

19/202000/050
mechanical engineering

Calculate dy/dx at $x=2.5$ (round to 3 SF)
 of $y = \ln(2x^2 + 5) / \ln 2x$

$$\ln y = \ln(2x^2 + 5) - \ln(\ln 2x)$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{1}{2x^2 + 5} \cdot 4x - \frac{1}{\ln 2x} \cdot \frac{1}{2x}$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{4x}{2x^2 + 5} - \frac{1}{2x \ln 2x}$$

$$\frac{dy}{dx} = y \left[\frac{4x}{2x^2 + 5} - \frac{1}{2x \ln 2x} \right]$$

$$\frac{dy}{dx} = \frac{2x^2 + 5}{\ln 2x} \left[\frac{4x}{2x^2 + 5} - \frac{1}{2x \ln 2x} \right]$$

At $x=2.5$, $\frac{dy}{dx} = \frac{2(2.5)^2 + 5}{\ln(2 \cdot 2.5)} \left[\frac{4(2.5)}{2(2.5)^2 + 5} - \frac{1}{2(2.5) \ln(2.5)} \right]$

$$\frac{dy}{dx} = \frac{5.3}{1.61} \left[\frac{10}{5.3} - \frac{1}{2.5 \ln 2.5} \right]$$

$$\frac{5.3}{1.61} \left[\frac{10}{5.3} - \frac{1}{3.22} \right]$$

$$\frac{5.3}{1.61} [1.25 - 0.31]$$

$$33.1 [0.94] = 31.1 //$$

iii) $z = 2x^3 \ln y$, Find dz/dy

$$\ln z = \ln 2x^3 + \ln y$$

$$\frac{1}{z} \frac{dz}{dy} = \frac{1}{\ln 2x^3} - \frac{3}{2x} \frac{dx}{dy} + \frac{1}{\ln y} \cdot \frac{1}{y}$$

$$\frac{1}{z} \frac{dz}{dy} = \frac{3}{\ln 2x^3} \frac{dx}{dy} + \frac{1}{\ln y} \cdot \frac{1}{y}$$

$$\frac{1}{z} \frac{dz}{dy} = \frac{3}{\ln 2x^3} \frac{dx}{dy} = \frac{1}{\ln y} \cdot \frac{1}{y}$$

$$\frac{dz}{dy} \left[\frac{1}{z} - \frac{3}{\ln 2x^3} \right] = \frac{1}{\ln y^2}$$

$$\frac{dz}{dy} \frac{dz}{dy} = \frac{1}{\ln y^2} \left[\frac{1}{z} - \frac{3}{\ln 2x^3} \right]$$