

T
Trigonometric
function

A
Algebraic
function

L
↓
Logarithmic
function

E
Exponential
function

Algebraic function →

1. Polynomial function → are continuous at for all $x \in \mathbb{R}$

2. Rational function

$$f(x) = \frac{g(x) \rightarrow \text{poly}}{h(x) \rightarrow \text{poly}}$$

$$\frac{0}{2} = 0$$

$$\frac{78}{0} = \infty$$

Rational function are continuous for all $x \in \mathbb{R} - \{x : h(x) = 0\}$

Algebraic function

Modulus function (मापांक फलन):-

↓↓

Modulus function

always continuous
for all $x \in \mathbb{R}$

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

$$f(x) = |x - a|$$

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

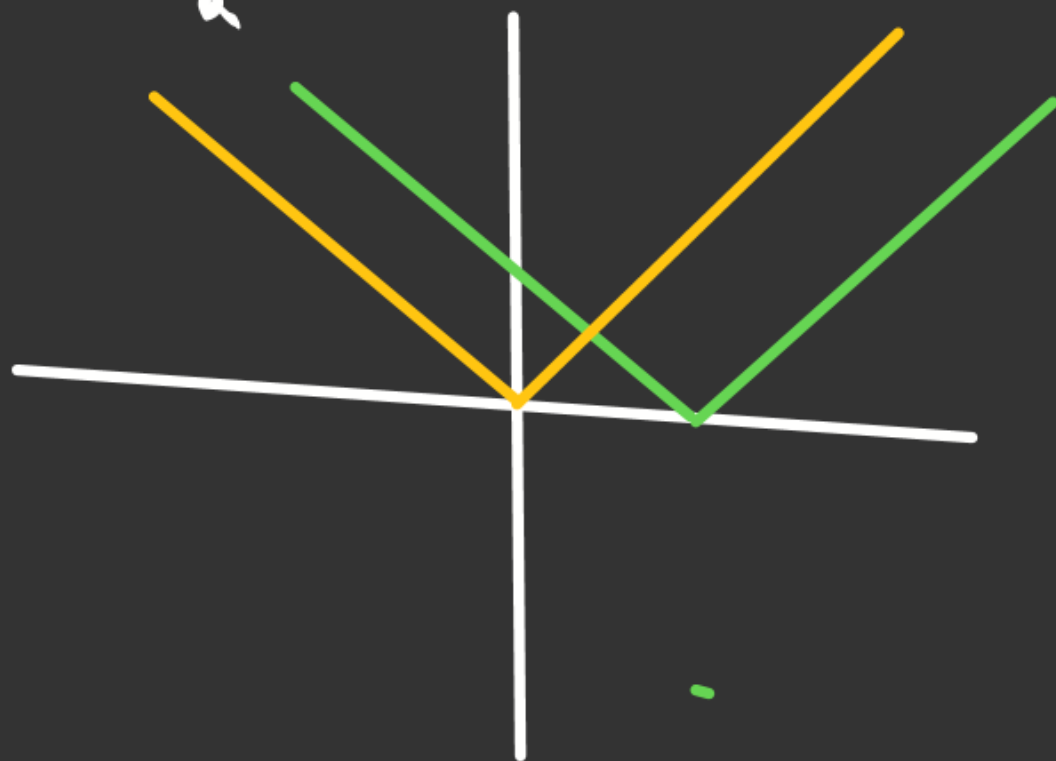
$$f(x) = x \pm |x|$$

$$7 - 9 = -2$$

$$|7 - 9| = 2$$

$$|9 - 7| = 2$$

$$9 - 7 = 2$$



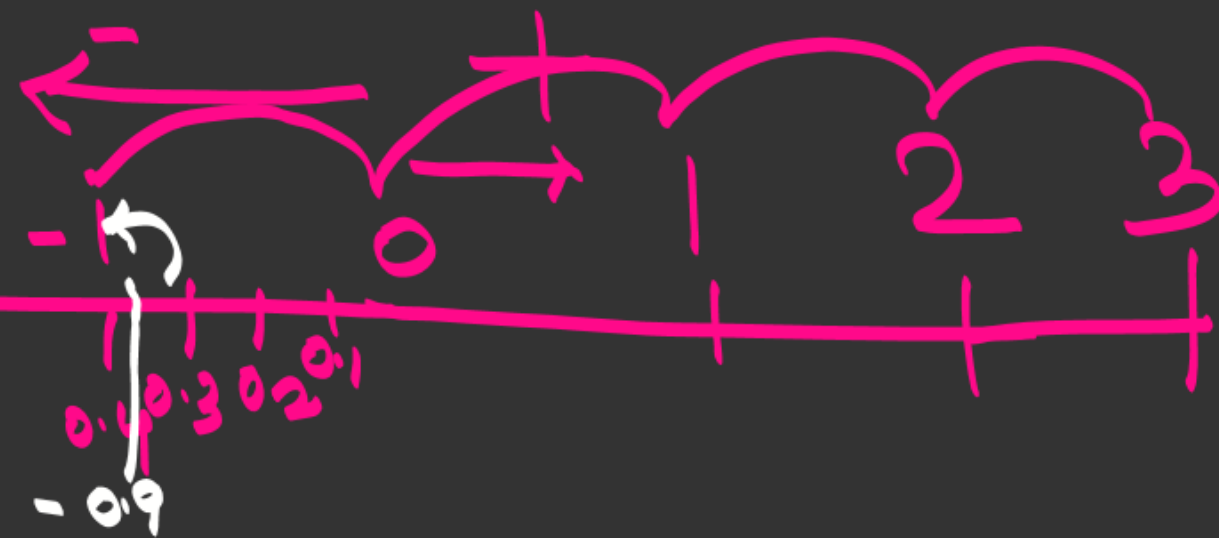
Greatest Integer function :-

$$\begin{aligned} \lceil -4.4 \rceil &= -4 \\ \lfloor -4.7 \rfloor &= -5 \end{aligned}$$

$$\lfloor -4.1 \rfloor = -5$$

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

$$\begin{aligned} \text{integer}(z) &\Rightarrow \left. \begin{aligned} \lfloor 2 \rfloor &= 2 \\ \lfloor 3 \rfloor &= 3 \\ \lfloor 2.4 \rfloor &= 2 \end{aligned} \right\} \\ &\quad \left. \begin{aligned} \lfloor 2.1 \rfloor &= 2 \\ \lfloor 2.3 \rfloor &= 2 \\ \vdots \\ \lfloor 2.9 \rfloor &= 2 \end{aligned} \right\} \end{aligned}$$

