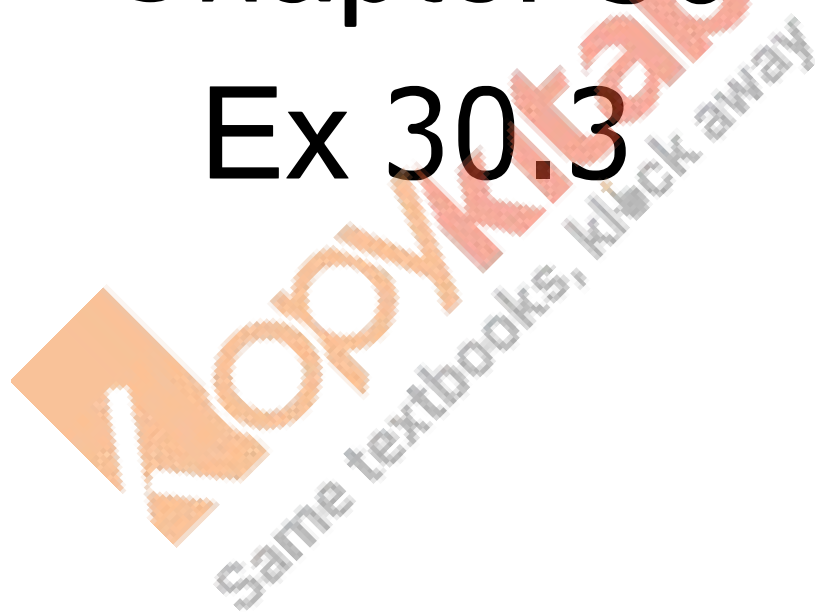


RD Sharma  
Solutions  
Class 11 Maths  
Chapter 30  
Ex 30.3



### Derivatives 30 EX 30.3 Q1

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

$$\begin{aligned} & \frac{d}{dx} (x^4 - 2 \sin x + 3 \cos x) \\ &= \frac{d(x^4)}{dx} - 2 \frac{d(\sin x)}{dx} + 3 \frac{d(\cos x)}{dx} \\ &= 4x^3 - 2 \cos x - 3 \sin x \end{aligned}$$

### Derivatives 30 EX 30.3 Q2

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

$$\begin{aligned} & \frac{d}{dx} (3^x + x^3 + 3^3) \\ &= \frac{d}{dx} (3^x) + \frac{d}{dx} (x^3) + \frac{d}{dx} (3^3) \\ &= 3^x \log 3 + 3x^2 + 0 \\ &= 3^x \log 3 + 3x^2 \end{aligned}$$

$$\left[ \because \frac{d(a^x)}{dx} = a^x \log a \right]$$

### Derivatives 30 EX 30.3 Q3

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

$$\begin{aligned} & \frac{d}{dx} \left( \frac{x^3}{3} - 2\sqrt{x} + \frac{5}{x^2} \right) \\ &= \frac{1}{3} \frac{d(x^3)}{dx} - 2 \frac{d(\sqrt{x})}{dx} + 5 \frac{d(x^{-2})}{dx} \\ &= \frac{1}{3} \cdot 3x^2 - 2 \cdot \frac{1 \cdot 1}{2\sqrt{x}} + 5 \cdot (-2)x^{-3} \\ &= x^2 - x^{-\frac{1}{2}} - 10x^{-3} \\ &= x^2 - \frac{1}{\sqrt{x}} - \frac{10}{x^3} \end{aligned}$$

### Derivatives 30 EX 30.3 Q4

We have,

$$\begin{aligned} & \frac{d}{dx} (e^{x \log a} + e^{a \log x} + e^{a \log a}) \\ &= \frac{d}{dx} (e^{x \log a}) + \frac{d}{dx} (e^{a \log x}) + \frac{d}{dx} (e^{a \log a}) \\ &= e^{x \log a} \cdot \log a + e^{a \log x} \cdot \frac{a}{x} + 0 \quad [\because e^{a \log a} \text{ is constant}] \\ &= \log a e^{x \log a} + \frac{a}{x} e^{a \log x} \\ &= \log a a^x + \frac{a}{x} x^a \quad [a^x \text{ can be written as } e^{x \log a}] \\ &= a^x \log a + a x^{a-1} \end{aligned}$$

