GATE
ALL BRANCHES
ENGINEERING MATHEMATICS

Probability and Statistics

Lecture No. 17

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exponential distribution

01 Single Variable calculus

Probability & Statistics

04-05 **Single variable Calculus:**

- ✓ Functions - Plotting (basic graphs)
- ✓ Limit, continuity or Differentiability
- ✓ Max/Min one variable
- ✓ Integration → Beta and gamma function
- ✓ Special type of Integral + Improper Integral
- ✓ Length of curve
- ✓ Area Bounded regions
- ✓ Rolles, Theorem, Lagrange Theorem.

CS
ME
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Functions :

$y = f(x)$

$y = f(x)$

x = Assign the value

y = Obtain the value

$y = f(x)$

Dependent variable

Independent variable

$A = \pi r^2$

r = radius

A = Area

r = Assign ⇒ Ind. variable

A = obtain ⇒ Dep. var.

$x = f(y)$

Dependent

Independent

x = account

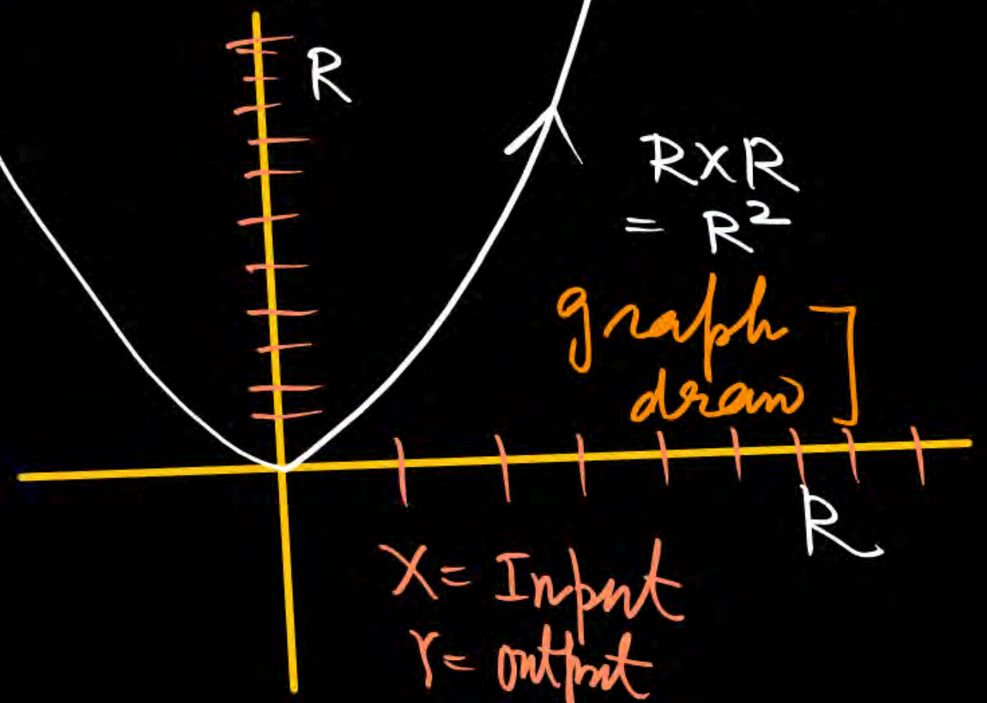
y = amount

$y = \sin x$ $y = \cos x$, $y = x^2$ $y = x^3$, $y = |x|$

x = Independent variable
y = dependent "

$y = x^2$

$x =$ 1 2 3 4 5
$y =$ 1 4 9 16 25



$y = x^2$

Input 1D
output 1D
= 2 dimensional RXR

Picture/Photo/
2-dimensional
Image

$y = f(x)$ = Single valued function

graph 12th

Single var: $x \rightarrow [f] \rightarrow y$ Machine (one dependent var + one Indep)

