Differentiate the functions given in Exercise 1 to 11 w.r.t x.

QNo. 1 $\cos x \cdot \cos 2x \cdot \cos 3x$.

Sol Let $y = \cos x \cos 2x \cos 3x$

Taking log on both sides

$$\log y = \log(\cos x) + \log(\cos 2x) + \log(\cos 3x)$$

$(\because \log(mn) = \log m + \log n)$

Differentiating both sides

$$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{1}{\cos x}\cdot\frac{d}{dx}(\cos x) + \frac{1}{\cos 2x}\cdot\frac{d}{dx}(\cos 2x) + \frac{1}{\cos 3x}\cdot\frac{d}{dx}(\cos 3x)$$

$$\Rightarrow \frac{1}{y}\cdot\frac{dy}{dx} = \frac{1}{\cos x}(-\sin x) + \frac{1}{\cos 2x}(-\sin 2x \cdot 2) + \frac{1}{\cos 3x}(-\sin 3x \cdot 3)$$

$$\Rightarrow \frac{1}{y}\frac{dy}{dx} = -\tan x - 2\tan 2x - 3\tan 3x$$

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

$$= -\cos x \cdot \cos 2x \cos 3x (\tan x + 2\tan 2x + 3\tan 3x)$$

QNo 2 $\sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$

Sol

Let $y = \sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}} = \left[\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}\right]^{1/2}$.

Taking log on both sides

$$\log y = \frac{1}{2}\left[\log(x-1) + \log(x-2) - \log(x-3) - \log(x-4) - \log(x-5)\right]$$

Differentiating both sides w.r.t x

$$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{1}{2}\left[\frac{1}{(x-1)}(1-0) + \frac{1}{(x-2)}(1-0) - \frac{1}{x-3}(1-0) - \frac{1}{x-4}(1-0) - \frac{1}{x-5}(1-0)\right]$$

$$\frac{dy}{dx} = \frac{y}{2}\left[\left(\frac{1}{x-1} + \frac{1}{x-2}\right) - \left(\frac{1}{x-3} + \frac{1}{x-4} + \frac{1}{x-5}\right)\right]$$

$$\therefore \frac{dy}{dx} = \frac{1}{2}\sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}\left[\left(\frac{1}{x-1}+\frac{1}{x-2}\right)-\left(\frac{1}{x-3}+\frac{1}{x-4}+\frac{1}{x-5}\right)\right]$$

Q No. 3 $(\log x)^{\cos x}$

Sol. Let $y = (\log x)^{\cos x}$.

Taking log on both sides.

$$\log y = \cos x \log(\log x)$$

Diffentiating both sides

$$\frac{1}{y}\cdot\frac{dy}{dx} = \cos x \cdot \frac{d}{dx}\log(\log x) + \log(\log x)\frac{d}{dx}(\cos x)$$

$$= \cos x \cdot \frac{1}{\log x}\cdot\frac{1}{x} + \log(\log x)(-\sin x)$$

$$= \frac{\cos x}{x\log x} - \sin x \log(\log x)$$

$$\Rightarrow \frac{dy}{dx} = y\left(\frac{\cos x}{x\log x} - \sin x\log(\log x)\right)$$

$$= (\log x)^{\cos x}\left[\frac{\cos x}{x\log x} - \sin x\log(\log x)\right]$$

Q No. 4: $x^x - 2^{\sin x}$.

Sol Let $y = u - v$ where $u = x^x$ $v = 2^{\sin x}$

So that $\frac{dy}{dx} = \frac{du}{dx} - \frac{dv}{dx}$. ....(1)

Now $u = x^x$

Taking log on both sides we get

$$\log u = x\log x$$

Differentiating both sides, we get

$$\frac{1}{u}\cdot\frac{du}{dx} = x\cdot\frac{1}{x} + \log x\cdot 1$$

$$\therefore \frac{du}{dx} = u[1+\log x] = x^x[1+\log x]$$

Also $\frac{dv}{dx} = 2^{\sin x}\cdot\log 2\cdot\frac{d}{dx}(\sin x) = \log 2\cdot 2^{\sin x}\cdot\cos x$

