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18/ENG02/065
Computer Engineering

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

$\ln y = \ln(2x^2+3) - \ln(\ln 2x)$

$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{1}{2x^2+3}\cdot 4x - \frac{1}{\ln 2x}\cdot\frac{1}{x}$

$\frac{1}{y}\frac{dy}{dx} = \frac{4x}{2x^2+3} - \frac{1}{x\ln 2x}$

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

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

$\therefore \frac{dy}{dx}$ at $x = 2.5$

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

$\frac{dy}{dx} = \frac{15.5}{1.609}\left[\frac{10}{15.5} - \frac{1}{4.024}\right]$

$\frac{dy}{dx} = \frac{15.5}{1.609}[0.397]$

$\frac{dy}{dx} = \frac{6.1525}{1.609}$

$\frac{dy}{dx} = 3.82$

$\frac{dy}{dx}$ at $x = 2.5 = 3.82$.

2) $y = \frac{2x}{(x^2-5)}$

$\ln y = \ln(2x) - \ln(x^2-5)$

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

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

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

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

$\frac{dy}{dx} = T$

$\therefore$ In at point $(2,-4)$

$T = \frac{2(2)}{2^2-5}\left[\frac{1}{2} - \frac{2(2)}{2^2-5}\right]$

$T = \frac{4}{-1}\left[\frac{1}{2} - \left(\frac{4}{-1}\right)\right]$

$T = -4(0.5+4)$

$T = -4\times 4.5$

$T = -18$

3) $z = 2x^3 \ln y$

$\frac{dz}{dx} = 2x^3 \times \ln y$

$\frac{dz}{dx} = 2x^3 \times \frac{1}{y}$

$\frac{dz}{dx} = \frac{2x^3}{y}$

4) $\int_0^2 x\sqrt{2x^2+1}\,dx$

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

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

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

$x^2 = \frac{u^2-1}{2}$

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

Let $y = \left(\frac{u^2-1}{2}\right)$

$x = \sqrt{y}$, $\frac{dx}{dy} = \frac{1}{2\sqrt{y}}$

$\frac{du}{dy} = 1 \times \frac{\sqrt{2}}{2\sqrt{2^2}1}$

$= \frac{\sqrt{2}}{2\sqrt{u^2-1}}$

$\frac{dx}{du} = \frac{dy}{du} \times \frac{dx}{dy}$

$\frac{dx}{du} = u \cdot \frac{\sqrt{2}}{2\sqrt{u^2-1}}$

$\frac{dx}{du} = \frac{u\sqrt{2}}{2\sqrt{u^2-1}}$

$dx = \frac{u\sqrt{2}\cdot du}{2\sqrt{u^2-1}}$

$\int x\sqrt{(2x^2+1)}\,dx$

$\int \sqrt{\frac{u^2-1}{2}} \cdot u$

$\frac{u\sqrt{2}\cdot du}{2\sqrt{u^2-1}}$

$\int \frac{u\,du}{2} = \left[\frac{u^3}{6}\right] + C$

Recall that $u = \sqrt{2x^2+1}$

$\left[\frac{2x^2+1)^3}{6}\right] + C$

$\int_0^2 x\,(2x^2+1)^{1/2}$

$\left[\frac{\sqrt{2(2)^2+1}^3}{6}\right] - \left[\frac{(\sqrt{2(0)^2+1})}{6}\right]$

$= \frac{3^3}{6} - \frac{1^3}{6}$

$= \frac{27}{6} - \frac{1}{6} = \frac{27-1}{6} =$

$\int_0^2 x\,(2x^2+1)^{1/2}\,dx = \frac{13}{3}$ sq