



Differentiation Ex 11.2 Q39

Let $y = \frac{2^x \cos x}{(x^2 + 3)^2}$

Differentiating with respect to x ,

$$\begin{aligned} \frac{dy}{dx} &= \frac{d}{dx} \left[\frac{2^x \cos x}{(x^2 + 3)^2} \right] \\ &= \left[\frac{(x^2 + 3)^2 \frac{d}{dx} (2^x \cos x) - (2^x \cos x) \frac{d}{dx} (x^2 + 3)^2}{[(x^2 + 3)^2]^2} \right] \\ &\quad \text{[Using quotient rule, product rule and chain rule]} \\ &= \left[\frac{(x^2 + 3)^2 \left[2^x \frac{d}{dx} \cos x + \cos x \frac{d}{dx} 2^x \right] - (2^x \cos x) 2(x^2 + 3) \frac{d}{dx} (x^2 + 3)}{(x^2 + 3)^4} \right] \\ &= \left[\frac{(x^2 + 3)^2 [-2^x \sin x + \cos x 2^x \log 2] - 2(2^x \cos x)(x^2 + 3)(2x)}{(x^2 + 3)^4} \right] \\ &= \left[\frac{2^x (x^2 + 3) [(x^2 + 3)(\cos x \log 2 - \sin x)] - 4x \cos x}{(x^2 + 3)^4} \right] \\ &= \frac{2^x}{(x^2 + 3)^2} \left[\cos x \log 2 - \sin x - \frac{4x \cos x}{(x^2 + 3)} \right] \end{aligned}$$

So,

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

Differentiation Ex 11.2 Q40

Let $y = x \sin 2x + 5^x + k^k + (\tan^2 x)^3$

Differentiate it with respect to x ,

$$\begin{aligned} \frac{dy}{dx} &= \frac{d}{dx} [x \sin 2x + 5^x + k^k + (\tan^2 x)^3] \\ &= \frac{d}{dx} (x \sin 2x) + \frac{d}{dx} (5^x) + \frac{d}{dx} (k^k) + \frac{d}{dx} (\tan^6 x) \\ &= \left[x \frac{d}{dx} (\sin 2x) + \sin 2x \frac{d}{dx} (x) \right] + 5^x \log 5 + 0 + 6 \tan^5 x \frac{d}{dx} (\tan x) \\ &\quad \text{[Using product rule and chain rule]} \\ &= \left[x \cos 2x \frac{d}{dx} (2x) + \sin 2x \right] + 5^x \log 5 + 6 \tan^5 x \sec^2 x \\ &= 2x \cos 2x + \sin 2x + 5^x \log 5 + 6 \tan^5 x \sec^2 x \end{aligned}$$

so,

$$\frac{d}{dx} (x \sin 2x + 5^x + k^k + (\tan^2 x)^3) = 2x \cos 2x + \sin 2x + 5^x \log 5 + 6 \tan^5 x \sec^2 x.$$

Differentiation Ex 11.2 Q41

Let $y = \log(3x + 2) - x^2 \log(2x - 1)$

Differentiate with respect to x ,

$$\begin{aligned}\frac{dy}{dx} &= \frac{d}{dx} [\log(3x + 2) - x^2 \log(2x - 1)] \\ &= \frac{d}{dx} \log(3x + 2) - \frac{d}{dx} (x^2 \log(2x - 1)) \\ &= \frac{1}{(3x + 2)} \frac{d}{dx} (3x + 2) - \left[x^2 \frac{d}{dx} \log(2x - 1) + \log(2x - 1) \frac{d}{dx} (x^2) \right] \\ &\quad \text{[Using product rule and chain rule]} \\ &= \frac{3}{3x + 2} - \left[x^2 \times \frac{1}{(2x - 1)} \frac{d}{dx} (2x - 1) + \log(2x - 1) \times 2x \right] \\ &= \frac{3}{3x + 2} - \frac{2x^2}{(2x - 1)} - 2x \log(2x - 1)\end{aligned}$$

So,

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

Differentiation Ex 11.2 Q42

Let $y = \frac{3x^2 \sin x}{\sqrt{7 - x^2}}$

Differentiate it with respect to x ,

$$\begin{aligned}\frac{dy}{dx} &= \frac{d}{dx} \left(\frac{3x^2 \sin x}{(7 - x^2)^{\frac{1}{2}}} \right) \\ &= \frac{(7 - x^2)^{\frac{1}{2}} \times \frac{d}{dx} (3x^2 \sin x) - 3x^2 \sin x \frac{d}{dx} (7 - x^2)^{\frac{1}{2}}}{\left[(7 - x^2)^{\frac{1}{2}} \right]^2} \\ &\quad \text{[Using quotient rule, chain and product rule]} \\ &= \left[\frac{(7 - x^2)^{\frac{1}{2}} \times 3 \times \left[x^2 \frac{d}{dx} \sin x + \sin x \frac{d}{dx} x^2 \right] - 3x^2 \sin x \times \frac{1}{2} (7 - x^2)^{-\frac{1}{2}} \frac{d}{dx} (7 - x^2)}{(7 - x^2)} \right] \\ &= \left[\frac{(7 - x^2)^{\frac{1}{2}} 3 (x^2 \cos x + 2x \sin x) - 3x^2 \sin x \times \frac{1}{2} (7 - x^2)^{-\frac{1}{2}} (-2x)}{(7 - x^2)} \right] \\ &= \left[\frac{(7 - x^2)^{\frac{1}{2}} \times 3 (x^2 \cos x + 2x \sin x)}{(7 - x^2)} + \frac{3x^3 \sin x (7 - x^2)^{-\frac{1}{2}}}{(7 - x^2)} \right] \\ &= \left[\frac{6x \sin x + 3x^2 \cos x}{\sqrt{(7 - x^2)}} + \frac{3x^3 \sin x}{(7 - x^2)^{\frac{3}{2}}} \right]\end{aligned}$$

So,

$$\frac{d}{dx} \left(\frac{3x^2 \sin x}{\sqrt{7 - x^2}} \right) = \left[\frac{6x \sin x + 3x^2 \cos x}{\sqrt{7 - x^2}} + \frac{3x^3 \sin x}{(7 - x^2)^{\frac{3}{2}}} \right].$$

Differentiation Ex 11.2 Q43

Let $y = \sin^2 [\log(2x + 3)]$

Differentiate with respect to x ,

$$\begin{aligned}\frac{dy}{dx} &= \frac{d}{dx} [\sin^2 (\log(2x + 3))] \\ &= 2 \sin(\log(2x + 3)) \frac{d}{dx} \sin(\log(2x + 3)) \quad \text{Using chain rule} \\ &= 2 \sin(\log(2x + 3)) \cos(\log(2x + 3)) \frac{d}{dx} \log(2x + 3) \\ &= \sin(2 \log(2x + 3)) \times \frac{1}{(2x + 3)} \frac{d}{dx} (2x + 3)\end{aligned}$$

$$[\text{Since, } 2 \sin A \cos A = \sin^2 A]$$

$$= \sin(2 \log(2x + 3)) \times \frac{2}{(2x + 3)}$$

So,

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

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