Date:

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Section - A
Quiz = Applied Calculus

Q1

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

Solution

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

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

Now Seperate the fraction

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

By using properties of integrals

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

Date:

$$\Rightarrow t^2 + \frac{1}{2} - \frac{1}{2} \times \ln(2t^2+1) - t + \sqrt{2} \times \arctan(\sqrt{2}t) + \frac{3}{4} \times \ln(2t^2+1) - \frac{\sqrt{2}\arctan(\sqrt{2}t)}{2}$$

$$\Rightarrow t^2 + \frac{1}{2} + \frac{1}{4} \times \ln(2t^2+1) - t$$

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

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

$$\Rightarrow \frac{1}{4} \times \ln(3)$$

$$\Rightarrow \boxed{0.2746} \text{ Ans}$$

Date: .....

Q2

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

Sol:

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

$$\Rightarrow \int t \times \sin(t^2) \, dt$$

$\Rightarrow$ By using Substitution method

$$u = t^2 \quad - (1)$$

$$= \int \frac{\sin(u)}{2} \, du$$

$$\Rightarrow \frac{1}{2} \times \int \sin(u) \, du$$

$$\Rightarrow \frac{1}{2} \times \left(-\cos(u)\right) \quad - (2)$$

Date:

Now put eq ① in eq ②

$$\frac{1}{2} \times \left(-\cos\left(t^2\right)\right)$$

$$\Rightarrow -\frac{\cos\left(t^2\right)}{2}$$

$$\Rightarrow -\frac{\cos\left(t^2\right)}{2}\Bigg|_2^3$$

$$\Rightarrow -\frac{\cos(3)^2}{2} - \left(-\frac{\cos(2)^2}{2}\right)$$

$$\Rightarrow \frac{-\cos 9 + \cos(4)}{2}$$

$$\Rightarrow \boxed{0.1287} \quad \text{Ans}$$