ORE-OWO TIMOTHY
19/ENG06/045
MECHANICAL
MAT104

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

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

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

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

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

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

$\frac{dy}{dx} = \frac{[(x+1)^2(x-2)^{1/2}]}{[(2x-1)(x-3)^{4/3}]}\left[\frac{2}{x+1} + \frac{1}{2x-4} - \frac{2}{2x-1} - \frac{4}{3x-9}\right]$

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

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

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

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

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

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

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

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

Let $u = 4x^2-1$

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

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

$\int \frac{2}{\sqrt{4x^2-1}} \cdot \frac{du}{8} = 2\int \frac{1}{\sqrt{u}} \cdot \frac{du}{8}$

$= \frac{2}{8}\int \frac{1}{\sqrt{u}} \cdot du$

$= \frac{1}{4}\int \frac{1}{\sqrt{u}} \cdot du$

Let $t = \sqrt{u}$

$\frac{dt}{du} = \frac{1}{2\sqrt{u}}$

$2dt = \frac{1}{\sqrt{u}}\,du$

$\Rightarrow \frac{1}{4}\int 2dt = \frac{1}{2}\int dt$

$= \frac{1}{2}t + C$

$= \frac{1}{2}\sqrt{u} + C$

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

3) $\int 4\sec^2(3x+1)$

Let $u = 3x+1$

$\frac{du}{dx} = 3$

$dx = \frac{1}{3}du$

$\int 4\sec^2 u \, dx = \frac{1}{3}\int 4\sec^2 u \cdot du$

$= \frac{1}{3} \cdot 4\tan u + c$

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

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

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

Let $u = 3t^2-1$

$\frac{du}{dt} = \frac{6t}{1}$

$\cancel{\frac{dt \times 6t}{du} = \frac{6tt}{du}} = \frac{1}{6}du = t\,dt$

$\int 2t \cdot u^{1/2}\,dt = \int 2u^{1/2}\,t\,dt$

$= \int 2u^{1/2}(1/6\,du)$

$= \frac{1}{6}\int 2u^{1/2}\,du$

$= \frac{1}{3}\int u^{1/2}\,du$

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

$= \frac{2}{9}u^{3/2} + c$

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