RD Sharma Solutions Class 11 Maths Chapter 30 Ex 30.3

Derivatives 30 EX 30.3 Q1

We have to differentiate $f(x)$ with respect to x

$$\frac{d}{dx}\left(x^4 - 2\sin x + 3\cos x\right)$$
$$= \frac{d(x)^4}{dx} - 2\frac{d}{dx}(\sin x) + 3\frac{d}{dx}(\cos x)$$
$$= 4x^3 - 2\cos x - 3\sin x$$

Derivatives 30 EX 30.3 Q2

We have to differentiate $f[x]$ with respect to x

$$\frac{d}{dx}\left(3^x + x^3 + 3^3\right)$$
$$= \frac{d}{dx}\left(3^x\right) + \frac{d}{dx}\left(x^3\right) + \frac{d}{dx}\left(3^3\right)$$
$$= 3^x \log 3 + 3x^2 + 0 \qquad \left[\because \frac{d}{dx}\left(a^x\right) = a^x \log a\right]$$
$$= 3^x \log 3 + 3x^2$$

Derivatives 30 EX 30.3 Q3

We have to differentiate $f(x)$ with respect to x

$$\frac{d}{dx}\left(\frac{x^3}{3} - 2\sqrt{x} + \frac{5}{x^2}\right)$$
$$= \frac{1d}{3dx}^{(x3)} - 2\frac{d}{dx}^{(\sqrt{x})} + 5\frac{d}{dx}^{(x^{-2})}$$
$$= \frac{1}{3}.3x^2 - 2.\frac{1.1}{2\sqrt{x}} + 5.(-2)x^{-3}$$
$$= x^2 - x^{\frac{-1}{2}} - 10x^{-3}$$
$$= x^2 - \frac{1}{\sqrt{x}} - \frac{10}{x^3}$$

Derivatives 30 EX 30.3 Q4

We have,

$$\frac{d}{dx}\left(e^{x\log a}+e^{a\log x}+e^{a\log a}\right)$$

$$=\frac{d}{dx}\left(e^{x\log a}\right)+\frac{d}{dx}\left(e^{a\log x}\right)+\frac{d}{dx}\left(e^{a\log a}\right)$$

$$=e^{x\log a}.\log a+e^{a\log x}.\frac{a}{x}+0 \qquad \left[\because e^{a\log a}\text{is constant}\right]$$

$$=\log a e^{x\log a}+\frac{a}{x}e^{a\log x}$$

$$=\log a.a^{x}+\frac{a}{x}x^{a} \qquad \left[a^{x}\text{ can be written as }e^{x\log a}\right]$$

$$=a^{x}\log a+ax^{a-1}$$

Derivatives 30 EX 30.3 Q5

We have,

$$\frac{d}{dx}\left(2x^{2}+1\right)(3x+2)$$

$$=(3x+2)\frac{d}{dx}\left(2x^{2}+1\right)+\left(2x^{2}+1\right)\frac{d}{dx}(3x+2) \qquad \text{[Using product rule]}$$

$$=(3x+2)(4x+0)+\left(2x^{2}+1\right)(3+0)$$

$$=\left(12x^{2}+8x+6x^{2}+3\right)$$

$$=18x^{2}+8x+3$$

Derivatives 30 EX 30.3 Q6

We have,

$$\frac{d}{dx}f(x)=\frac{d}{dx}\left(\log_{3}x+3\log_{e}x+2\tan x\right)$$

$$=\frac{1}{\log 3}\frac{d}{dx}\left(\log x\right)+3\frac{d}{dx}\left(\log_{e}x\right)+2\frac{d}{dx}\left(\tan x\right) \qquad \left[\because \log_{3}x=\frac{\log x}{\log 3}\right]$$

$$=\frac{1}{\log 3}\times\frac{1}{x}+\frac{3}{x}+2\sec^{2}x$$

$$=\frac{1}{x\log 3}+\frac{3}{x}+2\sec^{2}x$$

Derivatives 30 EX 30.3 Q7

We have,

$$\frac{d}{dx}\left(x+\frac{1}{x}\right)\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)$$

$$=\left(x+\frac{1}{x}\right)\frac{d}{dx}\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)+\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)\frac{d}{dx}\left(x+\frac{1}{x}\right) \quad \text{[Using product rule]}$$

