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

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

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

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

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

multiply both side by y

$\frac{dy}{dx} = y\left(\frac{3e^x}{3e^x} + \frac{\cos 2x}{\sin 2x} - \frac{5/2\, x^{3/2}}{x^{5/2}}\right)$

$\frac{dy}{dx} = y\left(1 + \frac{\cos 2x}{\sin 2x} - \frac{5/2\, x^{3/2}}{x^{5/2}}\right)$

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

Integration

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

$u = 3m+1$

$du = 3dm$

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

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

$4/3 \int \sec^2 u\, du$ Integration of $\sec^2 u = \tan u + C$

$4/3 \tan u + C$

$4/3 \tan(3m+1) + C$

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

Let $u = 3t^2 - 1$

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

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

$\int 2t \times (u)^{1/2} \frac{du}{6t}$

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

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

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

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

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

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

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

$u = 4x^2 - 1$

$du = 8x\, dx$

$dx = du/8x$

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

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

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

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

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

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

Course : MAT 104 Assignment

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Department : Computer engineering

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

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

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

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

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

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

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