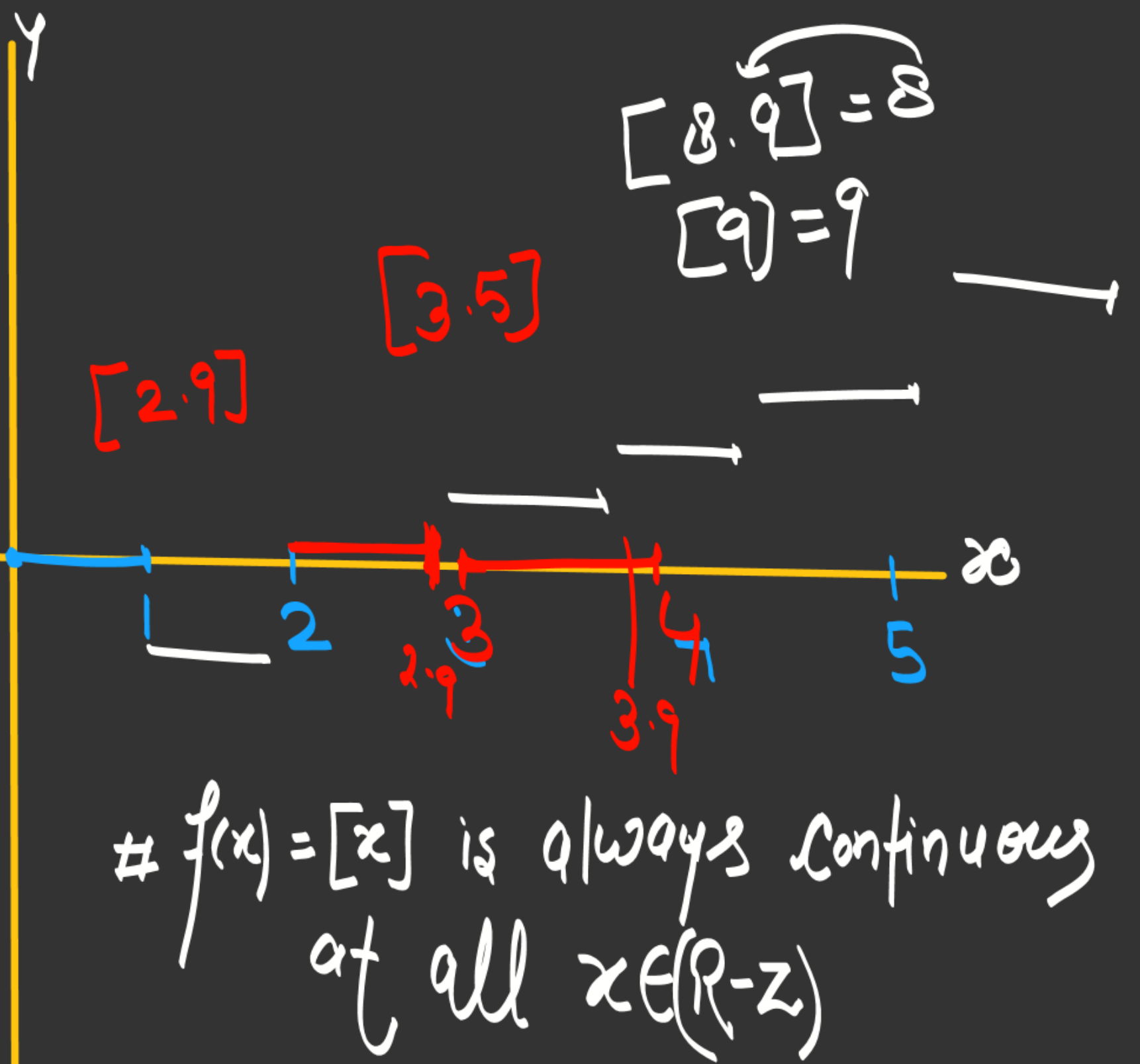


$$\begin{aligned} \lfloor 0.9 \rfloor &\Rightarrow 0 \\ \lfloor -1.9 \rfloor &\Rightarrow -2 \\ \lfloor -0.9 \rfloor &\Rightarrow -1 \\ \lfloor -4.7 \rfloor &\Rightarrow -5 \end{aligned}$$

