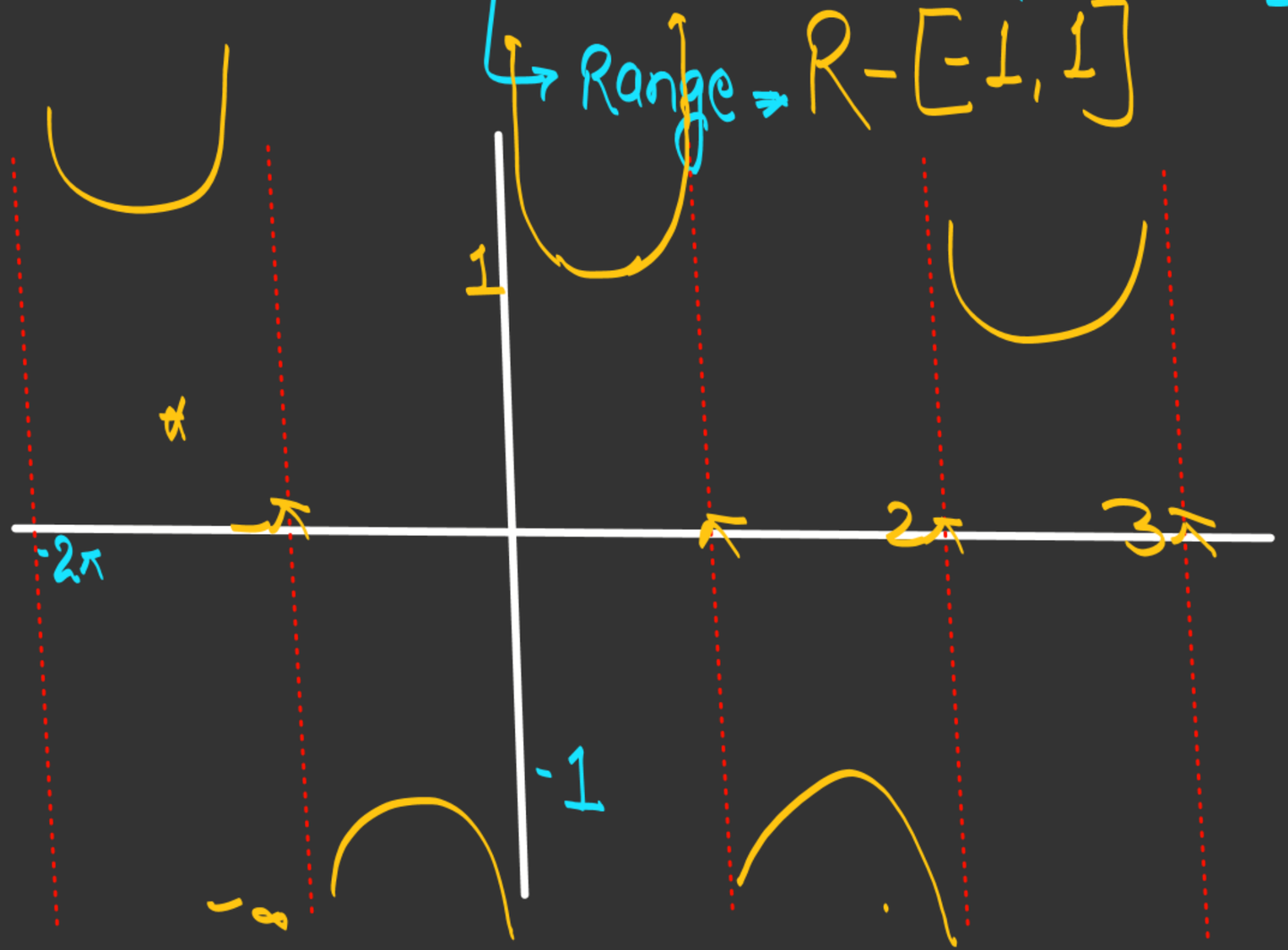
$\sin 0 = 0$
$\sin 180 = 0$
$\sin 360 = 0$
$\sin 540 = 0$
$\sin 720 = 0$
$\sin 900 = 0$