$\therefore$ From (1) $\frac{dy}{dx} = x^x(1+\log x) - 2^{\sin x}\cos x \log 2.$

Q No. 5: $(x+3)^2(x+4)^3(x+5)^4$

Sol. Let $y = (x+3)^2(x+4)^3(x+5)^4$

Taking log on both sides

$$\log y = \log(x+3)^2 + \log(x+4)^3 + \log(x+5)^4$$

ie $$\log y = 2\log(x+3) + 3\log(x+4) + 4\log(x+5)$$

Differentiating both sides w.r.t x

$$\frac{1}{y}\frac{dy}{dx} = 2\cdot\frac{1}{x+3}(1+0) + 3\cdot\frac{1}{x+4}(1+0) + 4\cdot\frac{1}{x+5}(1+0)$$

i.e $$\frac{1}{y}\frac{dy}{dx} = \frac{2}{x+3} + \frac{3}{x+4} + \frac{4}{x+5}$$

$$\Rightarrow \frac{dy}{dx} = y\left[\frac{2}{x+3} + \frac{3}{x+4} + \frac{4}{x+5}\right] = (x+3)^2(x+4)^3(x+5)^4\left[\frac{2}{x+3} + \frac{3}{x+4} + \frac{4}{x+5}\right]$$

Q No. 6. $\left(x+\frac{1}{x}\right)^x + \left(x^{\left(1+\frac{1}{x}\right)}\right)$

Sol. Let $y = u+v$ where $u = \left(x+\frac{1}{x}\right)^x$; $v = x^{\left(1+\frac{1}{x}\right)}$

So that $\frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}$ ----(1)

Now $$u = \left(x+\frac{1}{x}\right)^x$$

Taking log on both sides

$$\log u = \log\left(x+\frac{1}{x}\right)^x = x\log\left(x+\frac{1}{x}\right)$$

Differenting both sides w.r.t x.

$$\frac{1}{u}\cdot\frac{du}{dx} = x\cdot\frac{d}{dx}\log\left(x+\frac{1}{x}\right) + \log\left(x+\frac{1}{x}\right)\cdot\frac{d}{dx}(x)$$

ie $$\frac{1}{u}\cdot\frac{du}{dx} = x\cdot\frac{1}{x+\frac{1}{x}}\cdot\frac{d}{dx}\left(x+\frac{1}{x}\right) + \log\left(x+\frac{1}{x}\right)\cdot 1$$

$$= \frac{x^2}{x^2+1}\left(1-\frac{1}{x^2}\right) + \log\left(x+\frac{1}{x}\right) \quad \left[\because \frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}\right]$$

$$= \frac{x^2-1}{x^2+1} + \log\left(x+\frac{1}{x}\right) = \frac{x^2-1}{x^2+1} + \log\left(\frac{x^2+1}{x}\right)$$

$$\Rightarrow \frac{du}{dx} = u\left[\frac{x^2-1}{x^2+1} + \log\left(\frac{x^2+1}{x}\right)\right] = \left(x+\frac{1}{x}\right)^x\left[\frac{x^2-1}{x^2+1} + \log\left(\frac{x^2+1}{x}\right)\right]$$

And $\quad v = x^{\left(1+\frac{1}{x}\right)}$

Taking log on both sides

$$\log v = \log x^{(1+1/x)} = \left(1+\frac{1}{x}\right)\log x$$

Differentiating both sides w.r.t. x.

$$\frac{1}{v}\cdot\frac{dv}{dx} = \left(1+\frac{1}{x}\right)\frac{d}{dx}(\log x) + \log x \frac{d}{dx}\left(1+\frac{1}{x}\right)$$

$$= \left(1+\frac{1}{x}\right)\cdot\frac{1}{x} + \log x\cdot\left(0-\frac{1}{x^2}\right)$$

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

$$\therefore \frac{dv}{dx} = v\cdot\left(\frac{x+1}{x^2} - \frac{1}{x^2}\log x\right) = x^{\left(1+\frac{1}{x}\right)}\left[\frac{x+1}{x^2} - \frac{1}{x^2}\log x\right]$$

