QUESTION

Write on both sides of the paper

[illegible]

[illegible]

Mechanical Engineering

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

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

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

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

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

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

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

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

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

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

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

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

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

QUESTION: ____________

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

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

$u = 3m+1$

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

$du = 3dm$

$dm = du/3$

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

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

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

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

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

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

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

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

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

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

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

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

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

QUESTION ....

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

$\frac{2}{3}\int u^2\, du$ $\qquad = \frac{\sqrt{3x^2-1}}{2} + C$

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

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

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

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

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

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

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

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

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

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

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

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

$1/2 \int du$