UBANI, JOSEPH IKECHUKWU

COMPUTER ENGINEERING

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MAT 104

UBANI, JOSEPH IKECHUKWU

i) $y = \frac{(2x^2+3)}{\ln 2x} \frac{u}{v}$ at $x = 2.5$

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

$U = 2x^2 + 3$

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

$V = \ln 2x$, $\frac{dv}{dx} = \frac{1}{2x}$

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

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

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

at $x = 2.5$

$$\frac{dy}{dx} = \frac{10}{\ln 5} - \frac{15.5 \times \frac{1}{5}}{(\ln 5)^2}$$

$\frac{dy}{dx} = \frac{10}{1.6094} - \frac{3.1}{2.5902}$

$\frac{dy}{dx} = 6.2133 - 1.1967$

$\frac{dy}{dx} = 5.01657$

$\frac{dy}{dx} \approx 5.02$ to 3.s.f.

2) $y = 2x/(x^2-5)$ at point $(2,-4)$

$y = \frac{2x}{x^2-5}$ $\begin{matrix} u \\ v \end{matrix}$

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

$\frac{du}{dx} = 2$

$\frac{dv}{dx} = 2x$

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

$\frac{dy}{dx} = \frac{2x^2 - 10 - 4x^2}{x^4 - 10x^2 + 25}$

$m = dy/dx$ $\quad$ $y - y_1 = m(x - x_1)$

$m = \frac{2x^2 - 10 - 4x^2}{x^4 - 10x^2 + 25}$

at $x = 2$

$m = \frac{2(2)^2 - 10 - 4(2)^2}{(2)^4 - 10(2)^2 + 25}$

$m = \frac{8 - 10 - 16}{16 - 40 + 25} = \frac{-18}{1}$

$m_1 = -18$

at $x = -4$

$$m = \frac{2(-4)^2 - 10 - 4(-4)^2}{(-4)^4 - 10(-4)^2 + 25}$$

$$m = \frac{32 - 10 - 64}{256 - 160 + 25} = -\frac{42}{121}$$

$$m = -0.35$$

$m = -18$ and $m = -0.35$

3) $z = 2x^3 \ln y$,

$$\frac{dz}{dy} = 3.$$

$= 6x^2 \ln y \frac{dz}{dy} + 2x^3 \frac{1}{y} = 0$

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

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

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

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

let $u = 2x^2+1$

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

$du = 4x\,dx$

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

$u = 2x^2+1$

$2x^2 = u-1$

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

$x = \sqrt{u-1/2}$

$\int x \cdot \sqrt{u} \quad \frac{du}{2x}$

$\int_0^2 \sqrt{\frac{u-1}{2}} \cdot \sqrt{u} \quad \frac{du}{2x}$

$\int_0^2 \sqrt{\frac{2x^2+1-1}{2}} \cdot \sqrt{2x^2+1} \cdot \frac{du}{4x}$

$\int_0^2 \sqrt{\frac{2x^2}{2}} \quad \sqrt{2x^2+1} \cdot \frac{du}{2x}$

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

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

when $x = 2$

$$\frac{4}{2} \times \frac{(9)^{3/2}}{3/2}$$

$$2 \times \frac{27}{3/2}$$

$$2 \times 18$$

$$= 36$$

at $x = 0$ $= 0$

upper bound - lower bound

$= 36 - 0$

$\therefore \int_0^2 x(2x^2+1)\,dx$

$= 36.$