$\therefore$ From (1) $\quad \frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}.$

$$\Rightarrow \frac{dy}{dx} = \left(x+\frac{1}{x}\right)^x\left[\frac{x^2-1}{x^2+1} + \log\left(\frac{x^2+1}{x}\right)\right] + x^{\left(1+\frac{1}{x}\right)}\left[\frac{x+1}{x^2} - \frac{1}{x^2}\log x\right]$$

Q No 7 $\quad (\log x)^x + x^{\log x}.$

Sol: Let $y = u+v$ where $u = (\log x)^x$ and $v = x^{\log x}$

$$\therefore \frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}. \quad \cdots\cdots(1)$$

Now. $\quad u = (\log x)^x$

$$\Rightarrow \log u = x\log(\log x) \qquad \text{[Taking log on both side]}$$

$$\Rightarrow \frac{1}{u}\cdot\frac{du}{dx} = x\frac{d}{dx}(\log(\log x)) + \log(\log x)\cdot\frac{d}{dx}(x)$$

$$\Rightarrow \frac{du}{dx} = u\left[x\cdot\frac{1}{\log x}\cdot\frac{1}{x} + \log(\log x)\cdot 1\right]$$

$$\Rightarrow \frac{du}{dx} = (\log x)^x\left[\frac{1}{\log x} + \log(\log x)\right]$$

And $v = (x)^{\log x}$

$\Rightarrow \log v = \log x \cdot \log x$ [Taking log]

$\Rightarrow \log v = (\log x)^2$

$\Rightarrow \frac{1}{v} \cdot \frac{dv}{dx} = 2 \cdot \log x \cdot \frac{1}{x}$

$\Rightarrow \frac{dv}{dx} = v\left(\frac{2\log x}{x}\right) = 2\left(\frac{\log x}{x}\right) \cdot x^{\log x}$.

$\therefore$ from (1) $\frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}$

$\Rightarrow \frac{dy}{dx} = (\log x)^x\left[\frac{1}{\log x} + \log(\log x)\right] + 2\left(\frac{\log x}{x}\right) \cdot x^{\log x}$

QNo. 8: $(\sin x)^x + \sin^{-1}(\sqrt{x})$

NOTE We can also use the result $\frac{d}{dx}(u^v) = u^v \frac{d}{dx}(v \log u)$

$\therefore \frac{d}{dx}\left[(\sin x)^x + \sin^{-1}\sqrt{x}\right] = \frac{d}{dx}(\sin x)^x + \frac{d}{dx}\left(\sin^{-1}(x)^{1/2}\right)$

$= (\sin x)^x \cdot \frac{d}{dx}(x \log \sin x) + \frac{1}{\sqrt{1-(x^{1/2})^2}} \cdot \frac{d}{dx}(x)^{1/2}$

$= (\sin x)^x\left[x \cdot \frac{1}{\sin x} \cos x + \log(\sin x) \cdot 1\right] + \frac{1}{\sqrt{1-x}} \cdot \frac{1}{2} x^{-1/2}$

$= (\sin x)^x\left[x \cdot \cot x + \log(\sin x)\right] + \frac{1}{2\sqrt{x}\sqrt{1-x}}$

QNo 9: $x^{\sin x} + (\sin x)^{\cos x}$.

$\because \frac{d}{dx}(u^v) = u^v \cdot \frac{d}{dx}[v \log u]$

$\therefore \frac{d}{dx}\left[x^{\sin x} + (\sin x)^{\cos x}\right] = \frac{d}{dx}(x^{\sin x}) + \frac{d}{dx}(\sin x^{\cos x})$

$$= x^{\sin x}\left[\sin x \cdot \log x\right] + (\sin x)^{\cos x}\left[\cos x \log(\sin x)\right]$$

$$= x^{\sin x}\left[\sin x \cdot \frac{1}{x} + \log x \cdot \cos x\right] + (\sin x)^{\cos x}\left[\cos x \cdot \frac{1}{\sin x} \cdot \cos x + \log(\sin x)(-\sin x)\right]$$

$$= x^{\sin x}\left[\frac{\sin x}{x} + (\log x)(\cos x)\right] + (\sin x)^{\cos x}\left[\cos x \cot x - (\sin x)\log(\sin x)\right]$$

