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Matric NO : 19/ENG01/010

MAT 104

1 $y = \frac{(2x^2+3)}{\ln 2x}$ find dy/dx at $x = 2.5$

$u = 2x^2 + 3$ $\quad v = \ln 2x$

$du/dx = 4x$ $\quad dv/dx = \frac{1}{x}$

$$dy/dx = \frac{V\frac{du}{dx} - U\,dv/dx}{V^2}$$

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

$$dy/dx = \frac{(4x \ln 2x) - (2x + 3/x)}{\ln 4x^2}$$

$$= \frac{4(2.5) \cdot \ln(2(2.5)) - (2(2.5) + 3/2.5)}{\ln(4(2.5)^2)}$$

$$= \frac{(10(1.6094)) - (4.5 + 1.2)}{3.219}$$

$$= \frac{16.094 - 5.7}{3.219}$$

$$= \frac{10.394}{3.219}$$

$dy/dx = 3.2290$

≈ 3.23 3.S.f

2 $y = 2x/(x^2-5)$ find gradient at ~~$x = 2.5$~~ point $(2, -4)$

$u = 2x$ $\quad v = x^2 - 5$

$$\frac{dy}{dx} = \frac{(x^2-5)(2) - (2x)(2x)}{(x^2-5)^2} = \frac{-10 - 2x^2}{(x^2-5)^2}$$

At point $(2, -4)$, $x = 2$

$$\text{gradient} = \frac{-10 - 2(2)^2}{(2)^2 - 5)^2}$$

$$= \frac{-10 - 8}{(4-5)^2}$$

$$= \frac{-18}{-1}$$

$\therefore$ gradient ~~$=$~~ $= -18$

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

$\therefore u = (2x^2+1)^{1/2}$

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

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

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

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

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

$$= \int_0^2 \left(\frac{u^2-1}{2}\right)^{1/2} \cdot u \cdot \frac{u}{2}\left(\frac{u^2-1}{2}\right)^{-1/2} du$$

$$= \frac{1}{2}\int_0^2 u^2\,du$$

$$= \left[\frac{1}{2}\left[\frac{u^3}{3}\right]\right]_0^2$$

$$= \left[\frac{u^3}{6}\right]_0^2$$

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

$$= \left[\frac{8}{6}\right] - \left[0\right]$$

$$= \frac{4}{3}$$

$$= 1.33 \text{ Square Units}$$

3 $Z = 2x^3 \ln y$

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