$f(x) = \text{Cosec}\, x \Rightarrow \frac{1}{\sin x}$

↳ Domain → $R - \{x;\ \sin x = 0\}$

↳ Domain → $R - \{n\pi\}$

↳ Range → $R - [-1, 1]$



$\text{Cosec}\, 180 = \frac{1}{\sin 180} = \infty$

$\text{Cosec}\, 0 = \frac{1}{\sin 0} = \frac{1}{0} = \infty$

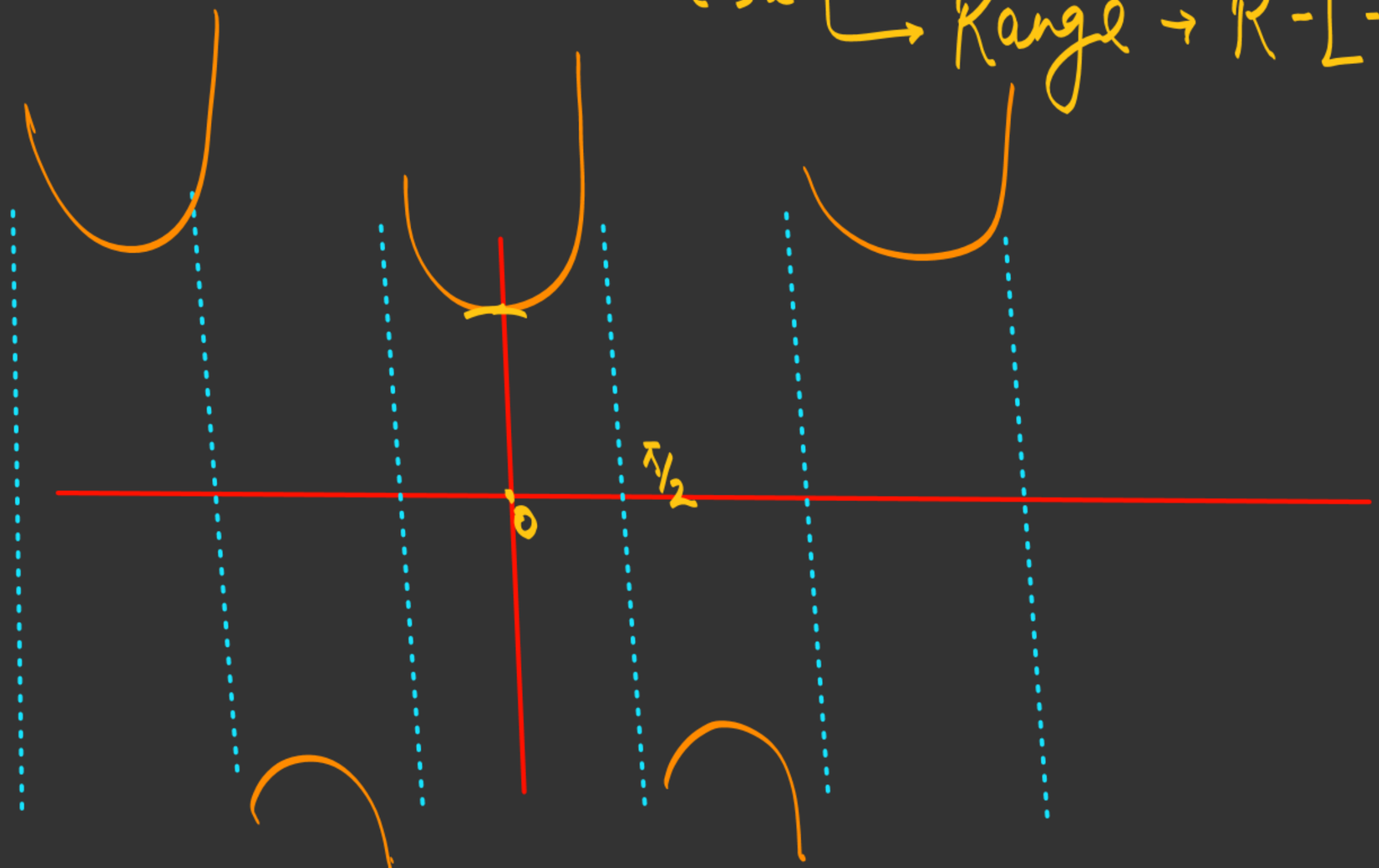
$\text{Cosec}\, 90 = \frac{1}{\sin 90} = \frac{1}{1} = 1$

	$\frac{1}{\sin\theta}$	$\frac{1}{\sin 30}$	$\frac{1}{\sin 45}$	$\frac{1}{\sin 60}$	$\frac{1}{\sin 90}$
	0°	30°	45°	60°	90°
Cosec	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1

Continuous at

$\Rightarrow f(x) = \sec x = \frac{1}{\cos x}$

- Domain $\rightarrow R - (2n+1)\frac{\pi}{2}$
- Range $\rightarrow R - [-1, 1]$



Exponential function (चर घातांकी फलन) →

$f(x) = e^x / a^x / 9^x / 17^x$ are continuous for all $x \in R$

If $f(x) = 15^x$ is continuous then

0.03^x is continuous or not?

