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Subject # Applied Calculus

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(1)

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

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

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

Taking integral on b/s

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

$$= \frac{2t^2}{2} - t + \frac{1}{4}\ln|2t^2+1|$$

Now Put The Limits

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

$$= \left(\frac{2}{2} - 1 + \frac{1}{4}\ln|3|\right) - \left(0 - 0 + \frac{1}{4}\ln(1)\right)$$

$$= 0 + \frac{1}{4}\ln(3) - (0)$$

$$= \frac{1}{4}\ln(3) \quad \text{Ans}$$

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

1st find $\int t \sin t^2 \, dt \rightarrow (1)$

let $y = t^2$

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

$\frac{1}{2} dy = t \, dt$

put These in (1)

$\int \frac{1}{2} \sin y \, dy = -\frac{1}{2} \cos y$

$= -\frac{1}{2} \cos t^2$

Now put limits

$= \left| -\frac{1}{2} \cos t^2 \right|_2^3 = -\frac{1}{2} (\cos(9) - \cos(4))$

$= \frac{\cos(4) - \cos(9)}{2}$ Ans