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MAT 104

A) Differentiate

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

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

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

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

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

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

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

- Find the Log of both sides

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

Differentiate with respect to x

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

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

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

m.b.s by

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

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

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

B.) Integration

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

$u = 3m+1$

$du = 3dm$

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

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

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

integration of $\sec^2 u = \tan u + C$

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

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

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

$u = 3t^2 - 1$

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

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

$\int 2t \times (u)^{\frac{1}{2}} \frac{du}{6t3}$

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

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

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

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

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

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

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

$u = 4x^2 - 1$

$du = 8x\,dx$

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

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

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

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

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

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

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