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19/ENG03/019
CIVIL ENGINEERING

MAT 104

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

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

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

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

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

$= 3.82$

2) $y = 2x/x^2-5$

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

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

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

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

at $x = 2.4$, $dy/dx = -37.26$

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

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

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

$y = 2x^2+1$

$\frac{dy}{dx} = 4x \qquad dx = \frac{dy}{4x}$

$\therefore \int_0^2 x(2x^2+1)^{1/2} = \int_0^2 x\, y^{1/2} \cdot \frac{dy}{4x}$

$= \frac{1}{4}\int_0^2 y^{1/2} \cdot dy$

$= \frac{1}{4}\int_0^2 \frac{y^{3/2}}{3/2} + C$

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

$= \frac{1}{4}\left[\frac{2(2(2)^2+1)^{3/2}}{3} - \frac{2(2(0)^2+1)^{3/2}}{3}\right]$

$= \frac{2(9)^{3/2}}{12} - \frac{2(1)^{3/2}}{12}$

$= \frac{54 - 2.8}{12}$

$= \frac{51.2}{12}$

$= 4.2\dot{6} = 4.27_{//}$