$z = f(x, y)$ = multivalued function

↓ Two Independent variable

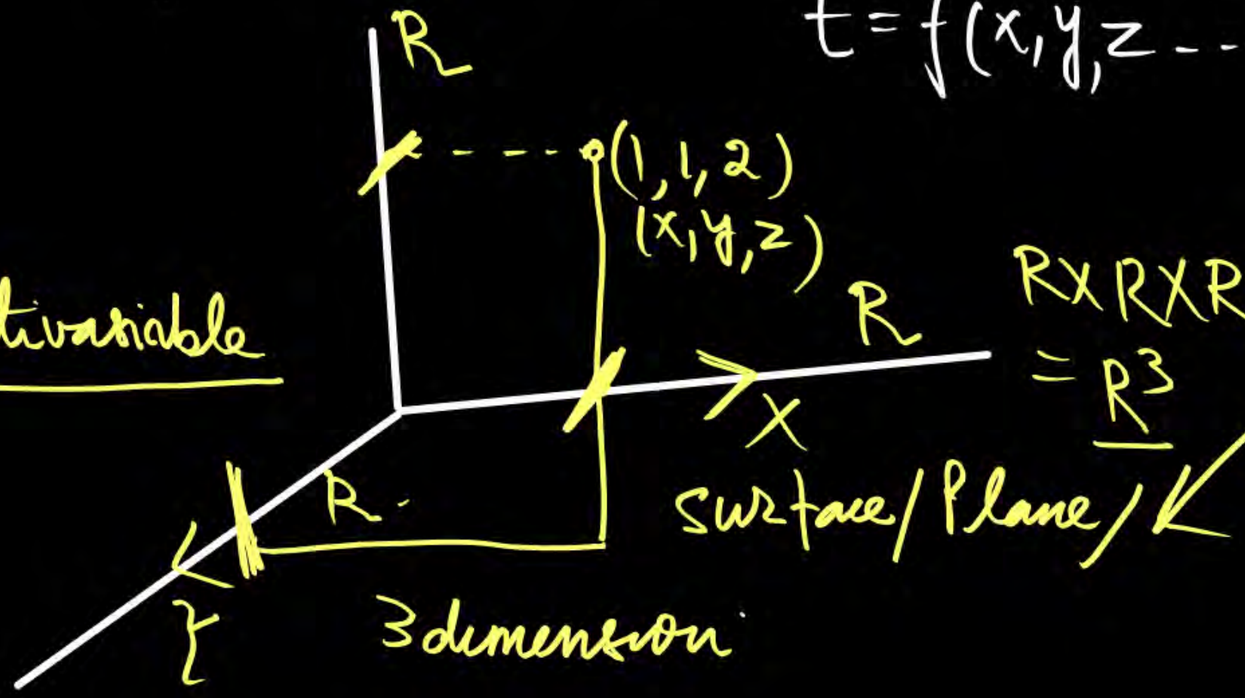
$t = f(x, y, z \ldots n)$

$z = f(x, y)$

$z = x + y$

$x = 1$	$x = 2$
$y = 1$	$y = 2$
$z = 2$	$z = 5$
$(1, 1, 2)$	$(2, 2, 4)$

multivariable



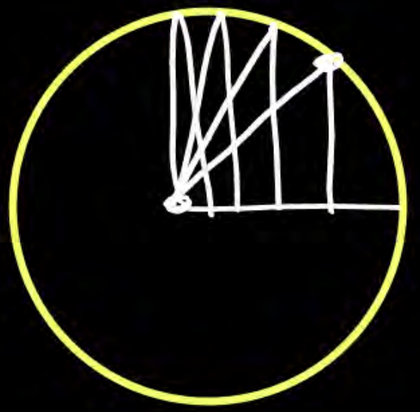
$R \times R \times R = R^3$

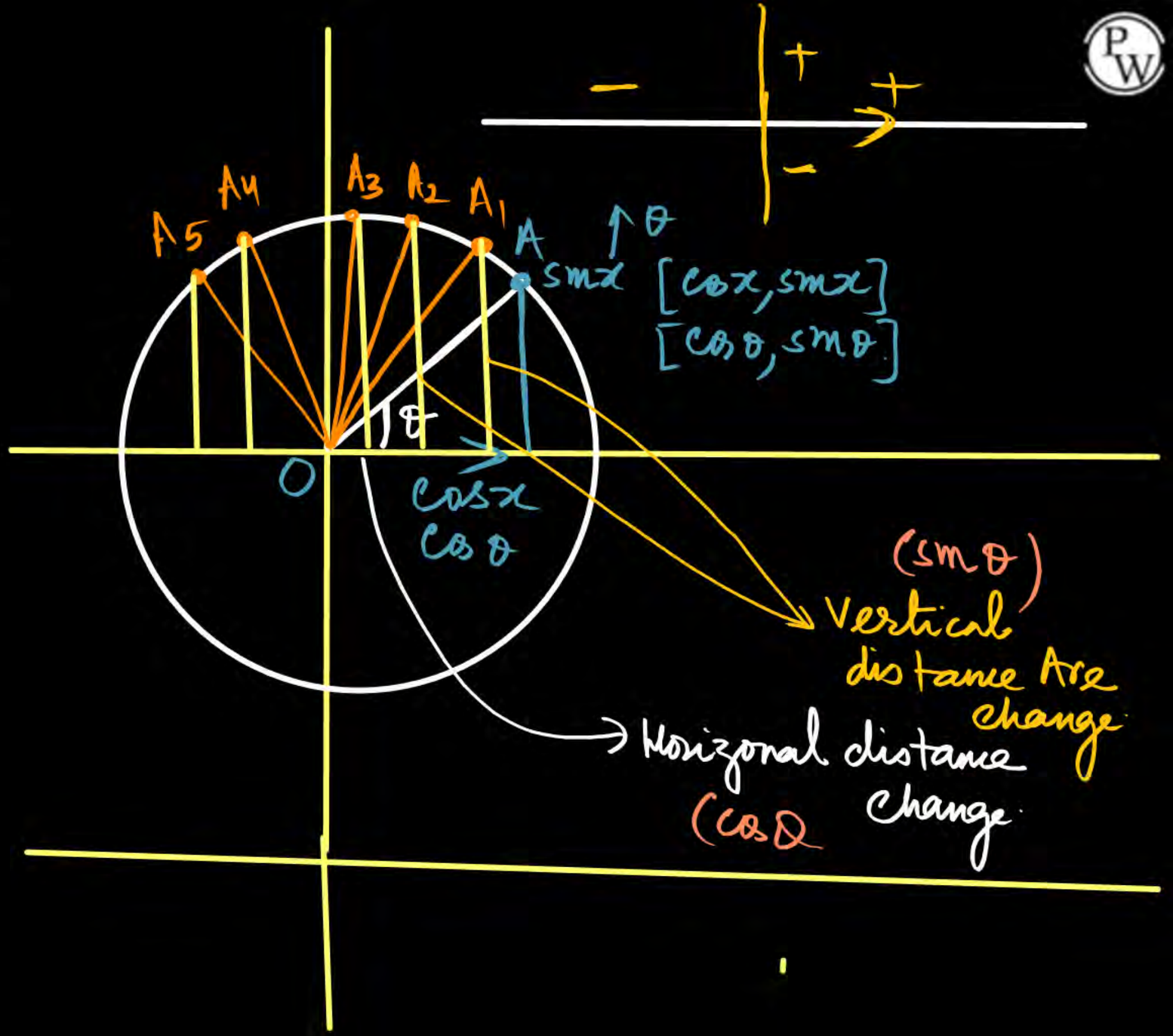
surface / Plane /

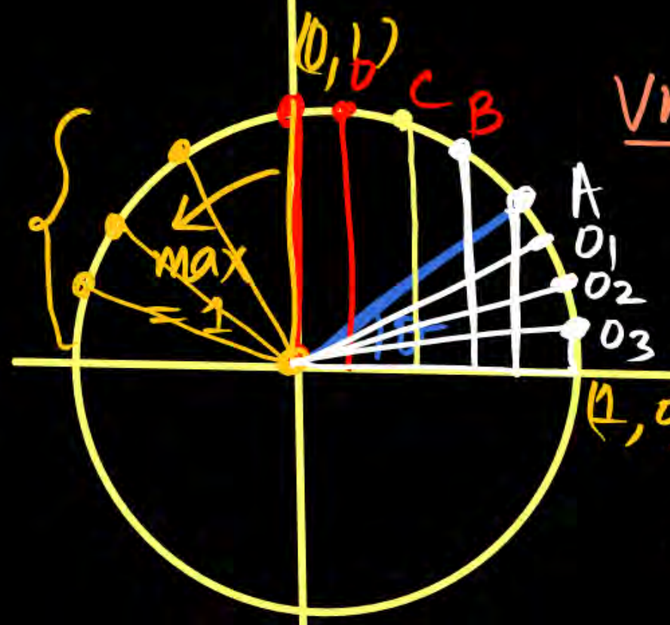
3 dimension

$y = \sin x$

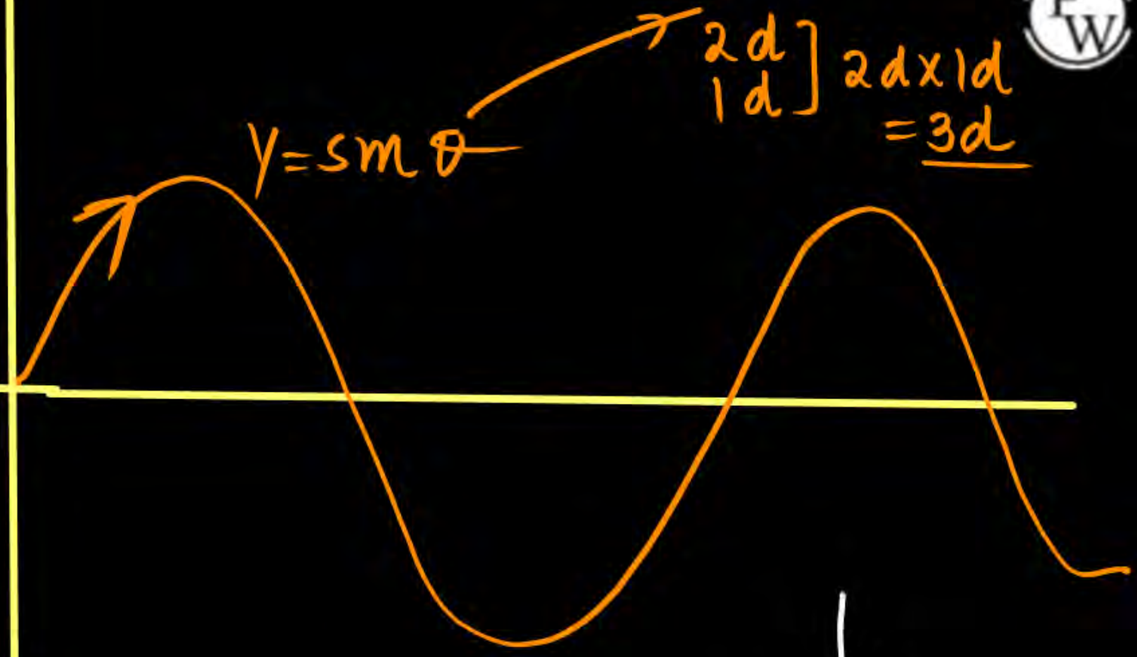
$y = \sin\theta$ (θ : Angle)

