Q1

$$\int_0^1 \frac{4t^3-2t^2+3t-1}{2t^2+1}\,dt$$

$$= \int_0^1 \frac{4t^3-2t^2+3t-1}{2t^2+1}\,dt$$

$$= \int_0^1 \frac{4t^3+3t-2t^2-1}{2t^2+1}\,dt$$

$$= \int_0^1 \frac{4t^3+3t-2t^2-1}{2t^2+1}\,dt$$

$$= \int_0^1 \frac{t(4t^2+3)-(2t^2+1)}{2t^2+1}$$

$$= \int_0^1 \frac{t(4t^2+3)}{2t^2+1}\,dt \quad \int_0^1 \frac{\cancel{2t^2+1}}{\cancel{2t^2+1}}\,dt$$

$$= \int_0^1 \frac{t(4t^2+3)}{2t^2+1}\,dt - \int_0^1 1\,dt$$

$$= \int_0^1 \frac{t(4t^2+3)}{2t^2+1}\,dt - [1-0]$$

$$= \int_0^1 \frac{t(4t^2+3)}{2t^2+1} - 1 - \cancel{0}$$

Now

let $2t^2+1 = y$ $\quad\Rightarrow 2t^2+1 = y$

As $t \to 1$ i.e. $y = 3$ $\quad 2t^2 = y-1$

$t \to 0$ i.e. $y = 1$ $\quad 4t^2 = 2y-2$

Now

$4t = dy/dt$ $\quad 4t^2+3 = 2y+1$

$= clt = dy/dt$

$= \int_1^3 \frac{(2y+1)}{4} : dy/(y) - 1$

$= \int_1^3 \frac{2y+1}{4y} \, dy - 1$

$= \frac{1}{4} \left[\int_1^3 \frac{2y\,dy}{y} + \int_1^3 \frac{1}{y}\, dy \right] - 1$

$\Rightarrow \frac{1}{4} \left[\int_1^3 2\,dy + \int_1^3 \frac{1}{y}\, dy \right] - 1$

$\Rightarrow \frac{1}{4} \left[2y |_1^3 + \ln y |_1^3 \right] - 1$

$\Rightarrow 1/4 \left[2(3) - 2(1) + \ln(3) - \ln(1) \right] - 1$

$\Rightarrow 1/4 [6 - 2 + 1.0986) - 1$

$\Rightarrow 1/4 [5.0986] - 1$

$\Rightarrow 1.27465 - 1$

$\Rightarrow 0.2746$ Ans

Q2 $\int_2^3 t \sin t^2 \, dt$

Sol Let $t^2 = y$

Diff w.r.t t^2

$2t = dy/dt$

$dt = dy/2t$

Now

As $t \to 3$ then $y = 9$

As $t \to 2$ Then $y = 4$

So $= \int_2^3 t \sin t^2 \, dt = \int_4^9 t \sin \, dy/2t$

$= \int_4^9 \sin y \, dy$

$= -\cos y \Big|_4^9$

$= -[\cos(9) - \cos(4)]$

$= -[0.9876 - 0.9975]$

$= -(-0.00987)$

$= +0.00987$ Ans.