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MATRIC NO; 19/ENG02/053.
COURSE; MAT 104.

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

Let $U = 2x^2+3$ $V = \ln 2x$

$$\frac{dy}{dx} = \frac{V\frac{dy}{dx} - y\frac{dy}{dx}}{V^2}$$

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

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

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

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

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

at $x = 2.5$

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

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

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

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

$\frac{dy}{dx} = 5.02$ (3 s.f)

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

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

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

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

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

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

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

$m = \frac{dy}{dx}$ and $y - y_1 = m(x - x_1)$

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

at $x = 2$

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

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

$\therefore m = -18$

at $x = -4$

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

$$m = \frac{32-10-6t}{256+60+25} = \frac{-42}{1.21}$$

$m = \div 035$

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

(3.) $Z = 2x^3 \ln y$

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

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

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

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

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

Let $u = 2x^2 + 1$

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

$$du = 4x\, dx$$

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

$u = 2x^2 + 1$

$2x^2 = u - 1$

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

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

$$\int x \cdot \sqrt{y} \, \frac{dy}{2x}$$

$$\int_0^2 \sqrt{\frac{y-1}{2}} \cdot \sqrt{y} \, \frac{dy}{2x}$$

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

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

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

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

When $x = 2$

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

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

$$2 \times 18$$

$$= 36$$

at $x = 0$

$$\frac{0}{2} \times \frac{(1)^{3/2}}{3/2} = 0$$

$\therefore 36 - 0 = 36$

$$\int_0^2 x(2x^2+1)\,dx = \underline{36}.$$