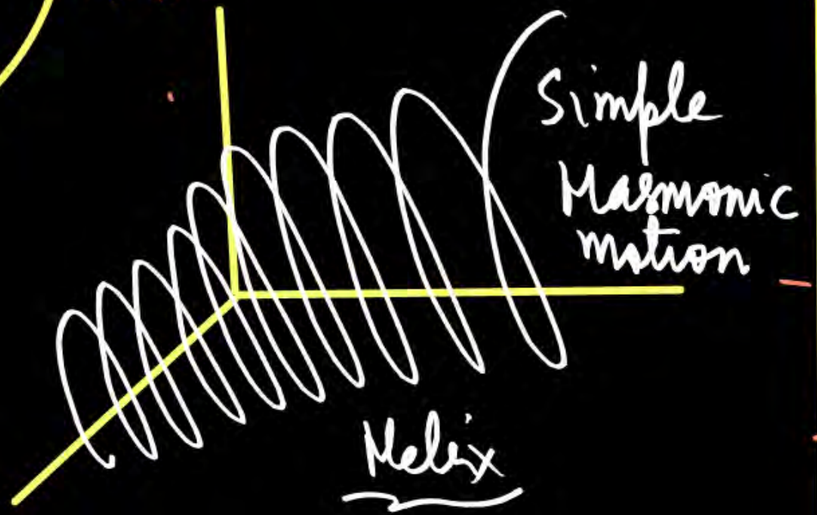


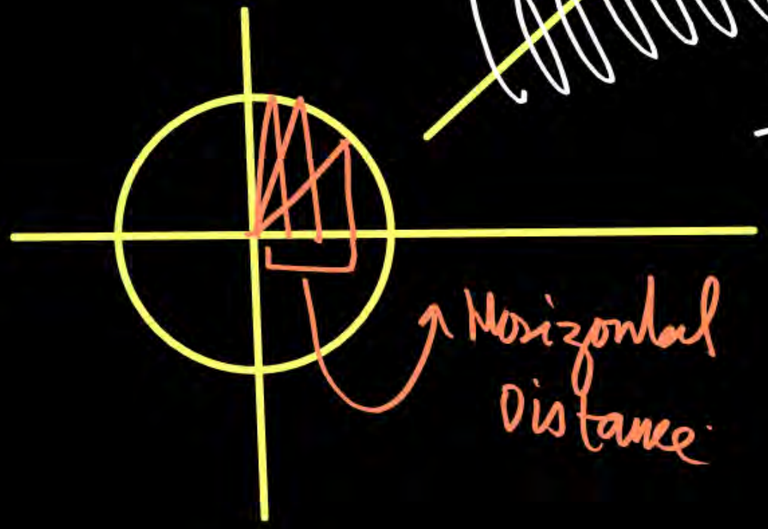


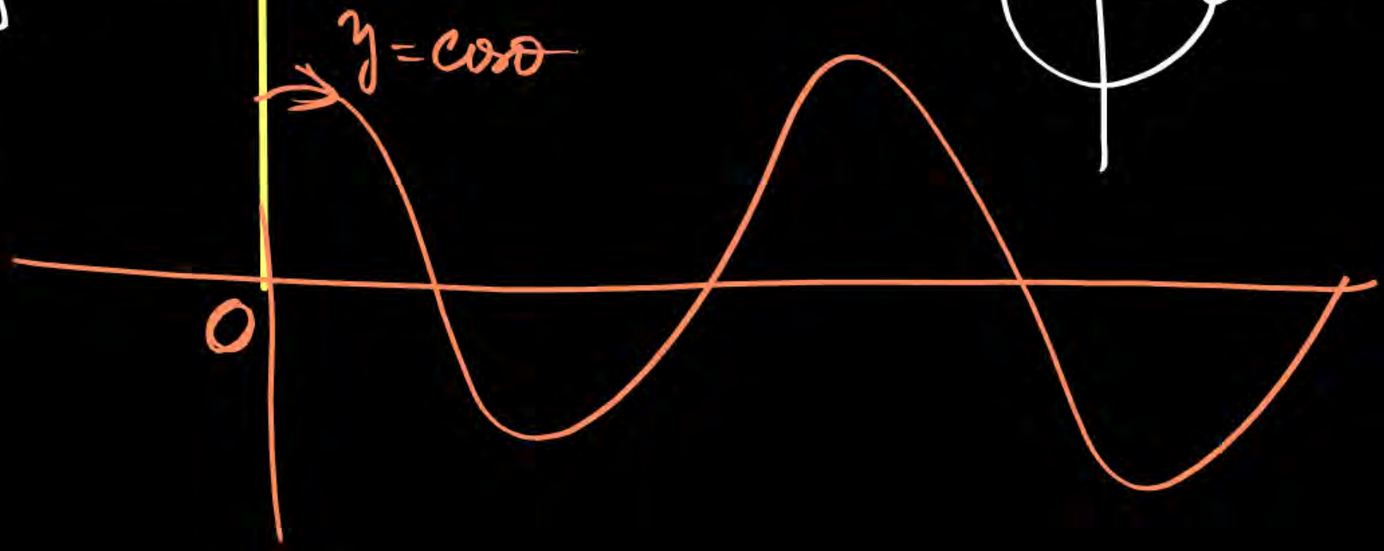

(0,b)
C
B
A
O1
O2
O3
max
1
(1,0)
(0,-1)

