Quiz

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Dept :- Civil Engineering
Subject :- Applied Calculus

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

Solution:

Perform polynomial long division

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

solving for $\int \frac{t}{2t^2+1} \, dt$

$\Rightarrow u = 2t^2 + 1 \qquad \frac{du}{dx} = 4t$

$\Rightarrow dt = \frac{1}{4t} \, du$

$= \frac{1}{4} \int \frac{1}{u} \, du$

Solving $\int \frac{1}{u} = \ln u$

puting values of u

$$= \ln \frac{2x^2+1}{4}$$

$$\Rightarrow \ln \frac{2x^2+1}{4}\Big|_0^1 + x^2\Big|_0^1 - x\Big|_0^1$$

putting limits

$$\Rightarrow \left[\frac{\ln(3)}{4} + 1 - 1\right] - \left[\frac{\ln(1)}{4} + 0 - 0\right]$$

$$\Rightarrow \frac{\ln 3}{4} \quad \text{Ans}$$

$$\Rightarrow 0.273 \quad \text{Ans}$$

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

Solution:

Let $y = \int_2^3 t \sin t^2 \, dt$

$$\Rightarrow \frac{d}{dt}(\cos t^2) = -\sin t^2 \frac{d}{dt}(t^2)$$

$$\Rightarrow \frac{d}{dt}(\cos t^2) = -\sin t^2 \, 2t$$

$$\Rightarrow \cos t^2 = -2t \sin t^2$$

$$\Rightarrow -\frac{\cos t^2}{2} = \int t \sin t^2 \, dt$$

$$\text{So} \quad y = \frac{-\cos t^2}{2} \Big|_2^3$$

$$\Rightarrow y = -\frac{1}{2}\left[\cos(3)^2 - \cos(2)^2\right]$$

$$\Rightarrow y = \frac{-1}{2}\left[\cos 9 - \cos 4\right]$$