

$$Q1 = \int_0^1 \frac{4t^3 - 2t^2 + 3t - 1}{2t^2 + 1} dt$$

$$\text{Sol:} \int_0^1 \frac{4t^3 - 2t^2 + 3t - 1}{2t^2 + 1} dt$$

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

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

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

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

$$= \int_0^1 \frac{t(4t^2 + 3)}{2t^2 + 1} dt - t \Big|_0^1$$

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

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

Now def

$$2t^2+1 = y$$

As  $t=1$  i.e.  $y=3$

$t \rightarrow 0$  i.e.  $y=1$

Now Diff

$$4t = \frac{dy}{dt}$$

$$dt = \frac{dy}{4t}$$

$$\Rightarrow \int_1^3 t \frac{(2y+1)}{y} \frac{dy}{4t} - 1$$

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

(2)

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

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

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

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

$$= \frac{1}{4} \left[ 6 - 2 + 1.0986 \right] - 1$$

$$= \frac{1}{4} \left[ 5.0986 \right] - 1$$

$$= 1.27465 - 1$$

$$= 0.2746 \text{ Ans.}$$

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

Sol:

$$\text{let } t^2 = y$$

Diff w.r.t

$$2t = \frac{dy}{dt} \dots$$

$$dt = \frac{dy}{2t}$$

Now

$$\text{As } t \rightarrow 3 \text{ then } y = 9$$

$$\text{As } t \rightarrow 2 \text{ then } y = 4$$

$$Q. \int_2^3 \sin t \, dt = \int_4^9 t \cdot \sin y \frac{dy}{dt}$$

$$= \frac{1}{2} \int_4^9 \sin y \, dy$$

$$= -\left(\frac{1}{2}\right) \cos y \Big|_4^9$$

$$= -\left(\frac{1}{2}\right) (\cos(9) - \cos(4))$$

$$= -\left(\frac{1}{2}\right) (0.9876 - 0.9975)$$

$$= -\left(\frac{1}{2}\right) (-0.00987)$$

$$= \frac{0.00987}{2} \text{ Ans}$$

Name: Uzair Ali Shah

ID: 160985

Section: A

Dept: BE (Civil)

Semester: Summer.

Subject: Calculus.

Instructor: Mam. Shumaila

Mazhar.