2) Gradient = dy/dx

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

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

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

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

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

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

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

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

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

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

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

$$b = -4\,[0.5 + 4]$$

$$b = -4 \times 4.5$$

$$b = -18.$$

3) If $Z = 2x^3 \ln y$. Find dz/dy

Solution

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

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

18/eng07/080

1) $y = \frac{(2x^2+3)}{\ln 2x}$ 18/eng07/080

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

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

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

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

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

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

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

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

$\cancel{\frac{dy}{dx} = \frac{15.5}{1.609}\left[\frac{10}{15.5} - \frac{1}{}\right]}$ $\frac{dy}{dx} = \frac{15.5}{1.609}\left[0.397\right]$

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

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

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

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

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

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

$\frac{dx}{dy} = \frac{1}{2\sqrt{\left(\frac{u^2-1}{2}\right)}}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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