

Differentiating again each term w.r.t. x

$$\Rightarrow (1-x^2)2 \frac{dy}{dx} \frac{d^2y}{dx^2} - 2x \left(\frac{dy}{dx}\right)^2 = m^2 \cdot 2y \frac{dy}{dx}$$

Dividing each term by $2 \frac{dy}{dx}$,

$$\Rightarrow (1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} = m^2 y \quad \text{Proved}$$

30. Select and write the correct option:

(isc Sem 1 – 2021)

Differentiation of $\log(1+x^2)$ with respect to $\tan^{-1} x$ is:

- (a) $\frac{1}{1+x^2}$
- (b) $2x$
- (c) $\frac{-1}{1+x^2}$
- (d) $-2x$

Answer: _____

Solution: (b)

$$\begin{aligned} \text{Let } y &= \log(1+x^2) \quad \text{and } z = \tan^{-1} x \\ \Rightarrow \frac{dy}{dx} &= \frac{1}{1+x^2} \times 2x & \Rightarrow \frac{dy}{dz} &= \frac{1}{1+x^2} \\ \therefore \frac{dy}{dz} &= \frac{\frac{dy}{dx}}{\frac{dz}{dx}} = \frac{\frac{2x}{1+x^2}}{\frac{1}{1+x^2}} = 2x \end{aligned}$$

31. Select and write the correct option:

(isc Sem 1 – 2021)

If $x^2 + y^3 = 42$, then $\frac{dy}{dx}$ is:

- (a) $\frac{dy}{dx} = \frac{-3y^2}{2x}$
- (b) $\frac{dy}{dx} = \frac{3y^2}{2x}$
- (c) $\frac{dy}{dx} = \frac{2x}{3y^2}$
- (d) $\frac{dy}{dx} = \frac{-2x}{3y^2}$

Answer: -----

Solution: (d)

$$\begin{aligned} x^2 + y^3 &= 42 \\ \Rightarrow 2x + 3y^2 \frac{dy}{dx} &= 0 & \text{(Differentiating both sides)} \\ \Rightarrow 3y^2 \frac{dy}{dx} &= -2x \\ \Rightarrow \frac{dy}{dx} &= \frac{-2x}{3y^2} \end{aligned}$$

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