$$\mathbb{Z} = \text{पूर्णांक}$$

step function

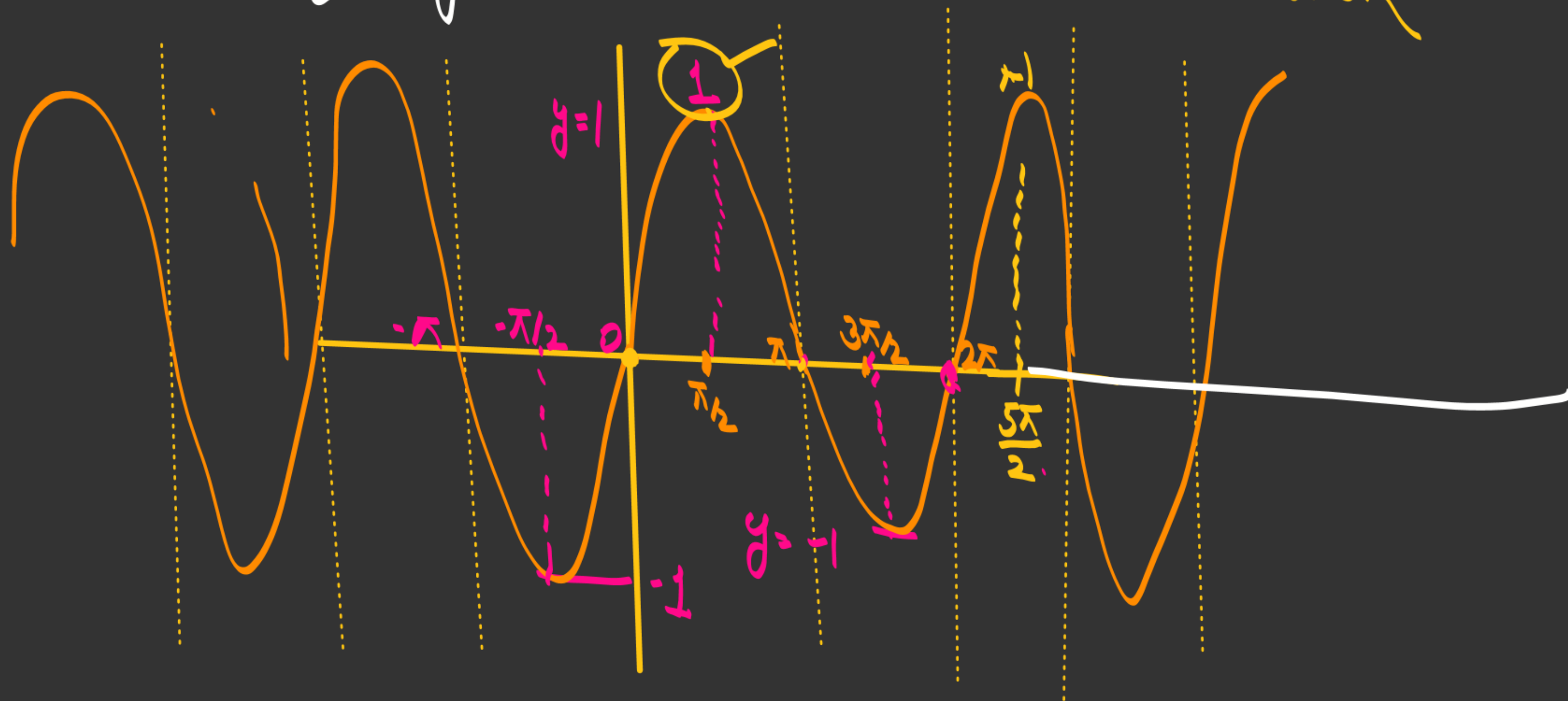
- * Continuous at all $x \in (\mathbb{R} - \mathbb{Z})$
- * Discontinuous at all $x \in \mathbb{Z}$