Unit circle


y=sin θ
2d
1d
2d x 1d
=3d


Simple Harmonic motion
Helix


Horizontal Distance


y=cos θ
O

Modulas Function : $y = |\text{Function of } x|$ $y = |f(x)|$

$f(x)$ $x \geq 0$

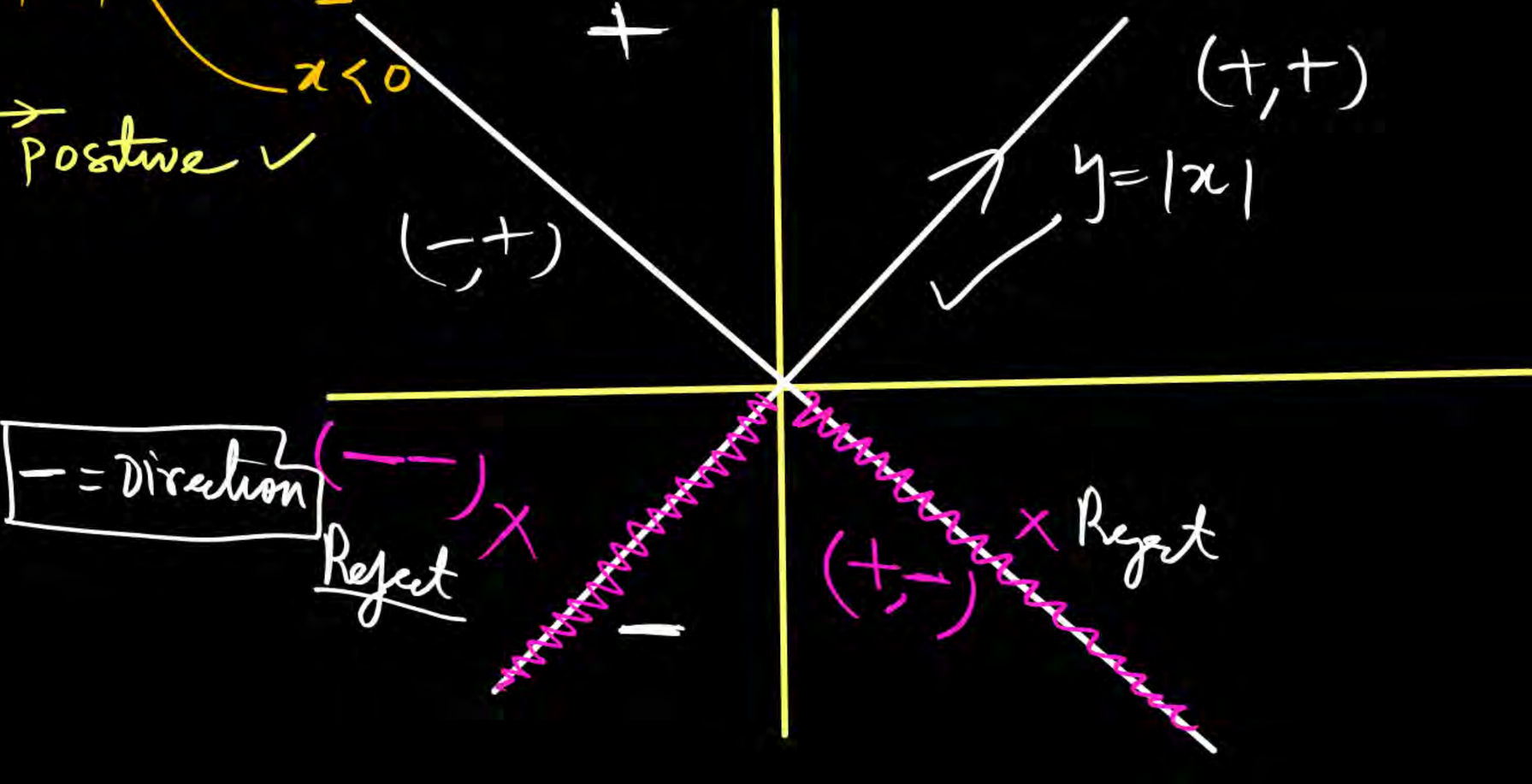
$-f(x)$ $x < 0$

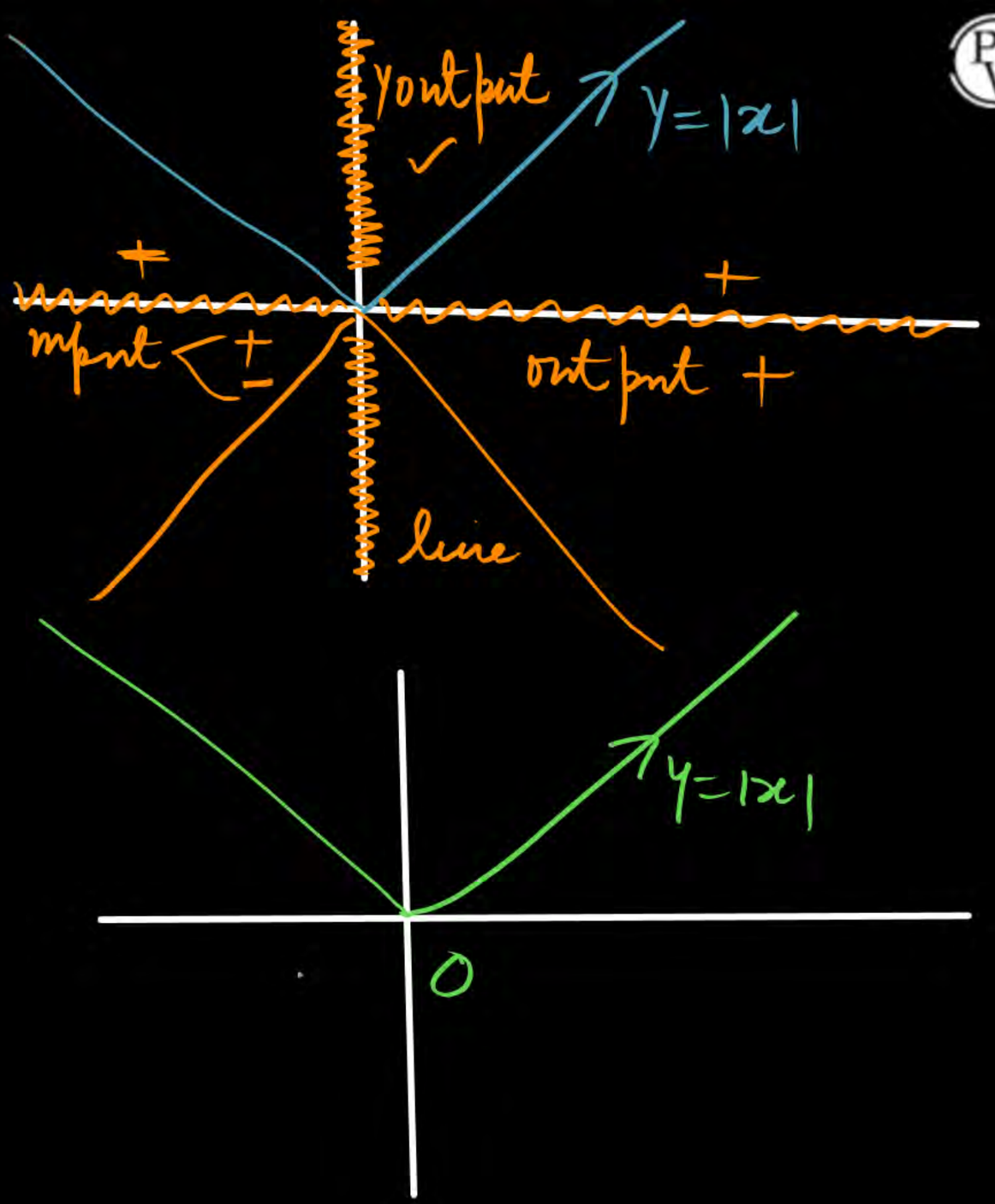