$$=\left(x+\frac{1}{x}\right)\left(\frac{1}{2\sqrt{x}}-\frac{1}{2x^{\frac{3}{2}}}\right)+\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)\left(1-\frac{1}{x^2}\right)$$

$$=\left(\frac{x}{2\sqrt{x}}-\frac{x}{2x^{\frac{3}{2}}}+\frac{1}{2x^{\frac{3}{2}}}-\frac{1}{2x^{\frac{5}{2}}}\right)+\left(\sqrt{x}-\frac{\sqrt{x}}{x^2}+\frac{1}{\sqrt{x}}-\frac{1}{x^{\frac{5}{2}}}\right)$$

$$=\left(\frac{1}{2}\sqrt{x}-\frac{1}{2\sqrt{x}}+\frac{1}{2x^{\frac{3}{2}}}-\frac{1}{2x^{\frac{5}{2}}}+\sqrt{x}-\frac{1}{x^{\frac{3}{2}}}+\frac{1}{\sqrt{x}}-\frac{1}{x^{\frac{5}{2}}}\right)$$

$$=\left(\frac{3}{2}\sqrt{x}+\frac{1}{2}\sqrt{x}-\frac{1}{2x^{\frac{3}{2}}}-\frac{3}{2x^{\frac{5}{2}}}\right)$$

$$=\frac{3}{2}x^{\frac{1}{2}}+\frac{1}{2}x^{\frac{-1}{2}}-\frac{1}{2}x^{\frac{-3}{2}}-\frac{3}{2}x^{\frac{-5}{2}}$$

Derivatives 30 EX 30.3 Q8

We have,

$$\frac{d}{dx}\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^3$$

$$=\frac{d}{dx}\left(x^{\frac{3}{2}}+3x.\frac{1}{\sqrt{x}}+3\sqrt{x}.\frac{1}{x}+\frac{1}{x^{\frac{3}{2}}}\right) \quad \left[(a+b)^3=a^2+3a^2b+3ab^2+b^3\right]$$

$$=\frac{d}{dx}\left(x^{\frac{3}{2}}+3x^{\frac{1}{2}}+3x^{-\frac{1}{2}}+x^{-\frac{3}{2}}\right)$$

$$=\frac{3}{2}x^{\frac{1}{2}}+\frac{3}{2}x^{-\frac{1}{2}}+3.\left(\frac{-1}{2}\right)x^{-\frac{3}{2}}-\frac{3}{2}x^{-\frac{5}{2}}$$

$$=\frac{3}{2}x^{\frac{1}{2}}-\frac{3}{2}x^{-\frac{5}{2}}+\frac{3}{2}x^{-\frac{1}{2}}-\frac{3}{2}x^{-\frac{3}{2}}$$

Derivatives 30 EX 30.3 Q9

We have,

$$\frac{d}{dx}\left(\frac{2x^2+3x+4}{x}\right)$$

$$=\frac{d}{dx}\left(\frac{2x^2}{x}+\frac{3x}{x}+\frac{4}{x}\right)$$

$$=\frac{d}{dx}\left(2x+3+4x^{-1}\right)$$

$$=2-\frac{4}{x^2}$$

Derivatives 30 EX 30.3 Q10

We have,

$$\frac{d}{dx}\frac{\left\{\left(x^3+1\right)\left(x-2\right)\right\}}{x^2}$$

$$=\frac{d}{dx}\frac{\left\{\left(x^4-2x^3+x-2\right)\right\}}{x^2}$$

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

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

$$=2x-2-\frac{1}{x^2}+2.\frac{2}{x^3}$$

$$=2x-2-\frac{1}{x^2}+\frac{4}{x^3}$$

Derivatives 30 EX 30.3 Q11

We have,

$$\frac{d}{dx}\left(\frac{a\cos x + b\sin x + c}{\sin x}\right)$$

$$= a\frac{d}{dx}\left(\frac{\cos x}{\sin x}\right) + b\frac{d}{dx}(1) + c\frac{d}{dx}\left(\frac{1}{\sin x}\right)$$

$$= a\left(-\operatorname{cosec}^2 x\right) + 0 + c\left(-\operatorname{cosec} x.\cot x\right)$$

