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2) $y = \frac{3e^k \sin 2^k}{K^{5/2}}$

find the log of both sides

$\ln y = \ln 3ek + \ln \sin 2k - \ln k^{5/2}$

Differentiate with respect to k

$\frac{d}{dk}(\ln y) = \frac{d(3e^k)}{dk} + \frac{d}{dx}(\ln \sin 2k) - \frac{d}{dk}(\ln k^{5/2})$

$\frac{1}{y} \cdot \frac{dy}{dk} = \frac{1}{3e^k}(3e^k) + \frac{1}{\sin 2k}(\cos 2k) - \frac{1}{k^{5/2}}(5/2 k^{3/2})$

$\frac{1}{y} \cdot \frac{dy}{dk} = \frac{3e^k}{3e^k} + \frac{\cos 2k}{\sin 2k} - \frac{5/2\, k^{3/2}}{k^{5/2}}$

multiply both sides by y

$\frac{dy}{dk} = y\left[1 + \frac{\cos 2k}{\sin 2k} - \frac{5/2\, k^{3/2}}{x^{5/2}}\right]$

$\frac{dy}{dk} = \frac{3ek \sin 2k}{k^{5/2}}\left[1 + \frac{\cos 2k}{\sin 2k} - \frac{5/2\, k^{3/2}}{K^{5/2}}\right]$ //

1) $y = \frac{[(x+1)^2 (x-2)^{1/2}]}{[(2x-1)(x-3)^{4/3}} \begin{matrix} \to u \\ \to v \end{matrix}$

Quotient Rule

$dy/dx = \frac{V\, du/dx - U\, dv/dx}{V^2}$

let $V = (2x-1)(x-3)^{4/3}$

$dv/dx =$ let $m = 2x-1$ $dm/dx = 2$

$n = (x-3)^{4/3}$ $dn/dx = 4/3(x-3)$

$dv/dx = m\, dn/dx + n\, dm/dx$

$dv/dx = 4/3(2x-1)(x-3) + 2(x-3)^{4/3}$

let $U = (x+1)^2 (x-2)^{1/2}$

$\frac{du}{dx}$ let $a = (x+1)^2$ $da/dx = 2(x+1)$

$b = (x-2)^{1/2}$ $db/dx = 1/2(x-2)$

$dy/dx = a\,db/dx + b\,da/dx$

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

$dx = \frac{V\,du/dx - U\,dV/dx}{V^2}$

$$\frac{[(2x-1)(x-3)^{4/3}][\frac{1}{2}(x-2)(x+1)^2 + 2(x+1)(x-2)^{1/2}] - [(x+1)^2(x-2)^{1/2}]\cdot(\frac{4}{3}(2x-1)(x-3) + 2(x-3)^{4/3}]}{[(2x-1)(x-3)^{4/3}]}$$

3) $\int 4\sec^2(3m+1)\,dm$

let $u = 3m+1$

$\frac{du}{dm} = 3 \therefore dm = \frac{du}{3}$

$\int 4\sec^2 \cdot u \cdot \frac{du}{3}$

$\frac{4}{3}\int \sec^2 u \cdot du$

$\frac{4}{3}[\tan u] + c$

$\frac{4}{3}[\tan(3m+1)] + c_{11}$

4) $\int 2t\,[3t^2-1]^{1/2}\,dt$

$u = 3t^2 - 1$

$\frac{du}{dt} = 6t$

$6t = \frac{du}{dt}$

$\int 3t \cdot [u]^{1/2} \frac{du}{6t}$

$\int \frac{1}{2} \times u^{1/2}\,du$

$\frac{1}{2}\int u^{1/2}\,du$

$\frac{1}{2} \times \frac{u^{1/2+1}}{1/2+1} + C$

$= \frac{1}{2} \times \frac{2}{3} u^{3/2} + C$

$= \frac{2}{6} u^{3/2} + C$

$\frac{1}{3}(3t^2-1)^{3/2} + C_{11}$

5) $\int \frac{2x}{(4x^2-1)^{1/2}}\,dx$

$= \int 2x(4x^2-1)^{-1/2}\,dx$

let $u = 4x^2 - 1$

$\frac{du}{dx} = 8x$

$dx = \frac{du}{8x}$

$= \int 2x \cdot (u)^{-1/2} \cdot \frac{du}{8x}$

$= \frac{1}{4}\int u^{-1/2}\,du$

$= \frac{1}{4} \times \frac{u^{-1/2+1}}{-1/2+1}$

$= \frac{1}{4} \times \frac{u^{1/2}}{1/2}$

$= \frac{1}{4} \times 2u^{1/2}$

$= \frac{1}{2} u^{1/2}$

$= \frac{1}{2}(4x^2-1)^{1/2}.$