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 Dept: Computer Engineering

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

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

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

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

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

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

∴ $\frac{dy}{dx}$ at $x = 2.5$

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

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

~~$\frac{dy}{dx} = \frac{15.5}{1.609} \left[\frac{10}{15.5} - \frac{1}{4.024} \right]$~~ $\frac{dy}{dx} = \frac{15.5}{1.609} [0.397]$

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

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

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

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

2) Gradient = $\frac{dy}{dx}$

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

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

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

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

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

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

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

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

\therefore In at point (2, -4)

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

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

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

$$b = -4 \times 4.5$$

$$b = -18.$$

3) If $Z = 2x^3 \ln y$. find $\frac{dz}{dy}$

Solution

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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