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MAT 104

① let $y = \frac{(2x^2+3)}{\ln 2x}$

$\ln y = \ln(2x^2+3) - \ln(\ln 2x)$

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

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

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

i) when $x = 2.d$

$\frac{dy}{dx} = \frac{2(2.5)^2+3}{\ln 2(2.5)}\left(\frac{4(2.5)}{2(2.5)^2+3} - \frac{1}{(2.5)\ln(2\times 2.5)}\right)$

$\frac{dy}{dx} = 3.82$ Approx to 3 S.F)

② $y = \frac{2x}{x^2-5}$

$\ln y = \ln 2x - \ln x^2 - 5$

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

$\frac{dy}{dx} = \frac{2x}{x^2-5}\left(\frac{1}{x} - \frac{2x}{x^2-5}\right)$

i) when $x = 2.4$ $\frac{dy}{dx} = 37.3$ Approx to 3 S.F

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

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

$\frac{dz}{dy} \frac{1}{z} = \frac{1}{y}$

$\frac{dz}{dx} = \frac{1}{y}$

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

let $u = 2x^2 + 1$, $\frac{du}{dx} = 4x$

$dx = \frac{du}{4x}$ recall $\int_0^2 x\sqrt{2x^2+1}\, dx$

$= \int_0^2 x\sqrt{u}\, \frac{du}{dx} = \frac{1}{4}\int_0^2 \sqrt{u}\, du$

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

$= \frac{1}{4}\left[\frac{2(2x^2+1)^{3/2}}{3}\right]_0^2$

$= \frac{1}{4}\left[\frac{52}{3}\right]$

$= \frac{13}{3}$