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18/ENG 02 065
Computer Engineering

1) $y = \frac{(x+1)^2 (x-2)^{1/2}}{(2x-1)(x+3)^{3/2}}$

$\ln y = \ln (x+1)^2 + \ln(\sqrt{x-2}) - \ln(2x-1) - \ln(x+3)^{3/2}$

$\frac{1}{y}\frac{dy}{dx} = \frac{1}{(x+1)^2} \cdot 2(x+1) + \frac{1}{\sqrt{x-2}} \cdot \frac{1}{2}(x-2)^{-1/2} - \frac{1}{2x-1} \cdot 2$

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

$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{2}{(x+1)} + \frac{1}{2(\sqrt{x-2})(\sqrt{x-2})} \frac{2}{2x-1} - \frac{3}{2}(x+3)^{1/2}$

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

$\frac{dy}{dx} = \frac{(x+1)^2(x-2)^{1/2}}{(2x-1)(x+3)^{3/2}} = \left[\frac{2}{x+1} + \frac{1}{2x-4} - \frac{2}{2x-1} - \frac{3}{2x+6}\right]$

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

$\ln y = \ln(3e^x) + \ln(\sin 2x) - \ln(x^{5/2})$

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

$\frac{1}{y} \cdot \frac{dy}{dx} = 1 + \frac{2\cos 2x}{\sin 2x} - \frac{5}{2} x^{3/2 - 5/2}$

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

$\frac{dy}{dx} = \frac{3e^x \sin 2x}{x^{5/2}} = \left[1 + \frac{2\cos 2x}{\sin 2x} - \frac{5}{2x}\right]$

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

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

$\frac{4}{3}\int \sec^2(u)\,du$

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

$= \frac{4}{3}\tan(3m+1) + c$

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

Let $u = \sqrt{3t^2-1}$

$u^2 = 3t^2 - 1$

$3t^2 = u^2+1$

$t^2 = \frac{u^2+1}{3}$

$t = \sqrt{\frac{u^2+1}{3}}$

$\frac{dt}{du} = \frac{1}{2}\left(\frac{u^2+1}{3}\right)^{-1/2} \cdot \frac{2u}{3}$

$\frac{dt}{du} = \frac{u}{3}\left(\frac{u^2+1}{3}\right)^{-1/2}$

$dt = \frac{u\,du}{3}\left(\frac{u^2+1}{3}\right)^{1/2}$

$\int 2\left(\frac{u^2+1}{3}\right)^{1/2} \cdot u \cdot \frac{u\,du}{3}\left(\frac{u^2+1}{3}\right)^{1/2}$

$= \frac{2}{3}\int u^2\left(\frac{u^2+1}{3}\right)^{1/2 - 1/2} du$

$= \frac{2}{3}\int u^2\,du$

$= \frac{2}{3}\left[\frac{u^3}{3}\right] + c$

$= 2u^3/9 + c = \frac{2(3t^2-1)^{3/2}}{9} + c$

5) $\int \frac{2x}{\sqrt{4x^2-1}}$

$u = \sqrt{4x^2-1}$

$u^2 = 4x^2-1$

$4x^2 = u^2+1$

$x = \sqrt{\frac{u^2+1}{4}}$

$\frac{dx}{du} = \frac{1}{2}\left(\frac{u^2+1}{4}\right)^{-1/2} \cdot \frac{u}{2}$

$\frac{dx}{du} = \frac{u}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$

$dx = \frac{u\,du}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$

$\int 2\left(\frac{u^2+1}{4}\right)^{1/2} \cdot \frac{u\,du}{4_2}\left(\frac{u^2+1}{4}\right)^{-1/2}$

$\frac{1}{2}\int \left(\frac{u^2+1}{4}\right)^{1/2 - 1/2} du$

$= \frac{u}{2} + c = \frac{\sqrt{4x^2-1}}{2} + c$