Trigonmetry formula :-

1. $\sin\theta = \dfrac{1}{\operatorname{cosec}\theta}$

2. $\sin^2\theta + \cos^2\theta = 1$

3. $1 + \tan^2\theta = \sec^2\theta$

4. $1 + \cot^2\theta = \operatorname{cosec}^2\theta$

5. II | I

   III | IV

6. $\sin 2\theta = 2\sin\theta \cdot \cos\theta$

7. $\cos 2\theta = \boxed{\cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta}$

★ $\dfrac{\sin 1/h}{1/h} = 1$

★ L.H. Rule $\rightarrow$ $\dfrac{\text{Neu}}{\text{Den}} \rightarrow x \rightarrow 1$

1. $\tan 2\theta = \dfrac{2\tan\theta}{1-\tan^2\theta}$

$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$

2. $\sin 2\theta = \dfrac{2\tan\theta}{1+\tan^2\theta}$

3. $\cos 2\theta = \dfrac{1-\tan^2\theta}{1+\tan^2\theta}$

4. $\sin 3\theta = 3\sin\theta - 4\sin^3\theta$

5. $\cos 3\theta = 4\cos^3\theta - 3\cos\theta$

6. $\tan 3\theta = \dfrac{3\tan\theta - \tan^3\theta}{1-3\tan^2\theta}$

$\sin(A+B) = \sin A\cos B + \cos A\sin B$

$\sin(A-B) = \sin A\cos B - \cos A\sin B$

$\cos(A+B) = \cos A\cos B - \sin A\sin B$

$\cos(A-B) = \cos A\cos B + \sin A\sin B$

$\tan(A+B) = \dfrac{\tan A + \tan B}{1-\tan A\tan B}$

$\tan(A-B) = \dfrac{\tan A - \tan B}{1+\tan A\cdot\tan B}$

$$\# \quad \sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$$

$$\# \quad \sin C - \sin D = 2\cos\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{C-D}{2}\right)$$

$$\# \quad \cos C + \cos D = 2\cos\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$$

$$\# \quad \underline{\cos C - \cos D} = 2\sin\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{D-C}{2}\right)$$

$$\# \quad \cos C - \cos D = -2\sin\left(\frac{C+D}{2}\right)\cdot\left[\sin\left(\frac{C-D}{2}\right)\right]$$

$$\# \quad \underline{\sin(A+B)} + \underline{\sin(A-B)}$$

$$= \sin A\cos B + \cancel{\cos A\sin B} + \sin A\cos B - \cancel{\cos A\sin B}$$

$$\boxed{= 2\sin A\cos B}$$

Conti. & Diff.

$x = \sqrt{a^{\sin^{-1}t}}$

$\Rightarrow x = \left(a^{\sin^{-1}t}\right)^{1/2}$

$$\boxed{x = a^{\frac{1}{2}\sin^{-1}t}}$$

$\rightarrow$ take log:- $\log x = \log a^{\frac{1}{2}\sin^{-1}t}$

$\rightarrow \log x = \frac{1}{2}\sin^{-1}t \log a$

diff$\rightarrow$ $\frac{1}{x} \times \frac{dx}{dt} = \frac{1}{2}\log a \cdot \frac{1}{\sqrt{1-t^2}}$

$\Rightarrow \frac{dx}{dt} = \frac{x}{2}\log a \cdot \frac{1}{\sqrt{1-t^2}}$ — 1

$y = \sqrt{a^{\cos^{-1}t}} = \left(a^{\cos^{-1}t}\right)^{1/2} = a^{\frac{1}{2}\cos^{-1}t}$

$\log y = \log a^{\frac{1}{2}\cos^{-1}t} = \frac{1}{2}\cos^{-1}t \cdot \log a$

$\rightarrow \frac{1}{y} \cdot \frac{dy}{dt} = \frac{1}{2}\log a \frac{-1}{\sqrt{1-t^2}}$

$\rightarrow \frac{dy}{dt} = \frac{y}{2}\log a \cdot \frac{-1}{\sqrt{1-t^2}}$ — 2

so! $\frac{dy}{dx} = \dfrac{\frac{y}{\cancel{2}}\cancel{\log a} \cdot \frac{-1}{\cancel{\sqrt{1-t^2}}}}{\frac{x}{\cancel{2}}\cancel{\log a} \cdot \frac{1}{\cancel{\sqrt{1-t^2}}}} = \frac{-y}{x}$

Ex1- $f(x) = (1+x)(1+x^2)(1+x^4)(1+x^8) \to f'(x)$ & $f'(1)$

Sol^n:- $\log y = \log\left[(1+x)(1+x^2)(1+x^4)(1+x^8)\right]$

$$\log y = \log(1+x) + \log(1+x^2) + \log(1+x^4) + \log(1+x^8)$$

$$\to \frac{1}{y}\cdot\frac{dy}{dx} = \frac{1}{1+x} + \frac{1}{1+x^2}\times 2x + \frac{1}{1+x^4}\times 4x^3 + \frac{1}{1+x^8}\times 8x^7$$

$$\to \frac{dy}{dx} = y\left[\frac{1}{1+x} + \frac{2x}{1+x^2} + \frac{4x^3}{1+x^4} + \frac{8x^7}{1+x^8}\right]$$

$$\to \frac{dy}{dx} = (1+x)(1+x^2)(1+x^4)(1+x^8)\left[\frac{1}{1+x} + \frac{2x}{1+x^2} + \frac{4x^3}{1+x^4} + \frac{8x^7}{1+x^8}\right] — f'(x) \text{ Ans}$$

$$\to f'(1) = 2\times 2\times 2\times 2\left[\frac{1}{2} + \frac{2}{2} + \frac{4}{2} + \frac{8}{2}\right] = \cancel{16}^{\,8}\left[\frac{15}{\cancel{2}}\right] = 120 \text{ Ans}$$

$\sec\theta$

$x = a\sin\theta \qquad\qquad y = b\tan\theta$

$\dfrac{dx}{d\theta} = a\cos\theta \qquad\qquad \dfrac{dy}{d\theta} = b\sec^2\theta$

$\Rightarrow \dfrac{dy}{dx} = \dfrac{b\sec^2\theta}{a\cos\theta} = \dfrac{b}{a}\sec^3\theta$

$\dfrac{dy}{d\theta} = \dfrac{b\sec^2\theta}{a\cdot\cancel{\sec}\theta\cdot\tan\theta} = \dfrac{b}{a}\times\dfrac{1}{\cancel{\cos}\theta}\times\dfrac{\cancel{\cos\theta}}{\sin\theta}$

$= \dfrac{b}{a}\operatorname{cosec}\theta$

$$y = f(x)$$

Diff →

$$\frac{dy}{dx} = y_1 = f'(x)$$

Diff.

$$\frac{d^2y}{dx^2} \quad y_2 \quad f''(x)$$

$$y = x^2$$

$$y_2 = ?$$

$$y_1 = 2x$$

$$y_2 = 2$$