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

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

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

$dU = 4x$ $\quad dV = 2\ln 2x$

$$\frac{4x\ln 2x - 4x^2 \ln 2x + 6\ln 2x}{(\ln 2x)^2}$$

$$\frac{\cancel{\ln 2x}(4x - 4x^2 + 6)}{(\cancel{\ln 2x})^2}$$

$$\Rightarrow \frac{4x - 4x^2 + 6}{\ln 2x}$$ #

where $x = 2.5$.

$$\Rightarrow \frac{4(2.5) - 4(2.5)^2 + 6}{\ln(5.0)}$$

$$\Rightarrow \frac{10 - 25 + 16}{1.6094} \Rightarrow 0.6213.$$

2) $y = \frac{2x}{x^2-5}$ $\quad u = 2x \quad v = x^2 - 5$

$du = 2 \quad dv = 2x$.

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

$\frac{dy}{dx} \Rightarrow \frac{2x^2 - 10 - 4x^2}{2x^4 - 10x^2 + 25}$, but at $(2, -4)$.

$$\Rightarrow \frac{2(2)^2 - 10 - 4(2)^2}{2(2)^4 - 10(2)^2 + 25} \Rightarrow \frac{8 - 10 - 16}{32 - 40 + 25} = \frac{-18}{13}.$$

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

$\frac{dz}{dy} \Rightarrow$ Let $u = 2x^3$, $v = \ln y$.

$du = 6x^2$, $dv = \ln y$.

$\frac{dz}{dy} \Rightarrow 6x^2 \ln y + 2x^3 \ln y$.

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

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

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

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

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

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

$\Rightarrow u\left(\frac{2}{2u^2-1}\right)^{1/2}$.

$$dx = v\,dv\left(\frac{2}{v^2-1}\right)^{1/2}$$

$$\int_0^2 \left(\frac{v^2-1}{2}\right)^{1/2} \cdot v \cdot v\,dv \left(\frac{v^2-1}{2}\right)^{-1/2}$$

$$\Rightarrow \int_0^2 \left(\frac{v^2-1}{2}\right)^{1/2-1/2} \cdot v^2\,dv$$

$$\Rightarrow \int_0^2 v^2 \frac{dv}{2}$$

$$\Rightarrow \left[\frac{v^3}{3}\right]_0^2$$

$$\Rightarrow \left[\frac{(2x^2+1)^{3/2}}{3}\right]_0^2 \Rightarrow \left[\frac{2(2)^2+1)^{3/2}}{3}\right] - \left[\frac{2(0)^2+1}{3}\right]^{3/2}$$

$$\Rightarrow \left[\frac{9^{3/2}}{3}\right] - \left[\frac{0^{3/2}}{3}\right]$$

$$\Rightarrow \frac{27}{3} = 9$$