Q No. 10 $x^{x\cos x} + \frac{x^2+1}{x^2-1}$

$$\therefore \frac{d}{dx}\left[x^{x\cos x} + \frac{x^2+1}{x^2-1}\right] = \frac{d}{dx}\left[x^{x\cos x}\right] + \frac{d}{dx}\left[\frac{x^2+1}{x^2-1}\right]$$

$$= x^{x\cos x}\left[x\cos x \cdot \log x\right] + \frac{(x^2-1)\frac{d}{dx}(x^2+1) - (x^2+1)\frac{d}{dx}(x^2-1)}{(x^2-1)^2}$$

$$= x^{x\cos x}\left[x \cdot \cos x \cdot \frac{1}{x} + \log x\left[x(-\sin x) + \cos x \cdot 1\right]\right] + \frac{(x^2-1)(2x) - (x^2+1)(2x)}{(x^2-1)^2}$$

$$= x^{x\cos x}\left[\frac{x\cos x}{x} + \log x(-x\sin x + \cos x)\right] + \frac{-4x}{(x^2-1)^2}$$

Q No 11 $\frac{d}{dx}\left[(x\cos x)^x + (x\sin x)^{1/x}\right] = \frac{d}{dx}(x\cos x)^x + \frac{d}{dx}(x\sin x)^{1/x}$

$$= (x\cos x)^x \frac{d}{dx}\left[x \cdot \log(x\cos x)\right] + (x\sin x)^{1/x}\frac{d}{dx}\left[\frac{1}{x}\log(x\sin x)\right]$$

$$\left[\because \frac{d}{dx}(u^v) = u^v \cdot \frac{d}{dx}(v \log u)\right]$$

$$= (x\cos x)^x\left[x \cdot \frac{1}{x\cos x}\left[x(-\sin x) + \cos x \cdot 1\right] + \log(x\cos x) \cdot 1\right] + (x\sin x)^{1/2}\left[\frac{1}{x} \cdot \frac{1}{x\sin x}\left[x\cos x + \sin x \cdot 1\right] + \log(x\sin x)(-1/x^2)\right]$$

$$= (x\cos x)^x\left[\frac{\cos x - x\sin x}{\cos x} + \log(x\cos x)\right] + (x\sin x)^{1/2}\left[\frac{\sin x + x\cos x}{x^2\sin x} - \frac{\log(x\sin x)}{x^2}\right]$$

Find $\frac{dy}{dx}$ of the functions given in exercise 12 to 15

Q.No 12 $x^y + y^x = 1$

differentiating both sides we get.

$$\frac{d}{dx}(x^y+y^x) = 0 \Rightarrow \frac{d}{dx}(x^y) + \frac{d}{dx}(y^x) = 0$$

$$\Rightarrow x^y \cdot \frac{d}{dx}(y\log x) + y^x \cdot \frac{d}{dx}(x\log y) = 0 \quad \left[\because \frac{d}{dx}(u^v) = u^v \cdot \frac{d}{dx}(v\log u)\right]$$

$$\Rightarrow x^y\left[y\cdot\frac{1}{x} + \log x \cdot \frac{dy}{dx}\right] + y^x\left[x\cdot\frac{1}{y}\cdot\frac{dy}{dx} + \log y\right] = 0$$

$$\Rightarrow y x^{y-1} + x^y \log x \cdot \frac{dy}{dx} + x y^{x-1}\frac{dy}{dx} + y^x \log y = 0$$

$$\Rightarrow \left(x^y\log x + x y^{x-1}\right)\frac{dy}{dx} = -y x^{y-1} - y^x \log y$$

$$\Rightarrow \frac{dy}{dx} = -\left(\frac{y x^{y-1} + y^x \log y}{x^y \log x + x y^{x-1}}\right)$$

Q.No. 13 Given $y^x = x^y$.

