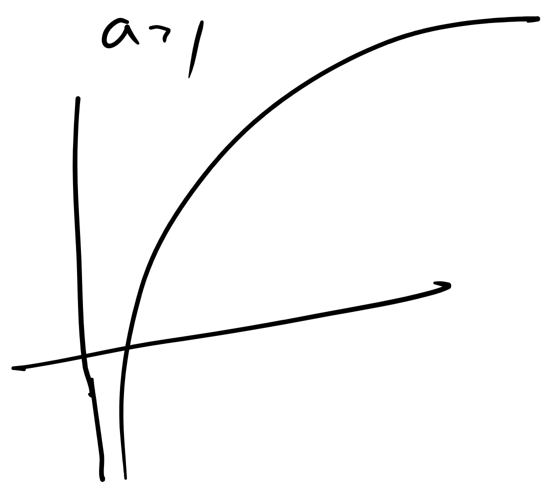


$a>1$ $\boxed{y = a^x}$

Logarithmic function

$0<a<1$

$a>1$



Domain finding for a logarithmic functions

$$f(x) = \frac{1}{\sqrt{\log_{1/2}(x^2-7x+13)}}$$

$\ln 0$ ×

$\ln -5$ ×

$\log(x^2-7x+13) > 0$

$\log_{1/2}(x^2-7x+13) > 0$

$x^2-7x+13 > \left(\frac{1}{2}\right)^0$

~~$x^2-7x+13 > 0$~~

$x^2-7x+13 < 1$

Remember in $\ln x$, $x>0$

$\boxed{x^2-7x+13>0}$

$x^2-7x+\frac{49}{4}+13-\frac{49}{4}>0$

$\left(x-\frac{7}{2}\right)^2+\frac{3}{4}>0$

$\left(x-\frac{7}{2}\right)>0$

$x>3.5$

$x^2-7x+12<0$

$(x-3)(x-4)<0$

$\boxed{3<x<4}$

$x>3.5$

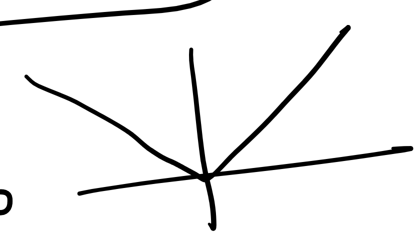
$3<x<4$

Common Zone

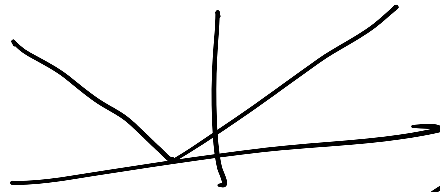
$\boxed{3.5 \text{ to } 4}$

$\boxed{3.5<x<4}$

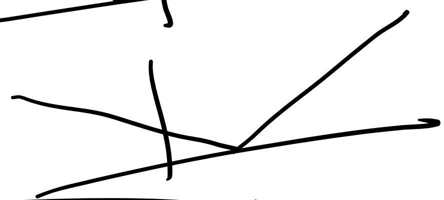
$$y=|x| \begin{cases} x & x\geq 0 \\ -x & x<0 \end{cases}$$



$y = |x+3|$



$y = |x-3|$



$\boxed{\text{Some special notes}}$

$|x|^2 = x^2$ $\qquad |x|^{2n} = x^{2n}$

$||x|| = |-x| = |x|$

$|x| = \max\{-x, x\}$

$-|x| = \min\{-x, x\}$

* $|x+y| \le |x| + |y|$ for all x, y
* $|x+y| = |x| + |y|$ iff $xy \ge 0$
* $|x-y| = |x| + |y|$ iff $xy \le 0$