TRIGONOMETRIC function →

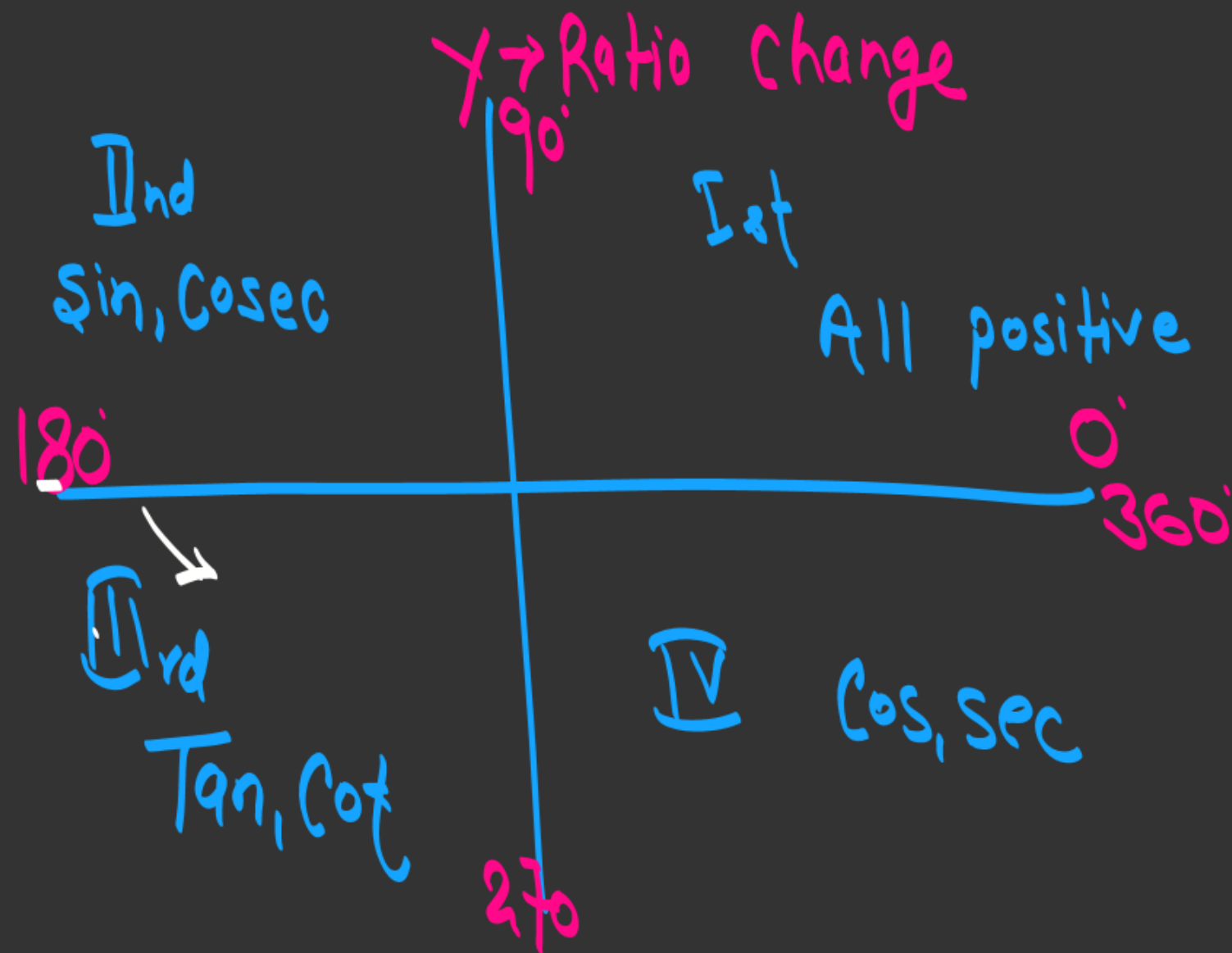
① $f(x) = \sin x$ $\begin{cases} \text{Domain} \rightarrow \mathbb{R} \\ \text{Range} \rightarrow [-1, 1] \end{cases}$

$f(x) = \sin x$ is continuous for all $x \in \mathbb{R}$



	0°	30°	45°	60°	90°	120°	135°	150°	180°
Sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0

