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19/ENG02194
MATH104

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

$\frac{dv}{dx} = 4x \qquad \frac{du}{dx} = \frac{1}{x}$

From Quotient rule

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

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

$= \left(\frac{4x \ln x}{1} - \frac{2x^2 + \cancel{3} \, 3}{x}\right) \div \ln(2x)^2$

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

$= 4x^2 \ln 2x - 2x^2 - 3$

Substute x or 2.5

$= \frac{4(2.5)^2 \ln(2 \times 2.5) - 2(2.5)^2 - 3}{2.5 \ln(2 \times 2.5)}$

$= \frac{40.26 - 12.5 - 3}{6.48}$

$= \frac{24.76}{6.48} = 3.82$

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

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

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

let $u = 2x^2+1$

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

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

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

$= \frac{1}{4}\int_0^2 \left[\frac{u^{3/2}}{3/2} + c\right]$

$= \frac{1}{4}\int_0^2 \left[\frac{2(2x^2+1)^{3/2}}{3}\right]$

$\therefore = \frac{1}{4}\left[\,2(2(2)^2+1)^{3/2}\right.$

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

$= \frac{13}{3}$