$(x-1)(x-2) \le 0$

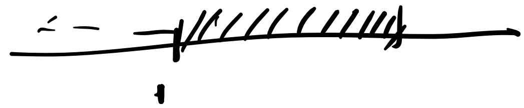
$x \le 1$

$x \le 2$

Q $(\ldots)\,(|x|-2) < 0$

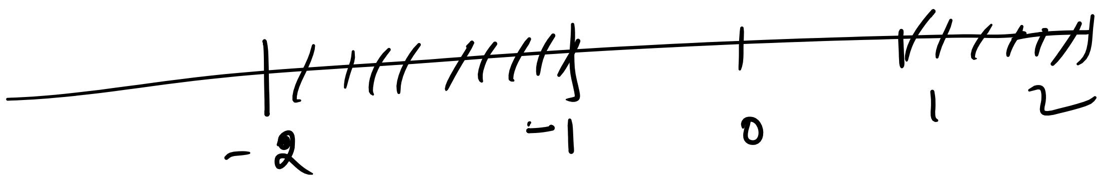
Q $(|x|-1)(|x|-2) \le 0$

$|x| \to$ 1, 2



$1 \le |x| \le 2$

$x \in [-2,-1] \cup [1,2]$



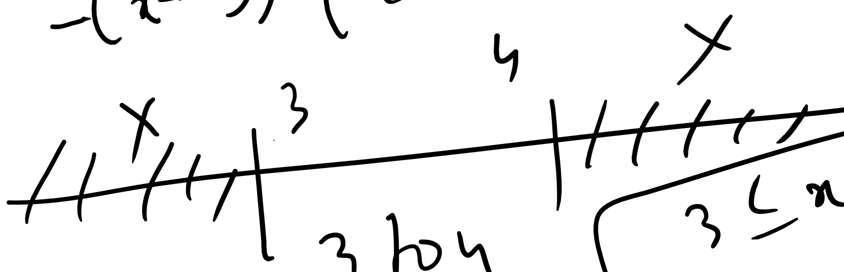
Q $|x-3| + |4-x| = 1$

we know, $|x|+|y| = |x+y|$ iff $\boxed{xy \ge 0}$

$(x-3)(4-x) \ge 0$ $\quad x \ge 3,\ x \le 4$

$-(x-3)(x-4) \ge 0$

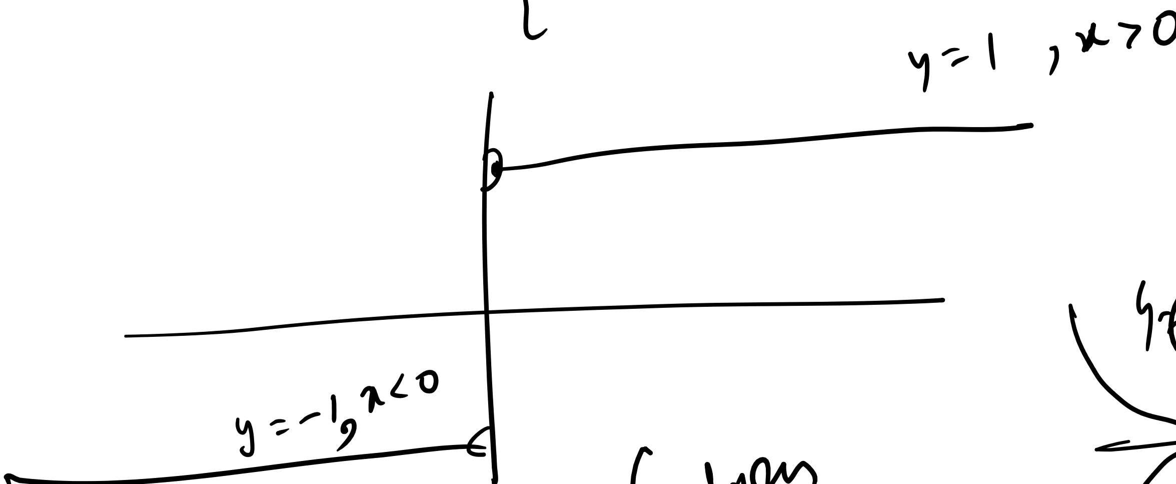
or

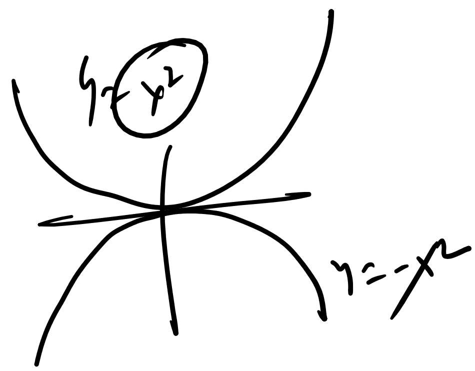


3 to 4 $\quad \boxed{3 \le x \le 4}$

Signum function

$$y = \operatorname{sgn} = \begin{cases} \dfrac{|x|}{x} \text{ or } \dfrac{x}{|x|} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases} \qquad x \begin{cases} -1 \\ +1 \end{cases}$$





Undeume functions

$$y = \operatorname{sgn}(x^2+1) = -1$$
$$= 1$$
$$= 0$$

$x^2+1 < 0$
$x^2+1 > 0$
$x^2+1 = 0$

$$y = \operatorname{sgn}(\ln_e x)$$

1
-1

$\ln_e x > 0$
$\ln_e x < 0$
$\ln_e x = 0$

$\ln\left(\frac{1}{3}\right)$
$= 0 - \ln 3$
< 0

-1 $\quad$ $\lim_{n} \frac{e}{e^{n}} = 0$

0 $\quad$ ϕ

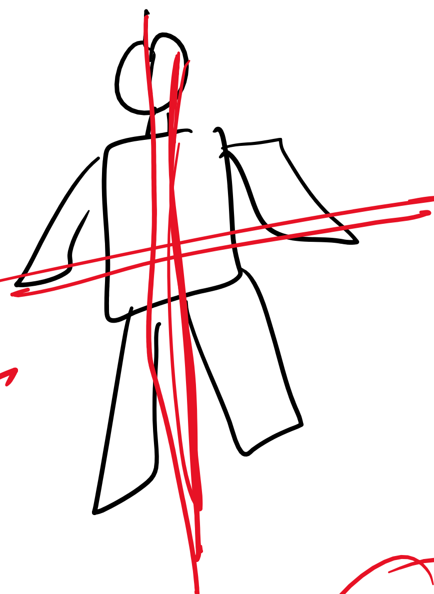
GIF function

$y = 0.99 \rightarrow 0$

$y = 1.25 \rightarrow 1$

$y = 1.60 \rightarrow 1$

ϕ



Number = Integer Part + fractional Part

$= 3.25$

$+ 0.67 \qquad -0.67$

$\overline{\overline{+ 7.00}}$

$[x]$

0

$0 \le x < 1$

$0 \leq x < ?$

$2 \leq x < 3 \qquad 2$

$-2 \leq x \leq -1 \qquad -2$

$-1 \leq x < 0 \qquad -1$