① $y = \frac{(2x^2+3)}{\ln 2x}$

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

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

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

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

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

$= \underline{\underline{3.82}}$ to 3 s.f

② $y = \frac{2x}{x^2-5}$

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

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

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

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

$= -37$ at $x = 2.4$, $\frac{dy}{dx} = -\underline{\underline{37.26}}$

③ $z = 2x^3 \ln y$

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

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

let $u = 2x^2+1$

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

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

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

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

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

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

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

$= \frac{13}{3}$