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COMPUTER ENGINEERING
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MAT 104

~~QUIZ~~ ASSIGNMENT

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

Let $u=(2x^2+3)$ and $v=\ln 2x$

$\frac{du}{dx}=4x$ $\quad \frac{dv}{dx}=\frac{1}{2x}$

$\frac{dy}{dx}=\frac{v\frac{du}{dx}-u\frac{dv}{dx}}{v^2}$

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

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

At $x=2.5$

$=\frac{4(2.5)\ln(2.5)-\frac{2(2.5)^2+3}{2(2.5)}}{(\ln 2(2.5))^2}=\frac{16.09-3.1}{2.590}$

$=\frac{9.163-3.1}{2.590}=\frac{6.063}{2.590}=5.015$

$=5.02$ to 3 s.f.

2.) $y=\frac{2x}{(x^2-5)}$ at the point $(2,-4)$.

Let $u=2x$ and let $v=x^2-5$

$\frac{dy}{dx}=\frac{v\frac{du}{dx}}{}$ $\quad \frac{du}{dx}=2$ $\quad \frac{dv}{dx}=2x$

$$\frac{dy}{dx} = \frac{V\frac{dU}{dx} - U\frac{dV}{dx}}{V^2}$$

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

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

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

$x = 2$

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

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

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

$m = -18$

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

Let $U = 2x^3$ and $V = \ln y$

$\frac{dU}{dy} = 6x^2 \frac{dx}{dy}$ $\quad \frac{dV}{dy} = \frac{1}{y}$

$$\frac{dz}{dy} = U\frac{dV}{dy} + V\frac{dU}{dy}$$

$$\frac{dz}{dy} = 2x^3\left(\frac{1}{y}\right) + \ln y\left(6x^2\frac{dx}{dy}\right)$$

$$= \frac{2x^3}{y} + 6x^2 \ln y \frac{dx}{dy} = 0$$

$$(6x^2 \ln y)\frac{dx}{dy} = -\frac{2x^3}{y}$$

$$\frac{dx}{dy} = -\frac{2x^3}{y} \div 6x^2 \ln y$$

$$\frac{dx}{dy} = -\frac{2x^3}{y} \times \frac{1}{6x^2 \ln y}$$

$$\frac{dx}{dy} = \frac{-2x^3}{6x^2 y \ln y}$$

4) Integrate $\int x(2x^2+1)^{\frac{1}{2}} dx$ from (0 to 2).

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

Let $u = 2x^2+1$

$\frac{du}{dx} = 4x$

$du = 4x\,dx$

$dx = \frac{du}{4x}$

$\int_0^2 x \cdot u^{\frac{1}{2}} \cdot \frac{du}{4x} = \int_0^2 u^{\frac{1}{2}} \cdot \frac{du}{4}$

$\frac{1}{4}\int_0^2 u^{\frac{1}{2}}du$

$= \frac{1}{4}\left[\frac{u^{\frac{1}{2}+1}}{\frac{1}{2}+1}\right]_0^2$

$= \frac{1}{4}\left[\frac{u^{3/2}}{\frac{3}{2}}\right]_0^2 = \frac{u^{\frac{3}{2}}}{6}$

$= \left[\frac{(2x^2+1)^{3/2}}{6} + C\right]_0^2$

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

$= \left[\frac{[9]^{3/2}}{6}\right] - \left[\frac{[1]^{3/2}}{6}\right]$

$= 4.5 - 0.167$

$= 4.33$