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Assignment.

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Questions

(1) Differentiate the following

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

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

$\frac{1}{y}\cdot\frac{dy}{dx} = \left[\left(\frac{2\times1}{x+1}\times1\right) + \left(\frac{1}{2}\times\frac{1}{x-2}\times1\right)\right] - \left[\left(\frac{1}{2x-1}\times2\right) + \left(\frac{3}{2}\times\frac{1}{x+3}\times1\right)\right]$

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

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

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

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

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

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

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

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

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

(b) Integrate the following with respect to the variable

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

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

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

Let $u = 3m+1$.

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

$$dm$$

$$du = 3\,dm.$$

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

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

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

$$\frac{4}{3}(\tan u) + c.$$

$= \frac{1}{3}[\tan(3x+1)] + C$

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

Let $u = 3t^2 - 1$

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

dt

$du = 6t\, dt$

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

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

$\frac{1}{3}\int (u)^{1/2}\, du.$

$\frac{1}{3}\left(\frac{u^{3/2}}{3/2}\right) + C.$

$\frac{1}{3}\left(\frac{2u^{3/2}}{3}\right) + C.$

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

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

Let $u = 4x^2 - 1$

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

dx

$du = 8x\,dx.$

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

$\int \frac{2x}{u^{1/2}} \cdot \frac{du}{4 \cdot 8x}$

$\frac{1}{4} \int \frac{1}{u^{1/2}} \cdot du.$

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

$\frac{1}{4} \int u^{-} \quad \frac{1}{4} \cdot \frac{u^{-1/2+1}}{-1/2+1} + C.$

$\frac{1}{4} \cdot \frac{u^{1/2}}{1/2} + C.$

$\frac{1}{4} \cdot 2u^{1/2} + C.$

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

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