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Quiz :- 01

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Subject :- Applied calculus.

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

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

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

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

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

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

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

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

Now,

$= \text{let } 2t^2 + 1 = y \quad \begin{cases} \Rightarrow 2t^2 + 1 = y \\ 2t^2 = y - 1 \end{cases}$

As $t \Rightarrow 1 - e \quad y = 3$

$= t \to 0$ i-e $y = 1$ | $= 4t^2 = 2y - 2$

Now Diffrenciate | $4t^2 + 3 = 2y - 2 + 3$

$= 4t = \frac{dy}{dt}$ | $4t^2 + 3 = 2y + 1$

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

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

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

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

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

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

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

$$= \frac{1}{4} \{6 - 2 + 1.0986\} - 1$$

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

$$= 1.27465 - 1$$

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

Q2:- $\int_2^3 t \sin t^2 \, dt$

Solution:- Let $t^2 = y$

Diff w.r.t t^2

$t^2 = y$

$(3)^2 = y$

$9 = y$

$2t = dy/dt$

$dt = dy/2t$

Now,

As $t \to 3$ then $y = \alpha$

As $t = 2$ then $y = 4$

So,

$= \int_2^3 t \sin t^2 dt = \int_4^9 t \sin y \frac{dy}{t}$

$= \int_4^9 \sin y \, dy$

$= -\cos y \int_4^9$

$= -[\cos(9) - \cos(4)]$

$$= -[0.9876 - 0.9775]$$

$$= -(-0.00987)$$

$$= \boxed{+0.00987} \text{ Ans.}$$

$\longleftrightarrow$