↳ will be continuous

Logarithmic function →

$f(x) = \log_a x$ is Continuous at $x \in (0, \infty)$

Differentiation →

$y = f(x) \Rightarrow y' = f'(x)$

Differentiate w.r.t $x \Rightarrow \frac{dy}{dx}$

Differentiate w.r.t $y = \frac{dx}{dy}$

$dy \rightarrow$ little change in y

$dx \rightarrow$ little change in x

Some Basic FORMULAE :-

1. $y = x^n$

$$\frac{dy}{dx} = nx^{n-1}$$

2. $y =$ Constant

$$\frac{dy}{dx} = 0$$

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

$$\frac{dy}{dx} = -\frac{1}{x^2}$$

4. $y = \sqrt{x}$

$$\frac{dy}{dx} = \frac{1}{2\sqrt{x}}$$

$y = \frac{1}{\sqrt{x}}$

$$\frac{dy}{dx} = \frac{-1}{2 \cdot x \cdot \sqrt{x}}$$

5. $y = \sin x$

$$\frac{dy}{dx} = \cos x$$

6. $y = \cos x$

$$\frac{dy}{dx} = -\sin x$$

7. $y = \tan x$

$$\frac{dy}{dx} = \sec^2 x$$

8. $y = \sec x$

$$\frac{dy}{dx} = \sec x \cdot \tan x$$

9. $y = \cot x$

$$\frac{dy}{dx} = -\operatorname{cosec}^2 x$$

10. $y = \operatorname{cosec} x$

$$\frac{dy}{dx} = -\operatorname{cosec} x \cdot \cot x$$

11. $y = e^x$

$\frac{dy}{dx} = e^x$ (same)

12. $y = a^x$

$\frac{dy}{dx} = a^x \log a$

If $f(x) = 3x^3 + 4x^2 + 5x + 9$ $\quad x^{1-1} = x^0 = 1$

$f'(x) = ?$

$f'(x) = \frac{d}{dx}(3x^3) + \frac{d}{dx}(4x^2) + \frac{d}{dx}(5x) + \frac{d}{dx}(9)$

$9x^2 + 8x + 5 + 0$

#

$$y = \sin^{-1} x$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}$$

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

$$\frac{dy}{dx} = \frac{-1}{\sqrt{1-x^2}}$$

$$y = \tan^{-1} x$$

$$\frac{dy}{dx} = \frac{1}{1+x^2}$$

$$y = \cot^{-1} x$$

$$\frac{dy}{dx} = \frac{-1}{1+x^2}$$

$$y = \sec^{-1} x$$

$$\frac{dy}{dx} = \frac{1}{|x|\sqrt{x^2-1}}$$

$$y = \operatorname{cosec}^{-1} x$$

$$\frac{dy}{dx} = \frac{-1}{|x|\sqrt{x^2-1}}$$

Properties of differentiation :-

* Addition | subtraction property *

$y = u \pm v$

$\frac{dy}{dx} = \frac{du}{dx} \pm \frac{dv}{dx}$

$y = \tan x + e^x$

$\frac{dy}{dx} = \sec^2 x + e^x$

② product Rule → $y = u \cdot v$

$y' = u'v + uv'$

$\frac{dy}{dx} = \frac{du}{dx} \cdot v + u \cdot \frac{dv}{dx}$

$y = \sin x \cdot \log x$

$\frac{dy}{dx} = \cos x \cdot \log x + \frac{1}{x} \cdot \sin x$

$\Rightarrow \cos x \cdot \log x + \frac{\sin x}{x}$

$y = \log x$

$\frac{dy}{dx} = \frac{1}{x}$

③ Division Rule → $y = \frac{u}{v}$

$$\frac{dy}{dx} = \frac{\frac{du}{dx} \cdot v - u \cdot \frac{dv}{dx}}{v^2}$$

$$y = \frac{\sin x}{x}$$

$$\frac{dy}{dx} = \frac{\cos x \cdot x - 1 \cdot \sin x}{x^2}$$

$$\Rightarrow \frac{x\cos x - \sin x}{x^2}$$