→ always Positive

$-x$ input → **f** (Process) → values always Positive

$y = |x|$ $x \geq 0$, $x < 0$

$y = |x|$ → Positive ✓




output
y=|x|
+
+
input
+
−
output +
line
y=|x|
0

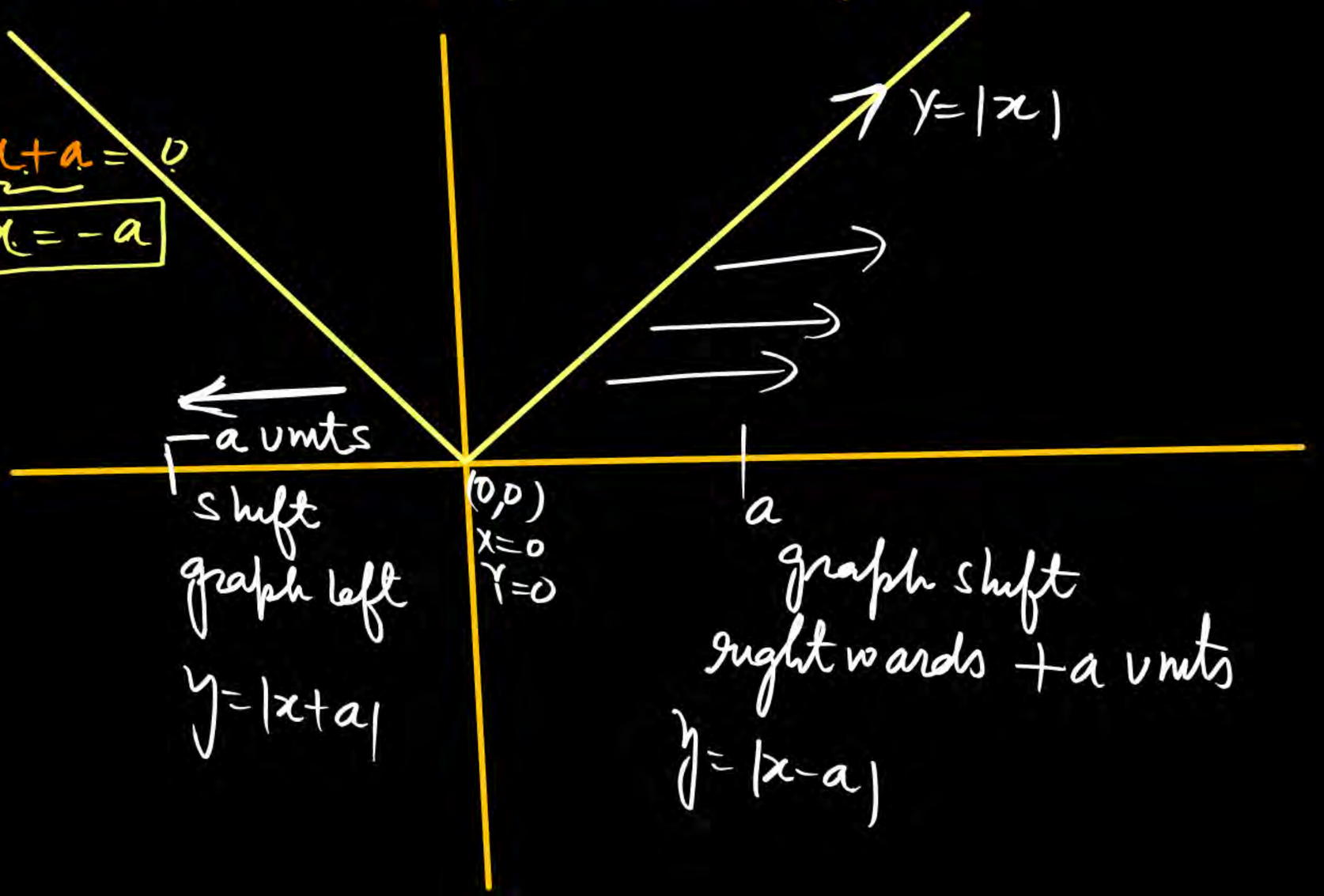
1) $y=|x+a|$, $y=|x-a|$, $y=|x|+a$, $y=|x|-a$

