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Electrical Electronics Engineering
Maths 104.
Serial No - 204

1) Differentiate $y = \dfrac{[(x+1)^2 (x-2)^{1/2}]}{[(2x-1)(x-3)^{4/3}]}$

$\ln y = \ln(x+1)^2 + \ln(x-2)^{1/2} \quad \ln(2x-1) - \ln(x-3)^{4/3}$

$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{1}{(x+1)^2} \cdot 2(x+1) + \frac{1}{\sqrt{x-2}} \cdot \frac{1}{2}(x-2)^{-1/2} - \frac{1}{2x-1} \cdot 2 - \frac{1}{(x-3)^{4/3}} \cdot \frac{4}{3}(x-3)^{4/3}$

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

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

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

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

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

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

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

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

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

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

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

$du/dm = 3$

$du = 3\,dm$

$dm = du/3$.

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

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

$4/3 \tan u + C$.

$= \frac{4}{3}\tan(3m+1)\,C$.

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

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

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

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

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

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

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

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

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

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

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

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

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

$\frac{2u^3}{9} + C$

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

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

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

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

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

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

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

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

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

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

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

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

$$\cancel{\tfrac{1}{2}c} \quad \frac{1}{2}\int du$$

$$= \frac{u}{2} + C$$

$$= \frac{\sqrt{4x^2-1}}{2} + C.$$