Name: Okwuchi Avitus Chukwuebuka
Department: Chemical Engineering
Matric NO: 19/ENG01/010

Assignment

(A) Differentiate

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

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

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

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

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

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

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

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

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

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

Name: Obiwuchi Avitus Chukwuebuka

Department: Chemical Engineering

Matric NO: 19/ENG01/010

Assignment

Integral =

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

$u = 3m + 1$

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

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

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

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

$= \frac{4}{3}(\tan u) + C$

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

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

$u = (3t^2 - 1)^{1/2}$

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

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

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

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

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

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

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

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

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

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

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

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

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

Name: Onwuchi Avitus Chubwudebuka
Department: Chemical Engineering
Matric No: 19/ENG01/010

Assignment

Integrate

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

$$u = (4x^2-1)^{1/2}$$

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

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

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

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

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

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

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

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

$$= \int \frac{du}{2}$$

$$= \tfrac{1}{2}\int du$$

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

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