$y=|x+a|$

$y=|x|$ ← $x+a=0$

$x=-a$

$y=|x|$



$y=|x-a|$

$y = |x-3|$

$y = |x+3|$

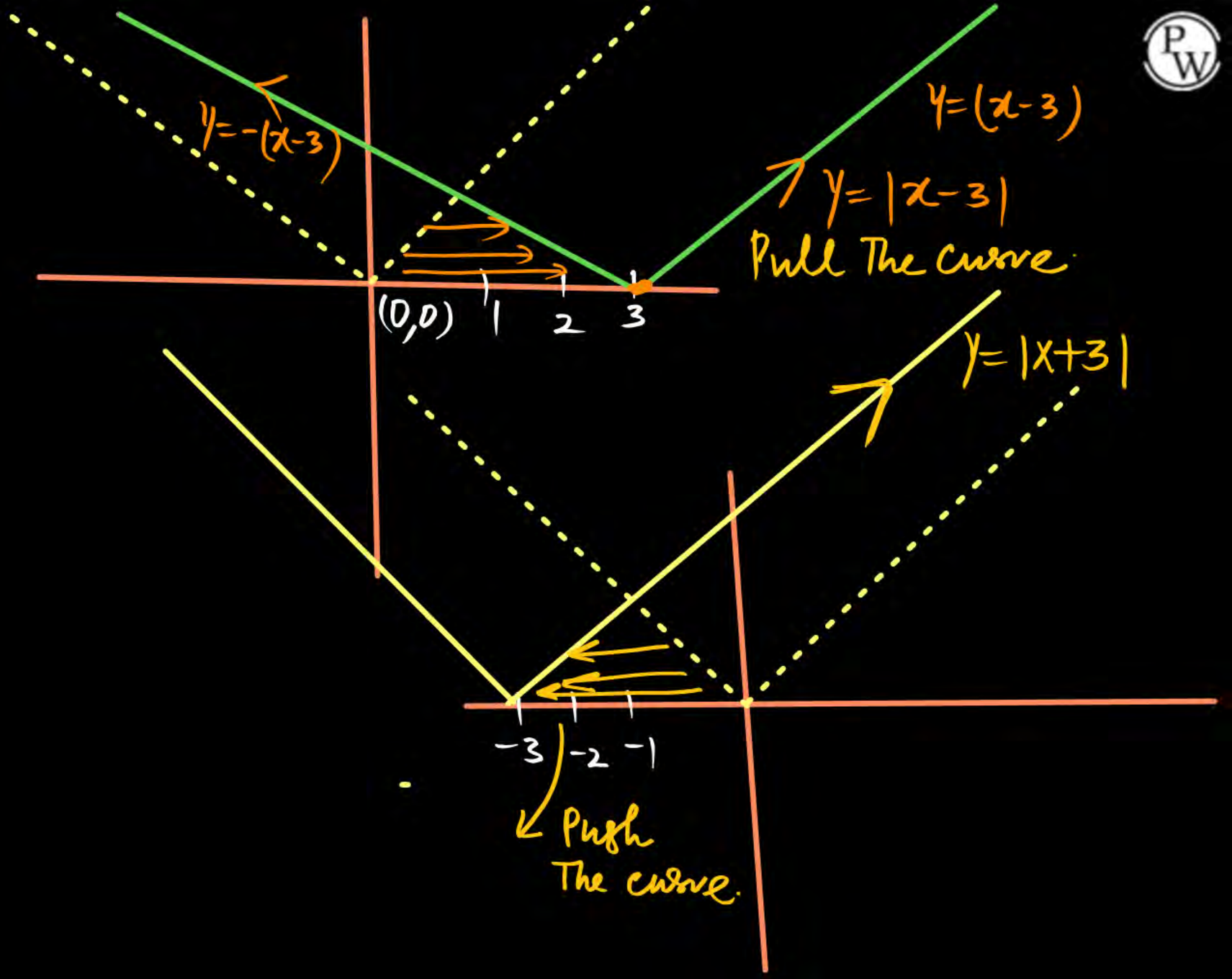
$x-3=0$

$x=3$

$y=|x+3|$

$x+3=0$

$x=-3$

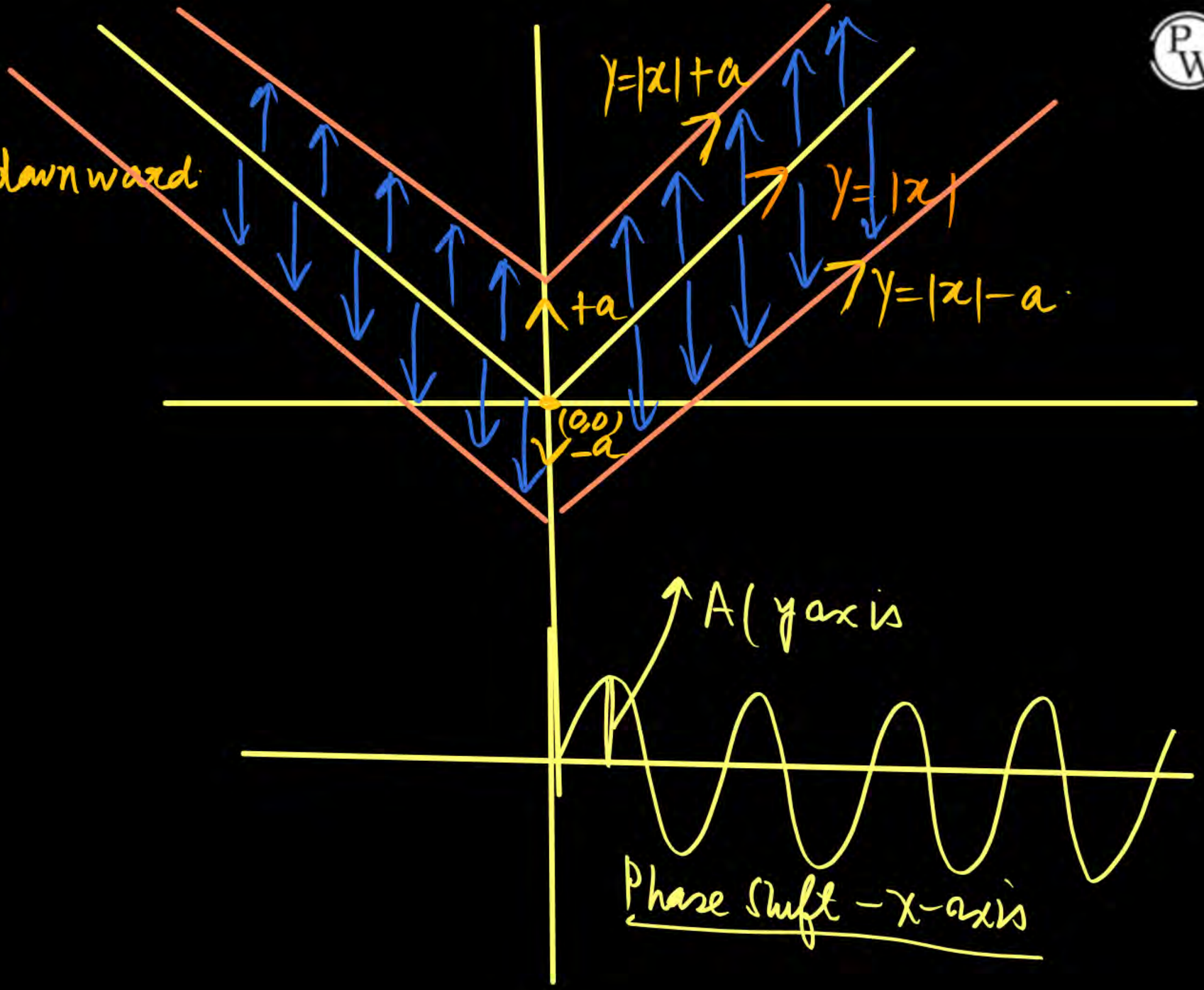


$y = |x| - a$

a unit shift downward

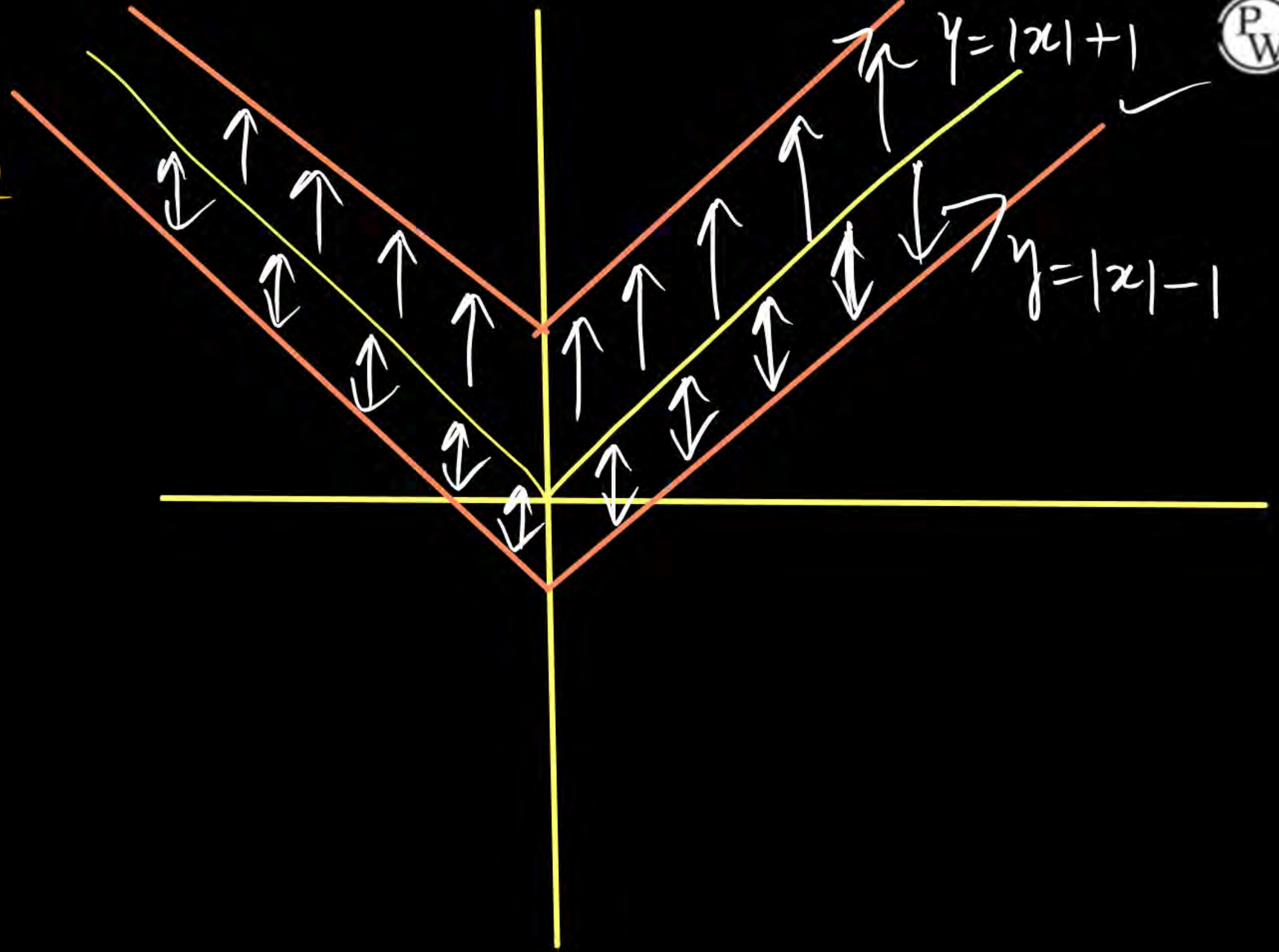
$y = |x| + a$

upward



$y = |x| - 1$

$y = |x| + 1$



Greatest Integer function :

$f(x) = [x]$ → Integer (only)

