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Module :- 7^{th}

Subject :- Applied Calculus

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Quiz :- 01

Q1) Find

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

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

By partial fraction method

Divide $4t^3-2t^2+3t-1$ by $2t^2+1$

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

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

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

using power rule

$$2\left(\frac{1}{2}t^2\Big]_0^1\right)+\int_0^1 -1\,dt+\int_0^1 \frac{t}{2t^2+1}\,dt$$

Combine $\frac{1}{2}$ & t^2

$$2\left(\frac{t^2}{2}\Big]_0^1\right) + \int_0^1 -1\,dt + \int_0^1 \frac{t}{2t^2+1}\,dt$$

$$2\left(\frac{t^2}{2}\Big]_0^1\right) + (-t)\Big]_0^1 + \int_0^1 \frac{t}{2t^2+1}\,dt$$

Using substitution

let $u = 2t^2+1$ then $du = 4t\,dt$ so

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

$$= 2\left[\frac{t^2}{2}\Big]_0^1\right] + (-t)\Big]_0^1 + \int_1^3 \frac{1}{u}\cdot\frac{1}{4}\,du$$

$$= 2\left(\frac{t}{2}\Big]_0^1\right] + (-t)\Big]_0^1 + \int_1^3 \frac{1}{4u}\,du$$

Applying limit we get

$$\boxed{f(x) = 0.2746}$$

Q2) Find $\int_2^3 t \sin t^2 dt$ (3)

Sol:- let $u = t^2$

$du = 2t\, dt$

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

Replace the value of t & dt

$= \int_2^3 t \sin u \frac{du}{2t}$

$= \int_2^3 \frac{1}{2} \sin u\, du$

$= -\frac{1}{2} \cos u \Big|_2^3$

replace u with t^2

$= -\frac{1}{2} \cos t^2 \Big|_2^3$ Applying limits

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

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

$\boxed{= 0.0049}$ Ans.