

Higher Order Derivatives Ex 12.1 Q3

$$y = x + tan x$$

differentiating both sides w.r.tx

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

differentiating w.r.tx

$$\Rightarrow \frac{d^2y}{dy^2} = 0 + 2\sec^2 x \tan x$$

$$\Rightarrow \frac{d^2y}{dx^2} = \frac{2\sin x}{\cos^3 x}$$

$$\Rightarrow cos^2 x \frac{d^2 y}{dx^2} = 2 tan x + 2x - 2x$$

$$\Rightarrow cos^2 \times \frac{d^2y}{dx^2} = 2(x + tan x) - 2x$$

$$\Rightarrow cos^2 x \frac{d^2y}{dx^2} = 2y - 2x$$

$$\Rightarrow cos^2 x \frac{d^2y}{dx^2} - 2y + 2x = 0$$

Higher Order Derivatives Ex 12.1 Q4

$$y = x^3 \log x$$

differentiating w.r.tx

$$\Rightarrow \frac{dy}{dx} = 3x^2 \log x + \frac{x^3}{x}$$

$$\Rightarrow \frac{dy}{dx} = 3x^2 \log x + x^2$$

differentiating w.r.t.x

$$\Rightarrow \frac{d^2y}{dx^2} = (\log x)(3 \times 2x) + \frac{3x^2}{x} + 2x$$

$$\Rightarrow \frac{d^2y}{dx^2} = 6 \times \log x + 5x$$

-differentiating w.r.t*x* 

$$\Rightarrow \frac{d^3y}{dx^3} = \frac{6x}{x} + 6\log x + 5$$

$$\Rightarrow \frac{d^3y}{dx^3} = 6\log x + 11$$

differentiating w.r.tx

$$\Rightarrow \frac{d^4y}{dx^4} = \frac{6}{x} + 0$$

$$\Rightarrow \frac{d^4y}{dx^4} = \frac{6}{x}$$

Higher Order Derivatives Ex 12.1 Q5

$$y = log(sinx)$$

differentiating w.r.t.x

$$\Rightarrow \frac{dy}{dx} = \frac{d(\log(\sin x))}{d(\sin x)} \times \frac{d(\sin x)}{dx} \text{ (chain rule)}$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{\sin x} \times \cos x = \cot x$$

differentiating w.r.t.x

$$\Rightarrow \frac{d^2y}{dx^2} = -\cos ec^2x$$

differentiating w.r.t x

$$\Rightarrow \frac{d^3y}{dx^3} = (-2\cos ecx) \times (-\cot x \cos ecx)$$

$$\Rightarrow \frac{d^3y}{dx^3} = \frac{2\cos ec^2\cos x}{\sin x}$$

$$\Rightarrow \frac{d^3y}{dx^3} = 2\cos ec^3x \cos x$$

Higher Order Derivatives Ex 12.1 Q6

$$y = 2\sin x + 3\cos x$$

differentiating w.r.t.x

$$\Rightarrow \frac{dy}{dx} = 2\cos x + 3(-\sin x) = 2\cos x - 3\sin x$$

differentiating w.r.t.x

$$\Rightarrow \frac{d^2y}{dx^2} = 2\left(-\sin x\right) - 3\cos x = -\left(2\sin x + 3\cos x\right) = -y$$

$$\Rightarrow \frac{d^2y}{dx^2} + y = 0$$

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