Adedokun Precious Adeola
Computer Engineering
18/ENG02/006
MAT 104

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

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

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

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

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

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

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

$\frac{dy}{dx} = \frac{2(2.5)^2+3}{\ln 2(2.5)}\left[\frac{4(2.5)}{2(2.5)^2+3} - \frac{1}{2.5\ln 2(2.5)}\right]$

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

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

$\frac{dy}{dx} = \frac{6.1535}{1.609}$

$\frac{dy}{dx} = 3.8244$

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

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

2 Gradient $= {dy}/{dx}$

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

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

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

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

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

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

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

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

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

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

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

$$z = -4(0.5+4)$$

$$z = -4\times 4.5$$

$$z = -18$$

3 If $z = 2x^3\ln y$. Find ${dx}/{dy}$.

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

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

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

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

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

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

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

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

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

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

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

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

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

$\int_0^2 x(2x^2+1)^{3/2}$

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

$$= \frac{(\sqrt{9})^3}{6} - \frac{(\sqrt{1})^3}{6}$$

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

$$\frac{27}{6} - \frac{1}{6} = \frac{27-1}{6} = \frac{13}{3}$$

$$\therefore \int_0^2 x(2x^2+1)^{1/2}\,dx = \frac{13}{3} \text{ square units.}$$