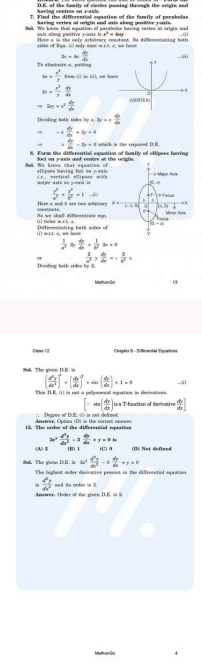


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RD Sharma Solutions Class 12 Ch 11 – Differentiation

Let $y = \sin^{-1} \left\{ \frac{x + \sqrt{1-x^2}}{\sqrt{2}} \right\}$

Put $x = \sin \theta$, so

$$y = \sin^{-1} \left\{ \frac{\sin \theta + \sqrt{1 - \sin^2 \theta}}{\sqrt{2}} \right\}$$

$$= \sin^{-1} \left\{ \frac{\sin \theta + \cos \theta}{\sqrt{2}} \right\}$$

$$= \sin^{-1} \left\{ \sin \theta \left(\frac{1}{\sqrt{2}} \right) + \cos \theta \left(\frac{1}{\sqrt{2}} \right) \right\}$$

$$= \sin^{-1} \left\{ \sin \theta \cos \frac{\pi}{4} + \cos \theta \sin \frac{\pi}{4} \right\}$$

$$y = \sin^{-1} \left\{ \sin \left(\theta + \frac{\pi}{4} \right) \right\} \quad \text{---(i)}$$

Here, $-1 < x < 1$
 $\therefore -1 < \sin \theta < 1$
 $\therefore -\frac{\pi}{2} < \theta < \frac{\pi}{2}$
 $\therefore \left(-\frac{\pi}{2} + \frac{\pi}{4} \right) < \left(\theta + \frac{\pi}{4} \right) < \frac{\pi}{2}$

So, from equation (i),

$$y = \theta + \frac{\pi}{4} \quad \left[\text{Since, } \sin^{-1}(\sin \theta) = \theta, \text{ as } \theta \in \left[-\frac{\pi}{2}, \frac{\pi}{2} \right] \right]$$

$$y = \sin^{-1} x + \frac{\pi}{4} \quad \left[\text{Since, } \sin \theta = x \right]$$

Differentiating it with respect to x ,

$$\frac{dy}{dx} \cdot \frac{1}{\sqrt{1-x^2}} = 0$$

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

Q15

Differentiate $y = \cos^{-1} \left\{ \frac{x + \sqrt{1-x^2}}{\sqrt{2}} \right\} - 1$, $x < 1$ with respect to x .

Solution

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MISCELLANEOUS EXERCISE

1. For each of the differential equations given below, indicate its order and degree (if defined)

(i) $\frac{d^2y}{dx^2} + 5x \left(\frac{dy}{dx} \right)^2 - 6y = \log x$

(ii) $\left(\frac{dy}{dx} \right)^3 - 4 \left(\frac{dy}{dx} \right)^2 + 7y = \sin x$

(iii) $\frac{d^4y}{dx^4} - \sin \left(\frac{d^3y}{dx^3} \right) = 0$

Sol. (i) The given differential equation is

$$\frac{d^2y}{dx^2} + 5x \left(\frac{dy}{dx} \right)^2 - 6y = \log x$$

The highest order derivative present in this differential equation is $\frac{d^2y}{dx^2}$ and hence order of this differential equation is 2.

The given differential equation is a polynomial equation in derivatives and highest power of the highest order

derivative $\frac{d^2y}{dx^2}$ is 1.

\therefore Order 2, Degree 1.

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