$\sin 225^\circ$
 $\sin (180 + 45)$
 $-\sin 45$
 $-\frac{1}{\sqrt{2}}$



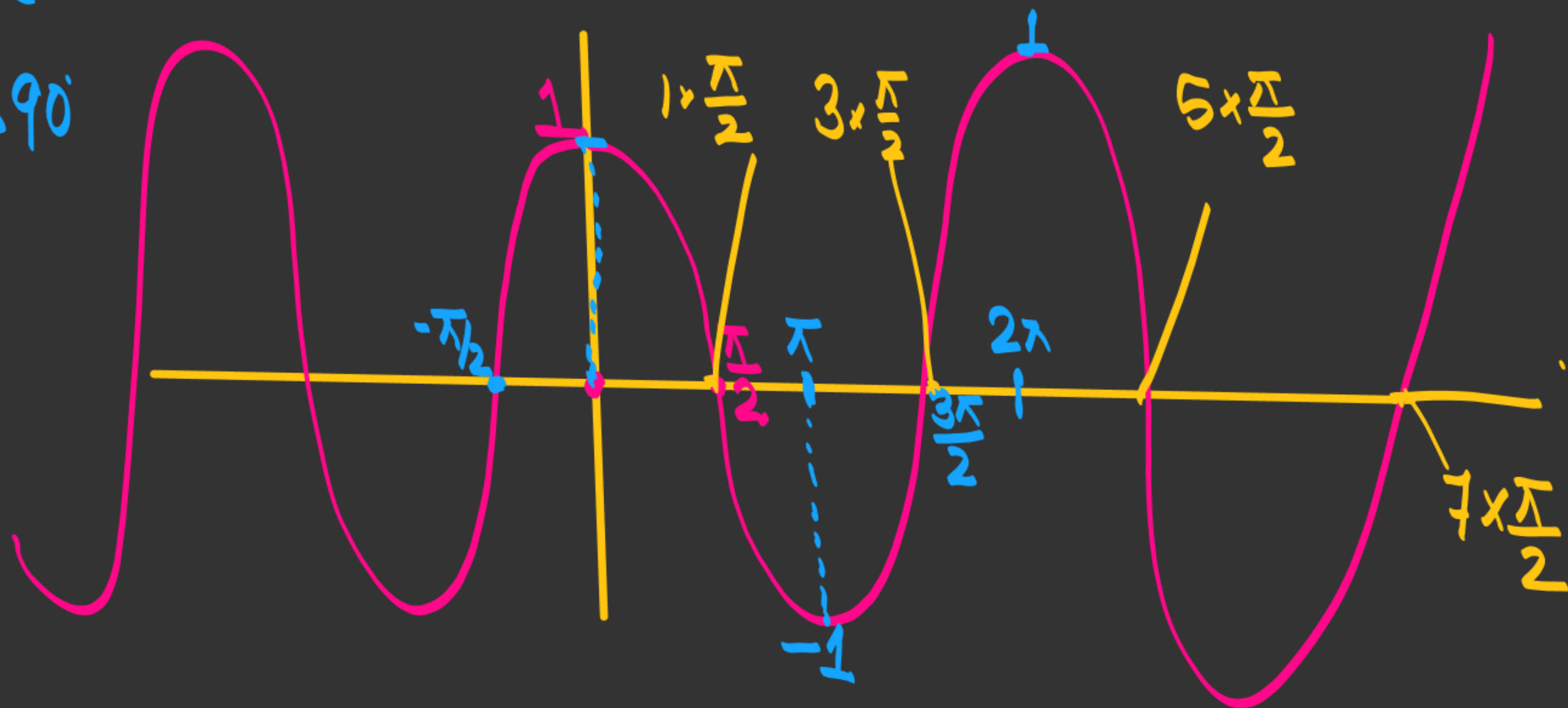
$\sin (120)$
 $\sin (90 + 30)$
 $\cos 30^\circ$
 $\frac{\sqrt{3}}{2}$

$$\# f(x) = \cos x \begin{cases} \rightarrow \text{Domain} \Rightarrow \mathbb{R} \\ \rightarrow \text{Range} \Rightarrow [-1, 1] \end{cases}$$

