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SEMISTER: SUMMER 2020

Applied Calculus

QUIZ # 1

FIND

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

Solution:-

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

As it is Improper function we have to change it to proper function by division method.

p.t.o

R.W

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

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

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

$$= \frac{\cancel{2}t^2}{\cancel{2}} - t \Big|_0^1 + \frac{1}{4}\int_0^1 \frac{4t}{2t^2+1}\,dt$$

$$= \left|t^2 - t + \frac{1}{4}\right| \ln(2t^2+1) \Big|_0^1$$

$$= \left((1)^2 - 1 + \frac{1}{4}(\ln(2(1)^2+1)\right) - \left((0)^2 - (0) + \frac{1}{4}(\ln(2(0)^2+1)\right)$$

$$\Rightarrow \left(\frac{1}{4}\ln(3)\right) - \left(\frac{1}{4}\ln(1)\right)$$

$(\ln(1) = 0)$

Result:

$$\Rightarrow \boxed{\frac{1}{4}\ln(3).} \quad \text{ANS}$$

Rough work:

$$\begin{array}{r|l} & 2t-1 \\ 2t^2+1 & 4t^3-2t^2+3t-1 \\ & \ominus 4t^3 \quad \ominus 2t \\ \hline & -2t^2+t-1 \\ & \ominus 2t^2 \quad \ominus 1 \\ \hline & t \end{array}$$

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

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

Solution:-

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

For simplifying, we use integration by parts than, we will apply definite integral

$$\int t \sin t^2 dt = t \cdot \int (\sin t^2) dt - \int \left(\frac{d}{dt} t\right) \left(\int \sin t^2 dt\right) dt$$

$$= (t)(-\cos t^2) - \int (1)(-\cos t^2) \, dt$$

$$= (-t \cos t^2) + (\sin t^2) + C$$

$$\int t \sin t^2 dt = -t \cos t^2 + \sin t^2$$

$$\int_2^3 t \sin t^2 dt = -t \cos t^2 + \sin t^2 \Big|_2^3$$

$$= (-3 \cos(9) + \sin(9)) - (-2 \cos(4) + \sin(4))$$

$$= (-2.01 + 0.15) - (-1.00 + 0.06)$$

$$= -1.86 + 0.94$$

$$= -0.92 \approx$$

Result: $\int_2^3 t \sin t^2 dt = \boxed{-1}$