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MAT 104 Assignment

Answers

Differentiation

1.) $y = \dfrac{(x+1)^2 (x-2)^{1/2}}{(2x-1)(x-3)^{4/3}}$

$\ln y = \ln[(x+1)^2] + \ln[(x-2)^{1/2}] - \ln(2x-1) - \ln[(x-3)^{4/3}]$

$\dfrac{1}{y}\dfrac{dy}{dx} = \dfrac{1}{(\cancel{x}+1)^2} \quad 2x+2 + \dfrac{1}{(\cancel{x}-2)^{1/2}} \; \tfrac{1}{2}(x-2)^{-1/2}$

$\dfrac{-1(2)}{2\cancel{x}-1)} - \dfrac{1}{(x-3)^{4/3}} \; \tfrac{4}{3}(\cancel{x}-3)$

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

$- \dfrac{\tfrac{4}{3}(x-3)^{1/3}}{(x-3)^{4/3}}$

$\dfrac{1}{y}\dfrac{dy}{dx} = \dfrac{2}{(x+1)} + \dfrac{1}{2} - \dfrac{2}{(2x-1)} - \dfrac{\tfrac{4}{3}(x-3)^{1/3}}{(x-3)^{4/3}}$

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

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

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

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

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

$\frac{1}{y}\frac{dy}{dk} = 1 + \frac{2\cos 2k}{\sin 2k} - \frac{5k^{3/2}}{2k^{5/2}}$

$\frac{1}{y}\frac{dy}{dx} = 1 + 2\tan 2k - \frac{5k^{3/2}}{2k^{5/2}}$

$\frac{dy}{dk} = y\left[1 + 2\tan 2k - \frac{5k^{3/2}}{2k^{5/2}}\right]$

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

Integration

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

Let $u = 3m + 1$

$\frac{du}{dm} = 3 \quad \leq \quad dx = \frac{du}{3}$

$= \int 4\sec^2 u \cdot \frac{du}{3} = \frac{1}{3}\int u\sec^2 u\, du$

$= 1/3 \cdot [4\tan u + c] = \frac{4\tan u + c}{3}$

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

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

let $u = 3t^2 - 1$

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

$= \int 2t\,u^{1/2} \cdot \frac{du}{6t} = \int u^{1/2}\,\frac{du}{3}$

$\frac{1}{3}\int u^{1/2}\,du = \frac{1}{3}\left[\frac{u^{3/2}}{3/2} + c\right]$

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

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

let $u = 4x^2 - 1$

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

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

$= \frac{1}{4}\int u^{-1/2}\,du = \frac{1}{4}\left[\frac{u^{1/2}}{1/2} + c\right]$

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

OR

$\frac{\sqrt{(4x^2-1)}}{2} + c$