NAME: Omoregie Efosa
DEPARTMENT: mechanical engineering
MATRIC NO: 19/ENG06/1050
COURSE: MAT102

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

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

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

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

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

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

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

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

$$\left[\frac{2}{x+1} + \frac{1}{2x-4} - \frac{2}{2x-1} - \frac{3}{2x+6}\right]$$

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

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

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

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

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

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

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

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

$u = 3x + 1$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4