$f(x) = \cos x$ is continuous for all $x \in \mathbb{R}$

$$\cos(-\theta) = \cos \theta$$

$$\cos(-90) = \cos 90 = 0$$



$$\# f(x) = \tan x = \frac{\sin x}{\cos x}$$

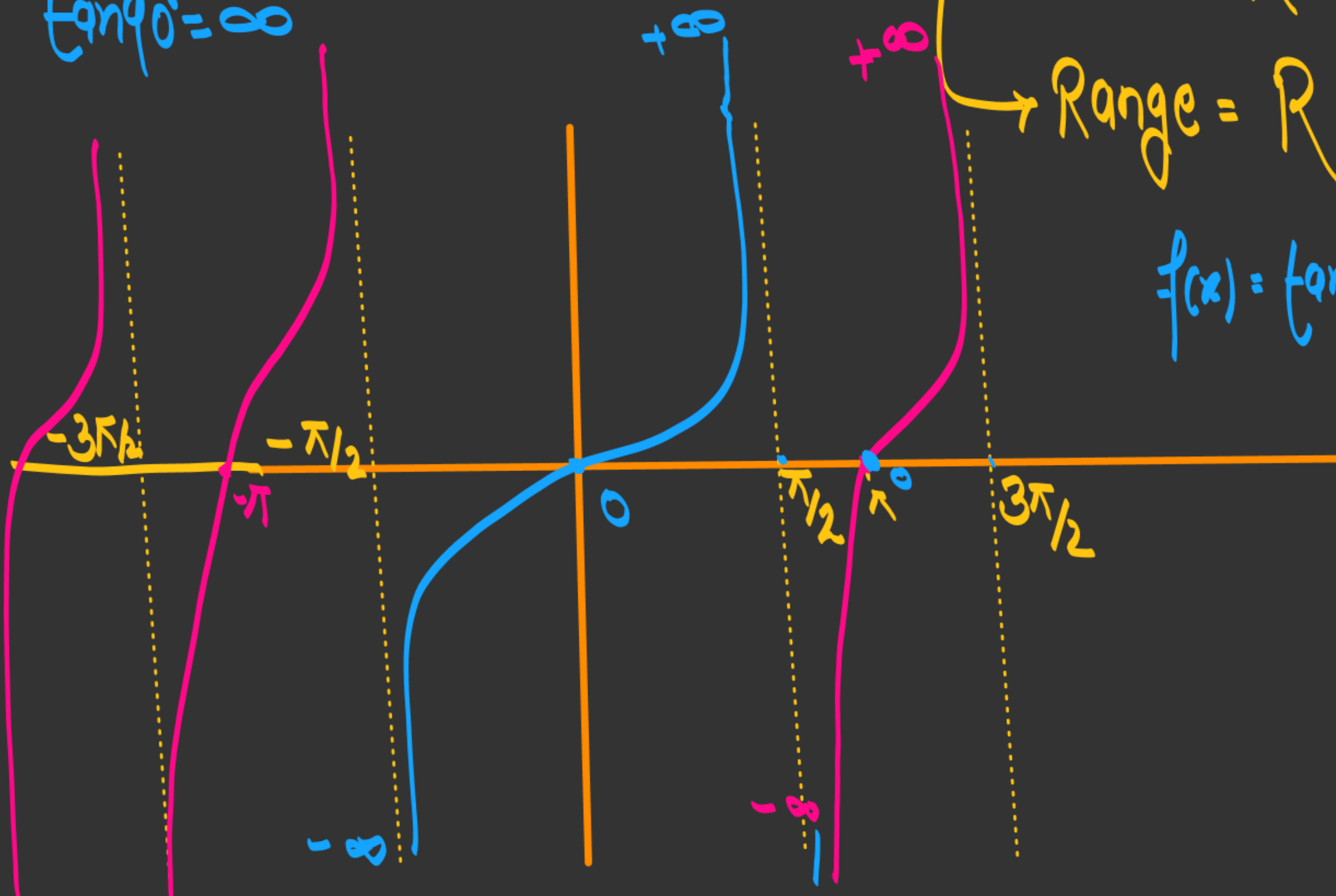
$$\text{Domain} \Rightarrow \mathbb{R} - \left\{ x; \cos x = 0 \right\}$$

$$\hookrightarrow \mathbb{R} - (2n+1)\frac{\pi}{2}$$

$$\text{Range} = \mathbb{R} \rightarrow [-\infty, \infty]$$

$f(x) = \tan x$ is continuous
at $x \in \mathbb{R} - (2n+1)\frac{\pi}{2}$

$$\tan 90^\circ = \infty$$



odd
↓
 90×3
↑
 $\tan 270^\circ = \text{No}$

$$\frac{\pi}{2} \times (2 \times 1 + 1)$$

$$(2n+1) \times \frac{\pi}{2}$$

$$n=1$$

$\tan 1590^\circ = \text{yes}$

$$\cot 0 = \infty$$

$$\cot 90^\circ \Rightarrow \frac{\cos 90^\circ}{\sin 90^\circ} \\ \Rightarrow \frac{0}{1} = 0$$

$$\# f(x) = \cot x = \frac{\cos x}{\sin x}$$

Domain $\rightarrow \mathbb{R} - \{x: \sin x = 0\}$
 $\mathbb{R} - (n\pi)$

Range $\rightarrow \mathbb{R} \Rightarrow [-\infty, \infty]$

$f(x) = \cot x$ is continuous
 for all $x \in \mathbb{R} - (n\pi)$