Input = always defined Integer I

Number = Integer + Fractional

$5.3 = 5 + .3$

$[5.3] = 5$

$[3.9] = 3$

$[1.9] = 1$

$[1.99999999] = 1$

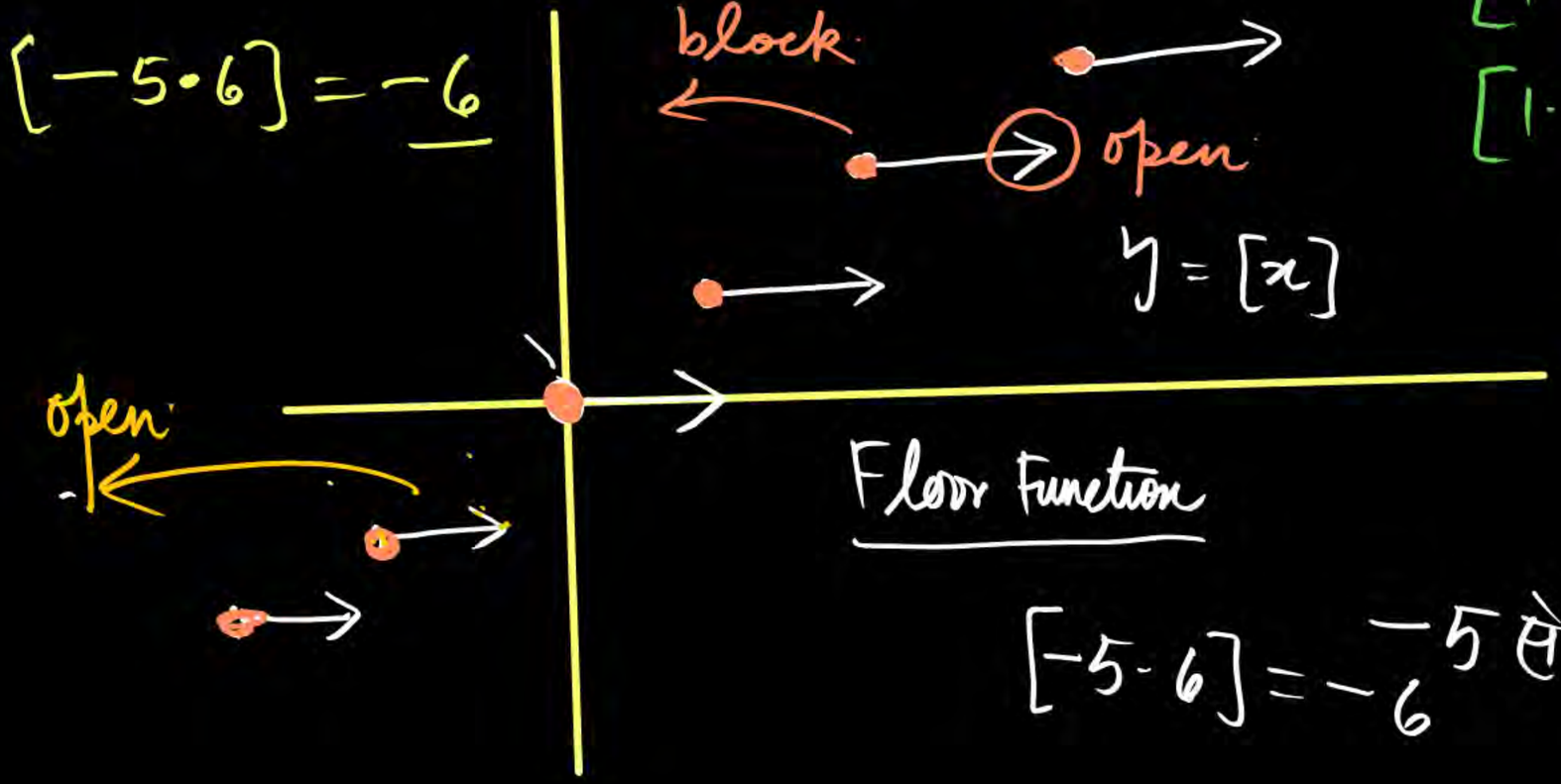
$[-5.6] = -6$

$[-5] = -6$

$[-n] = -n-1$

↓ n is Integer

$[-5.6] = -6$ 5 से पास में सबसे small



Fractional Function

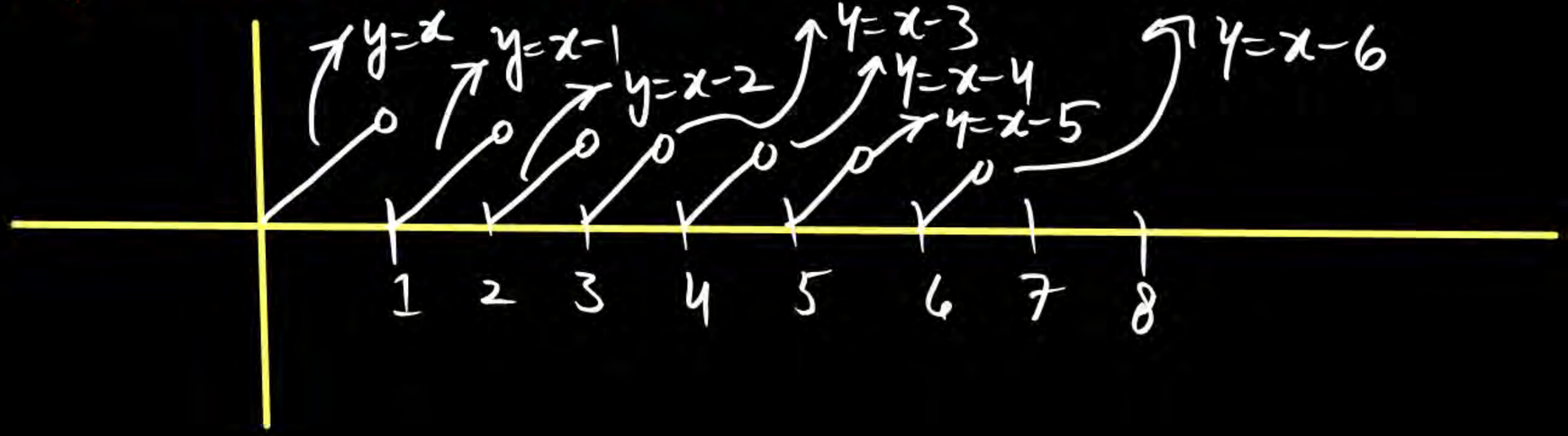
$f(x) = \{x\} = x - [x]$

$x = [x] + \{x\}$

$\{x\} = x - [x]$ → Integer (Piecewise)

→ Input (Defined)

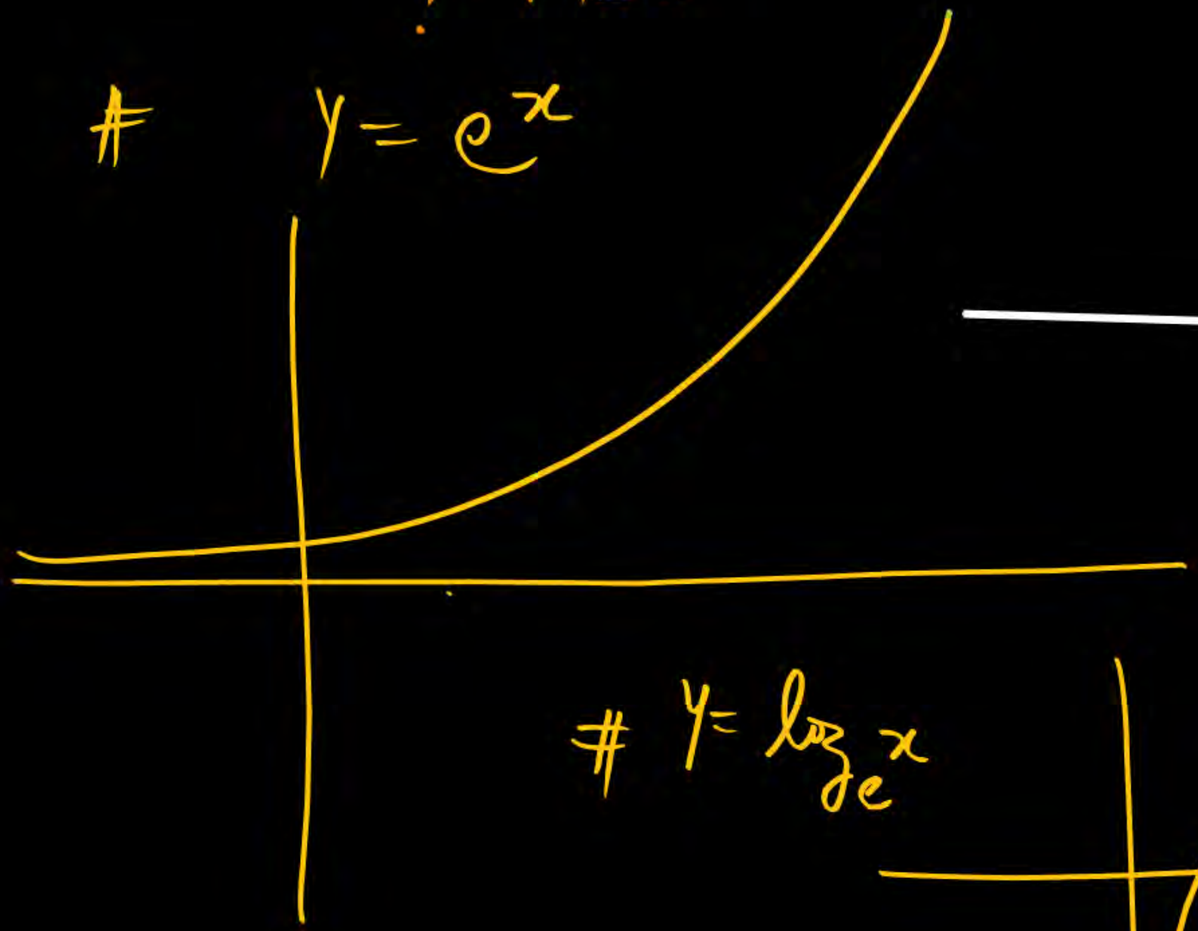
$$f(x) = \{x\} = \begin{cases} x-[x] = x-0 & 0 \le x < 1 \\ x-[x] = x-1 & 1 \le x < 2 \\ x-[x] = x-2 & 2 \le x < 3 \\ \vdots & \\ x-[x] = x-n & n \le x < n+1 \end{cases}$$