### Derivatives 30 EX 30.3 Q5

We have,

$$\begin{aligned} & \frac{d}{dx} (2x^2 + 1)(3x + 2) \\ &= (3x + 2) \frac{d}{dx} (2x^2 + 1) + (2x^2 + 1) \frac{d}{dx} (3x + 2) \quad [\text{Using product rule}] \\ &= (3x + 2)(4x + 0) + (2x^2 + 1)(3 + 0) \\ &= (12x^2 + 8x + 6x^2 + 3) \\ &= 18x^2 + 8x + 3 \end{aligned}$$

### Derivatives 30 EX 30.3 Q6

We have,

$$\begin{aligned} \frac{d}{dx} f(x) &= \frac{d}{dx} (\log_3 x + 3 \log_9 x + 2 \tan x) \\ &= \frac{1}{\log 3} \frac{d}{dx} (\log x) + 3 \frac{d}{dx} (\log_9 x) + 2 \frac{d}{dx} (\tan x) \quad [\because \log_3 x = \frac{\log x}{\log 3}] \\ &= \frac{1}{\log 3} \times \frac{1}{x} + \frac{3}{x} + 2 \sec^2 x \\ &= \frac{1}{x \log 3} + \frac{3}{x} + 2 \sec^2 x \end{aligned}$$

### Derivatives 30 EX 30.3 Q7

We have,

$$\begin{aligned} & \frac{d}{dx} \left( x + \frac{1}{x} \right) \left( \sqrt{x} + \frac{1}{\sqrt{x}} \right) \\ &= \left( x + \frac{1}{x} \right) \frac{d}{dx} \left( \sqrt{x} + \frac{1}{\sqrt{x}} \right) + \left( \sqrt{x} + \frac{1}{\sqrt{x}} \right) \frac{d}{dx} \left( x + \frac{1}{x} \right) \quad [\text{Using product rule}] \\ &= \left( x + \frac{1}{x} \right) \left( \frac{1}{2\sqrt{x}} - \frac{1}{2x^{3/2}} \right) + \left( \sqrt{x} + \frac{1}{\sqrt{x}} \right) \left( 1 - \frac{1}{x^2} \right) \\ &= \left( \frac{x}{2\sqrt{x}} - \frac{x}{2x^{3/2}} + \frac{1}{2x^{3/2}} - \frac{1}{2x^{5/2}} \right) + \left( \sqrt{x} - \frac{\sqrt{x}}{x^2} + \frac{1}{\sqrt{x}} - \frac{1}{x^{5/2}} \right) \\ &= \left( \frac{1}{2}\sqrt{x} - \frac{1}{2\sqrt{x}} + \frac{1}{2x^{3/2}} - \frac{1}{2x^{5/2}} + \sqrt{x} - \frac{1}{x^{3/2}} + \frac{1}{\sqrt{x}} - \frac{1}{x^{5/2}} \right) \\ &= \left( \frac{3}{2}\sqrt{x} + \frac{1}{2}\sqrt{x} - \frac{1}{2x^{3/2}} - \frac{3}{2x^{5/2}} \right) \\ &= \frac{3}{2}x^{1/2} + \frac{1}{2}x^{-1/2} - \frac{1}{2}x^{-3/2} - \frac{3}{2}x^{-5/2} \end{aligned}$$

### Derivatives 30 EX 30.3 Q8

We have,

$$\begin{aligned} & \frac{d}{dx} \left( \sqrt{x} + \frac{1}{\sqrt{x}} \right)^3 \\ &= \frac{d}{dx} \left( x^{3/2} + 3x \cdot \frac{1}{\sqrt{x}} + 3\sqrt{x} \cdot \frac{1}{x} + \frac{1}{x^{3/2}} \right) \quad [(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3] \\ &= \frac{d}{dx} \left( x^{3/2} + 3x^{1/2} + 3x^{-1/2} + x^{-3/2} \right) \\ &= \frac{3}{2}x^{1/2} + \frac{3}{2}x^{-1/2} + 3 \cdot \left( \frac{-1}{2} \right) x^{-3/2} - \frac{3}{2}x^{-5/2} \\ &= \frac{3}{2}x^{1/2} - \frac{3}{2}x^{-3/2} + \frac{3}{2}x^{-1/2} - \frac{3}{2}x^{-5/2} \end{aligned}$$

### Derivatives 30 EX 30.3 Q9

We have,

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

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

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

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

### Derivatives 30 EX 30.3 Q10

We have,

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

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

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

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

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

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

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### Derivatives 30 EX 30.3 Q11

