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Computer Engr.
19/ENG02/020
19AT 104

1. $dy/dx \quad (2x^2+3) / \ln(2x)$

$$\frac{\frac{d}{dx}[2x^2+3]\cdot \ln(2x) - (2x^2+3)\cdot \frac{d}{dx}[\ln(2x)]}{\ln^2(2x)}$$

$$\frac{(2\cdot\frac{d}{dx}[x^2]+\frac{d}{dx}[3])\ln(2x) - (2x^2+3)\frac{1}{2x}\cdot\frac{d}{dx}[2x]}{\ln^2(2x)}$$

$$\frac{2\cdot 2x+0)\ln(2x) - \frac{(2x^2+3)\cdot 2\cdot\frac{d}{dx}[x]}{2x}}{\ln^2(2x)}$$

$$\frac{4x\ln(2x) - (2x^2+3)\cdot 1/x}{\ln^2(2x)}$$

$$\frac{4x\ln(2x) - (2x^2+3)/x}{\ln^2(2x)}$$

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

at $x=2.5$ $\quad \frac{4(2.5)}{\ln(2(2.5))} - \frac{2(2.5)^3+3}{(2.5)\ln^2(2(2.5))}$

$= 3.8198 \approx 3.82$ to 3 s.f

2. $\frac{d}{dx}\left[\frac{2x}{x^2-5}\right]$

$= 2 \cdot \frac{d}{dx}\left[\frac{x}{x^2-5}\right]$

$= 2 \cdot \frac{\frac{d}{dx}[x] \cdot (x^2-5) - x \cdot \frac{d}{dx}[x^2-5]}{(x^2-5)^2}$

$\frac{2\,(1\,(x^2-5) - (\frac{d}{dx}[x^2] + \frac{d}{dx}[-5])\,x)}{(x^2-5)^2}$

$= \frac{2\,(x^2 - (2x+0)\,x - 5)}{(x^2-5)^2}$

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

$m = \frac{-2(2)^2 - 10}{[(2)^2-5]^2} = -18/1$

gradient $= -18$

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

$u = 2x^3 \quad v = \ln y$

$\frac{du}{dy} = 6x^2\, dx/dy \qquad \frac{dv}{dy} = 1/y$

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

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

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

let $u = 2x^2+1$

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

$du = dx\,4x$

$dx = du/4x$.

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

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

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

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

$= \frac{1}{6}[27-1]$

$\frac{1}{6}[26]$

$= 4.333 \approx 4.33$