Taking log we get $x\log y = y\log x$

Differentiating both sides

$$x\left(\frac{1}{y}\right)\frac{dy}{dx} + \log y \cdot 1 = y\cdot\frac{1}{x} + (\log x)\frac{dy}{dx}$$

$$\Rightarrow \frac{x}{y}\frac{dy}{dx} - (\log x)\frac{dy}{dx} = \frac{y}{x} - \log y$$

$$\Rightarrow \left(\frac{x}{y} - \log x\right)\frac{dy}{dx} = \frac{y}{x} - \log y \Rightarrow \left(\frac{x - y\log x}{y}\right)\frac{dy}{dx} = \frac{y - x\log y}{x}$$

$$\Rightarrow \frac{dy}{dx} = \frac{y - x\log y}{x} \times \frac{y}{x - y\log x} = \frac{y}{x}\left(\frac{y - x\log y}{x - y\log x}\right)$$

QNo 14 $\quad (\cos x)^y = (\cos y)^x$

$\Rightarrow \quad y\log(\cos x) = x \cdot \log(\cos y)$ [Taking log on both sides

Differenting both sides w.r.t. x.

$$y\left(\frac{1}{\cos x}\right)(-\sin x) + \log(\cos x)\cdot\frac{dy}{dx} = x\left(\frac{1}{\cos y}\right)(-\sin y)\cdot\frac{dy}{dx} + \log(\cos y)$$

$$\Rightarrow \log(\cos x)\frac{dy}{dx} + x\tan y\frac{dy}{dx} = \log(\cos y) + y\tan x$$

$$\Rightarrow \left(\log(\cos x) + x\tan y\right)\frac{dy}{dx} = \log(\cos y) + y\tan x$$

$$\Rightarrow \frac{dy}{dx} = \frac{\log(\cos y) + y\tan x}{\log(\cos x) + x\cdot\tan y}.$$

QNo. 15 $\quad xy = e^{x-y}$.

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

$$\Rightarrow x\frac{dy}{dx} + y = e^{x-y}\left(1 - \frac{dy}{dx}\right)$$

or. $\quad x\dfrac{dy}{dx} + e^{x-y}\dfrac{dy}{dx} = e^{x-y} - y.$

or $\quad \dfrac{dy}{dx}\left(x + e^{x-y}\right) = e^{x-y} - y.$

$$\Rightarrow \frac{dy}{dx} = \left[\frac{e^{x-y} - y}{x + e^{x-y}}\right] \Rightarrow \frac{dy}{dx} = \left[\frac{xy - y}{x + xy}\right] \quad \left[\because e^{x-y} \underset{\text{Given}}{=} xy\right]$$

$$\Rightarrow \frac{dy}{dx} = \frac{y(x-1)}{x(1+y)}$$

QNo 16: Find the derivative of the function given by $f(x) = (1+x)(1+x^2)(1+x^4)(1+x^8)$ and hence find $f'(1)$

Sol: Taking log on both sides, we get

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

$$[\because \log(mn) = \log m + \log n]$$

Differentiating both sides, We get.

$$\frac{1}{f(x)} \cdot f'(x) = \frac{1}{1+x}(0+1) + \frac{1}{1+x^2}(0+2x) + \frac{1}{1+x^4}(0+4x^3) + \frac{1}{1+x^8} \cdot (0+8x^7)$$

$$\therefore f'(x) = f(x)\left[\frac{1}{1+x} + \frac{2x}{1+x^2} + \frac{4x^3}{1+x^4} + \frac{8x^7}{1+x^8}\right]$$

$$\therefore f'(1) = f(1)\left[\frac{1}{1+1} + \frac{2\times 1}{1+1^2} + \frac{4(1)^3}{1+(1)^4} + \frac{8(1)^7}{1+(1)^8}\right]$$

$$= \left((1+1)(1+1^2)(1+1^4)(1+1^8)\right)\left[\frac{1}{2} + \frac{2}{2} + \frac{4}{2} + \frac{8}{2}\right]$$

$$= (2\times 2\times 2\times 2)\left(\frac{1+2+4+8}{2}\right) = 2\times 2\times 2\times 15 = 120.$$

Q No. 17 Differentiate $(x^2-5x+8)(x^3+7x+9)$ in three ways as below:

(I) By using Product rule.