We have,

$$\begin{aligned} & \frac{d}{dx} \left( \frac{a \cos x + b \sin x + c}{\sin x} \right) \\ &= a \frac{d}{dx} \left( \frac{\cos x}{\sin x} \right) + b \frac{d}{dx} (1) + c \frac{d}{dx} \left( \frac{1}{\sin x} \right) \\ &= a (-\operatorname{cosec}^2 x) + 0 + c (-\operatorname{cosec} x \cdot \cot x) \\ &= -a \operatorname{cosec}^2 x - c \operatorname{cosec} x \cdot \cot x \end{aligned}$$

### Derivatives 30 EX 30.3 Q12

We have,

$$\begin{aligned} & \frac{d}{dx} (2 \sec x + 3 \cot x - 4 \tan x) \\ &= 2 \frac{d}{dx} (2 \sec x) + 3 \frac{d}{dx} (\cot x) - 4 \frac{d}{dx} (\tan x) \\ &= 2 \sec x \tan x - 3 \operatorname{cosec}^2 x - 4 \sec^2 x \end{aligned}$$

### Derivatives 30 EX 30.3 Q13

We have,

$$\begin{aligned} & \frac{d}{dx} (a_0 x^n + a_1 x^{n-1} + a_2 x^{n-2} + \dots + a_{n-1} x + a_n) \\ &= a_0 \frac{d(x)^n}{dx} + a_1 \frac{d(x)^{n-1}}{dx} + a_2 \frac{d(x)^{n-2}}{dx} + \dots + a_{n-1} \frac{d(x)}{dx} + a_n \frac{d(1)}{dx} \\ &= n a_0 x^{n-1} + (n-1) a_1 x^{n-2} + \dots + a_{n-1} + 0 \\ &= n a_0 x^{n-1} + (n-1) a_1 x^{n-2} + \dots + a_{n-1} \end{aligned}$$

### Derivatives 30 EX 30.3 Q14

We have,

$$\begin{aligned} & \frac{d}{dx} \left( \frac{1}{\sin x} + 2^{x+3} + \frac{4}{\log x^3} \right) \\ &= \frac{d}{dx} \operatorname{cosec} x + 2^3 \frac{d}{dx} (2^x) + \frac{4}{\log 3} \times \frac{d}{dx} (\log x) \left[ \because \log_b a = \frac{\log a}{\log b} \right] \\ &= -\operatorname{cosec} x \cdot \cot x + 8 \cdot 2^x \log 2 + \frac{4}{\log 3} \times \frac{1}{x} \left[ \because \frac{d}{dx} (a^x) = a^x \log a \right] \\ &= -\operatorname{cosec} x \cot x + 2^{x+3} \log 2 + \frac{4}{x \log 3} \end{aligned}$$

### Derivatives 30 EX 30.3 Q15

We have,

$$\begin{aligned} & \frac{d}{dx} \left\{ \frac{(x+5)(2x^2-1)}{x} \right\} \\ &= \frac{d}{dx} \left( \frac{2x^3 + 10x^2 - x - 5}{x} \right) \\ &= \frac{d}{dx} (2x^2 + 10x - 1 - 5x^{-1}) \\ &= 2 \frac{d}{dx} (x^2) + 10 \frac{d}{dx} (x) - \frac{d}{dx} (1) - 5 \frac{d}{dx} (x^{-1}) \\ &= 2 \times 2x + 10 - 0 + \frac{5}{x^2} \\ &= 4x + 10 + \frac{5}{x^2} \end{aligned}$$

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### Derivatives 30 EX 30.3 Q16

$$\begin{aligned} & \frac{d}{dx} \left\{ \log\left(\frac{1}{\sqrt{x}}\right) + 5x^a - 3a^x + \sqrt[3]{x^2} + 6\sqrt[4]{x^{-3}} \right\} \\ &= \frac{d}{dx} \log\left(\frac{1}{\sqrt{x}}\right) + 5 \frac{d}{dx}(x^a) - 3(a^x) + \frac{d}{dx}(\sqrt[3]{x^2}) + 6 \frac{d}{dx}(\sqrt[4]{x^{-3}}) \\ &= \frac{-1}{2} \frac{1}{x} + 5ax^{a-1} - 3a^x \log a + \frac{2x^{-1/3}}{3} + 6x^{-7/4}(-3/4) \\ &= \frac{-1}{2x} + 5ax^{a-1} - 3a^x \log a + \frac{2x^{-1/3}}{3} - \frac{9}{2}x^{-7/4} \end{aligned}$$

### Derivatives 30 EX 30.3 Q17

We have,

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

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

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

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

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

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

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

$$[\because \cos(x+a) = \cos x \cos a - \sin x \sin a]$$

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