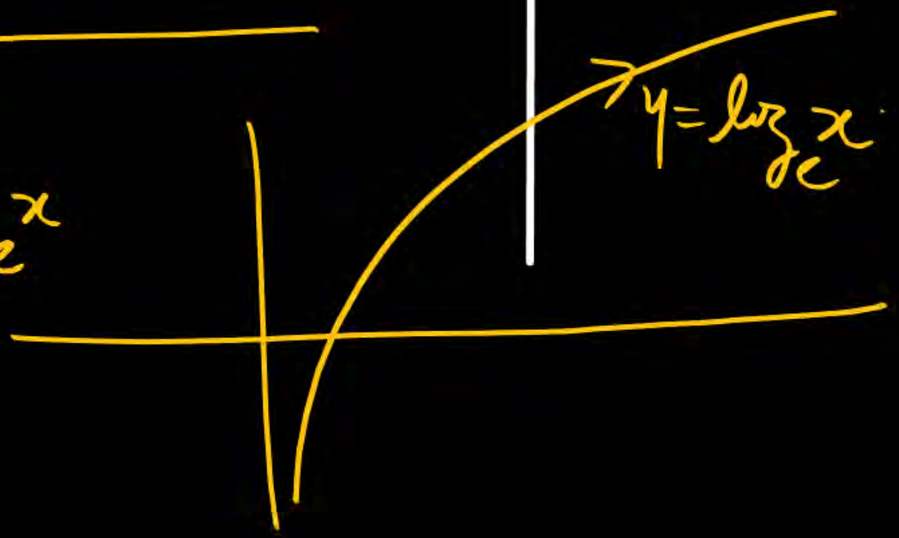
$y = |x \pm 5|$

$y = |x| \pm 5$

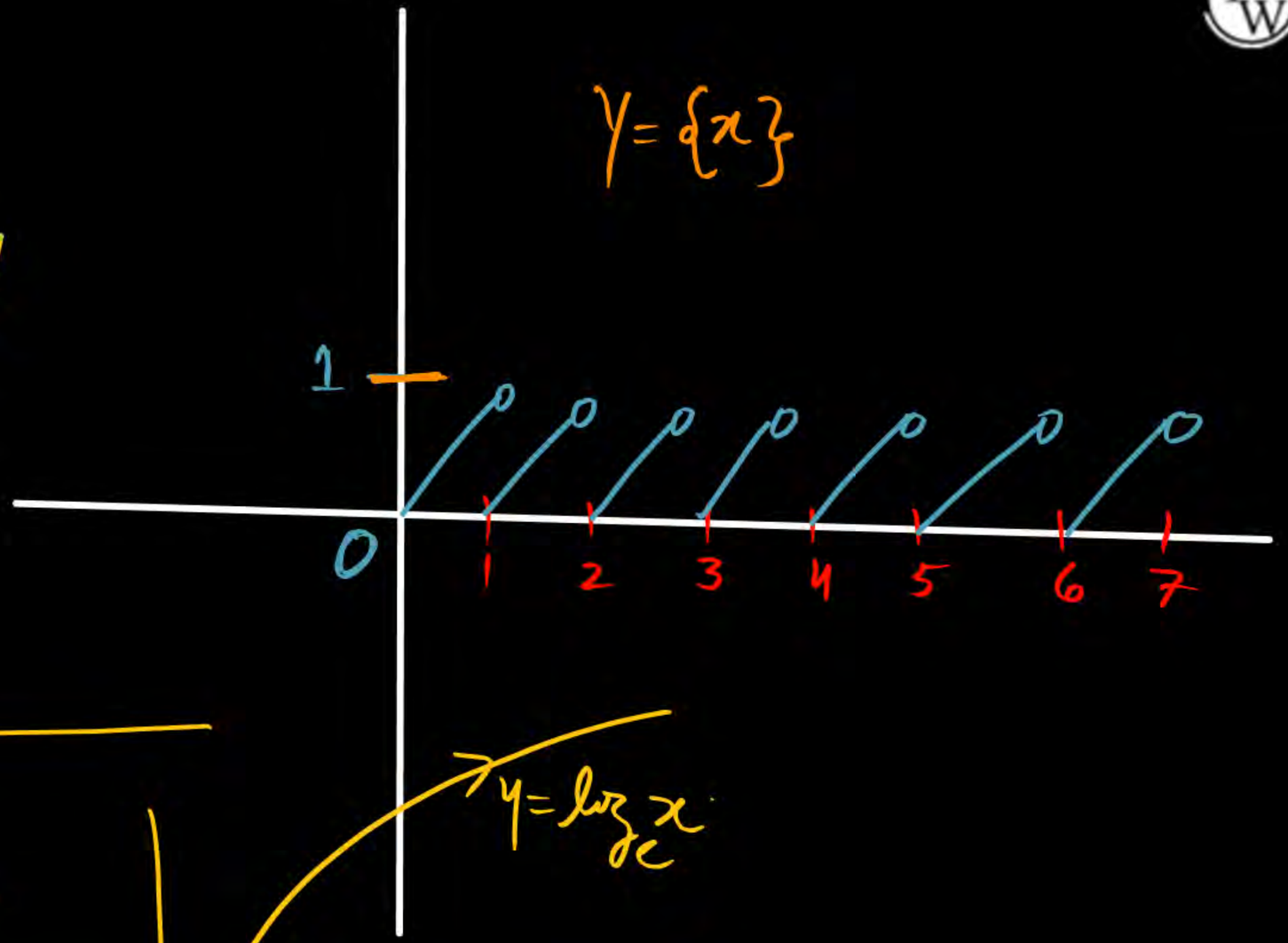
$y = e^x$



$y = \log_e x$



$y = \{x\}$



Thank You!

GW Soldiers