(II) By expanding the product to obtain a single polynomial

(iii) By logarithmic differentiation.

Do they all give the same answer.?

Sol. Let $y = (x^2-5x+8)(x^3+7x+9)$

(I) Using product rule $\frac{dy}{dx} = (x^2-5x+8)\left(\frac{d}{dx}(x^3+7x+9)\right) + (x^3+7x+9)\frac{d}{dx}(x^2-5x+8)$

$$\Rightarrow \frac{dy}{dx} = (x^2-5x+8)(3x^2+7) + (x^3+7x+9)(2x-5)$$

$$= 3x^4 - 15x^3 + 24x^2 + 7x^2 - 35x + 56 + 2x^4 + 14x^2 + 18x - 5x^3 - 35x - 45$$

$$= 5x^4 - 20x^3 + 45x^2 - 52x + 11$$

(II) $y = (x^2-5x+8)(x^3+7x+9) = x^5 - 5x^4 + 15x^3 - 26x^2 + 11x + 72$

$$\therefore \frac{dy}{dx} = 5x^4 - 20x^3 + 45x^2 - 52x + 11$$

(iii) Taking log on both sides

$\log y = \log(x^2-5x+8) + \log(x^3+7x+9)$

$\Rightarrow \frac{1}{y}\frac{dy}{dx} = \frac{2x-5}{x^2-5x+8} + \frac{3x^2+7}{x^3+7x+9} \Rightarrow \frac{dy}{dx} = y\left[\frac{(2x-5)(x^3+7x+9) + (3x^2+7)(x^2-5x+8)}{(x^2-5x+8)(x^3+7x+9)}\right]$

$= (2x-5)(x^3+7x+9) + (3x^2+7)(x^2-5x+8)$

$= 2x^4 + 14x^2 + 18x - 5x^3 - 35x - 45 + 3x^4 - 15x^3 + 24x^2 + 7x^2 - 35x + 56$

$= 5x^4 - 20x^3 + 45x^2 - 52x + 1$

We find that result obtained is same in every case.

Q.No. 18: If u, v, w are functions of x, then show that

$\frac{d}{dx}(u.v.w) = \frac{du}{dx}(v.w) + u.\frac{dv}{dx}.w + u.v\frac{dw}{dx}$ in two ways.

- first by repeated application of product rule, second by logarithmic differentiation.

Sol. First we use Product Rule and find that

$\frac{d}{dx}(uvw) = \frac{d}{dx}\left[(uv).w\right] = uv.\frac{dw}{dx} + w.\frac{d}{dx}(uv)$

$= uv.\frac{dw}{dx} + w\left[u.\frac{dv}{dx} + v.\frac{du}{dx}\right]$

$= uv.\frac{dw}{dx} + w.u.\frac{dv}{dx} + w.v.\frac{du}{dx} \quad \ldots(1)$

Second by taking log on both sides of $y = uvw$

$\Rightarrow \log y = \log u + \log v + \log w.$

$\therefore \frac{1}{y}\frac{dy}{dx} = \frac{1}{u}.\frac{du}{dx} + \frac{1}{v}.\frac{dv}{dx} + \frac{1}{w}.\frac{dw}{dx}$

$$\Rightarrow \frac{dy}{dx} = y\left[\frac{1}{u}\frac{du}{dx} + \frac{1}{v}\frac{dv}{dx} + \frac{1}{w}\cdot\frac{dw}{dx}\right]$$

$$= (uvw)\left[\frac{1}{u}\frac{du}{dx} + \frac{1}{v}\frac{dv}{dx} + \frac{1}{w}\cdot\frac{dw}{dx}\right]$$

$$= (vw)\frac{du}{dx} + (uw)\cdot\frac{dv}{dx} + uv\cdot\frac{dw}{dx}$$

$$\therefore \frac{d}{dx}(uvw) = = uv\cdot\frac{dw}{dx} + uw\frac{dv}{dx} + wv\frac{du}{dx} \quad \cdots (2)$$

from (i) and (ii) we find that Result obtained is same in both the cases.

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