$$= -a\operatorname{cosec}^2 x - c\operatorname{cosec} x.\cot x$$

Derivatives 30 EX 30.3 Q12

We have,

$$\frac{d}{dx}(2\sec x + 3\cot x - 4\tan x)$$

$$= 2\frac{d}{dx}(2\sec x) + 3\frac{d}{dx}(\cot x) - 4\frac{d}{dx}(\tan x)$$

$$= 2\sec x\tan x - 3\operatorname{cosec}^2 x - 4\sec^2 x$$

Derivatives 30 EX 30.3 Q13

We have,

$$\frac{d}{dx}\left(a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \ldots + a_{n-1}x + a_n\right)$$

$$= a_0\frac{d(x)^n}{dx} + a_1\frac{d(x)^{n-1}}{dx} + a_2\frac{d(x)^{n-2}}{dx} + \ldots + a_{n-1}\frac{d(x)}{dx} + a_n\frac{d(1)}{dx}$$

$$= na_0x^{n-1} + (n-1)a_1x^{n-2} + \ldots + a_{n-1} + 0$$

$$= na_0x^{n-1} + (n-1)a_1x^{n-2} + \ldots + a_{n-1}$$

Derivatives 30 EX 30.3 Q14

We have,

$$\frac{d}{dx}\left(\frac{1}{\sin x}+2^{x+3}+\frac{4}{\log x^3}\right)$$

$$=\frac{d}{dx}\operatorname{cosec}x+2^3\frac{d}{dx}\left(2^x\right)+\frac{4}{\log 3}\times\frac{d}{dx}\left(\log x\right)\left[\because\ \log_b a=\frac{\log a}{\log b}\right]$$

$$=-\operatorname{cosec}x.\cot x+8.2^x\log 2+\frac{4}{\log 3}\times\frac{1}{x}\qquad\left[\because\ \frac{d}{dx}\left(a^x\right)=a^x\log a\right]$$

$$=-\operatorname{cosec}x\cot x+2^{x+3}\log 2+\frac{4}{x\log 3}$$

Derivatives 30 EX 30.3 Q15

We have,

$$\frac{d}{dx}\left\{\frac{(x+5)\left(2x^2-1\right)}{x}\right\}$$

$$=\frac{d}{dx}\left(\frac{2x^3+10x^2-x-5}{x}\right)$$

$$=\frac{d}{dx}\left(2x^2+10x-1-5x^{-1}\right)$$

$$=2\frac{d}{dx}\left(x^2\right)+10\frac{d}{dx}\left(x\right)-\frac{d}{dx}\left(1\right)-5\frac{d}{dx}\left(x^{-1}\right)$$

$$=2\times 2x+10-0+\frac{5}{x^2}$$

$$=4x+10+\frac{5}{x^2}$$

Derivatives 30 EX 30.3 Q16

$$\frac{d}{ax}\left\{\log\left(\frac{1}{\sqrt{x}}\right)+5x^{a}-3a^{x}+\sqrt[3]{x^{2}}+6\sqrt[4]{x^{-3}}\right\}$$

$$=\frac{d}{ax}\log\left(\frac{1}{\sqrt{x}}\right)+5\frac{d}{ax}\left(x^{a}\right)-3\left(a^{x}\right)+\frac{d}{ax}\left(\sqrt[3]{x^{2}}\right)+6\frac{d}{ax}\left(\sqrt[4]{x^{-3}}\right)$$

$$=\frac{-1}{2}\frac{1}{x}+5ax^{a-1}-3a^{x}\log a+\frac{2x^{-1/3}}{3}+6x^{-7/4}\left(-3/4\right)$$

$$=\frac{-1}{2x}+5ax^{a-1}-3a^{x}\log a+\frac{2x^{-1/3}}{3}-\frac{9}{2}x^{-7/4}$$

Derivatives 30 EX 30.3 Q17

We have,

$$\frac{d}{dx}\left\{\cos\left(x+a\right)\right\}$$

$$=\frac{d}{dx}\left(\cos x.\cos a-\sin x.\sin a\right) \qquad \left[\because \cos\left(x+a\right)=\cos x\cos a-\sin x\sin a\right]$$

$$=\cos a\frac{d}{dx}\left(\cos x\right)-\sin a\frac{d}{dx}\left(\sin x\right)$$

$$=\cos a\left(-\sin x\right)-\sin a\left(\cos x\right)$$

$$=\cos x\sin a+\sin x\cos a$$

$$=-\left(\sin x\cos a+\cos x\sin a\right)$$

$$=-\sin\left(x+a\right)$$