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Subject Calculus

Assignment No 01

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Question no 2:

$$\int_0^1 (4y-y^2+4y^3+1)^{-2/3}(12y^2-2y+4)\,dy$$

Solution:

$$\int_0^1 (4y-y^2+4y^3+1)^{-2/3}(12y^2-2y+4)\,dy \rightarrow *$$

~~by by subtitution~~

by substitution method:

Let

$$4y-y^2+4y^3+1 = t \longrightarrow (1)$$

Now

Apply d/dt both side of eq(1)

$$\Rightarrow \frac{d}{dt}(4y-y^2+4y^3+1) = \frac{d}{dt}(t)$$

$$\Rightarrow \frac{d}{dt}(4y) - \frac{d}{dt}(y^2) + \frac{d}{dt}(4y^3) + \frac{d}{dt}(1) = \frac{dt}{dt}$$

$$\Rightarrow 4(dy/dt) - \frac{d}{dt}y^2 + 4\frac{d}{dt}(y^3) + \frac{d}{dt}(1) = \frac{dt}{dt}$$

$$\Rightarrow 4\left(\frac{dy}{dt}\right) - 2y\left(\frac{dy}{dt}\right) + 4\times 3y^2\left(\frac{dy}{dt}\right) + 0 = 1$$

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$$\Rightarrow 4\left(\frac{dy}{dt}\right) - 2y\left(\frac{dy}{dt}\right) + 12y^2\left(\frac{dy}{dt}\right) = 1$$

Now Taking common (dy/dt)

$$\frac{dy}{dt}\left[4 - 2y + 12y^2\right] = 1$$

$$\frac{dy}{dt}\left(12y^2 - 2y + 4\right) = 1$$

$$dy\left(12y^2 - 2y + 4\right) = dt$$

$$\left(12y^2 - 2y + 4\right) dy = dt \rightarrow (ii)$$

Now

put value of eq (i) & (ii)

in original equation (*)

$$\int_0^1 \left(4y - y^2 + 4y^3 + 1\right)^{-2/3}\left(12y^2 - 2y + 4\right)$$

$$\int_0^1 (t)^{-2/3}\, dt \longrightarrow (iii)$$

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As from power rule

$$\int t^n \, dt = \frac{(t)^{n+1}}{n+1}$$

$$\Rightarrow \int_0^1 (t)^{-2/3} \, dt$$

$$\Rightarrow \int_0^1 \frac{(t)^{\left(\frac{-2}{3}+1\right)}}{\frac{-2}{3}+1}$$

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

$$\Rightarrow \int_0^1 \frac{(t)^{1/3}}{\frac{1}{3}}$$

$$\int_0^1 3(t)^{1/3}$$

$$\int_0^1 3\sqrt[3]{t} \longrightarrow$$

Now

Put the vale of $t = 4y - y^2 + 4y^3 + 1$

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$$\Rightarrow \int_0^1 3\left(\sqrt[3]{t}\right) + c$$

$$\Rightarrow \int_0^1 3\left(\sqrt[3]{(4y - y^2 + 4y^3 + 1)}\right) + c$$

$$\Rightarrow \int_0^1 3\left(\sqrt[3]{4y - y^2 + 4y^3 + 1}\right) + c$$

Now apply limmit:

$$= 3\left[\sqrt[3]{4y - y^2 + 4y^3 + 1}\right]_0^1 + c$$

$$\Rightarrow 3\left[\left(\sqrt[3]{4(1) - (1)^2 + 4(1)^3 + 1}\right) - \left(\sqrt[3]{4(0) - (0)^2 + 4(0)^3 + 1}\right)\right]$$

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

$$\Rightarrow 3\left(\sqrt[3]{8} - \sqrt[3]{1}\right) + c$$

$$\Rightarrow 3\left((2) - (1)\right) + c$$

$$\Rightarrow$$

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$\Rightarrow 3\left[\,1\,\right]$

$\Rightarrow 3$

$$\Rightarrow \boxed{\int_0^1 \left(4y - y^2 + 4y^3 + 1\right)^{-\frac{2}{3}} \cdot \left(12y^2 - 2y + 4\right) dy = 3}$$

$\Downarrow$

ANS

x —— y —— x —— x —— x —— x —— x

QNo1:- $\int_0^{\pi/4} (1-\sin t)^{3/2} \cos(2t)\, dt$.

Solution

solve through integration by part As.

$$\int u\cdot v\,dx = u\int v\,dx - \int\left[\frac{d}{dx}(u) \times \int v\,dx\right]dx.$$

$$\Rightarrow (1-\sin t)^{3/2}\int \cos(2t)\,dt - \int \frac{d}{dt}(1-\sin t)^{3/2} \times \int \cos 2t\,dt\;dt$$

$$\Rightarrow (1-\sin t)^{3/2}\left(\frac{\sin 2t}{2}\right) - \int\left[\frac{3}{2}(\cos t)(1-\sin)^{1/2} \times \frac{\sin 2t}{2}\right]dt$$

$$(1-\sin t)^{3/2} \times \frac{\sin 2t}{2} - \int\left[3/2\,(1-\sin)^{1/2} \times \cos t\cdot\frac{\sin 2t}{2}\right]dt$$

$$\cancel{(1-\sin t)^{3/2}\left(\frac{\sin(2t)}{2}\right) - \int \frac{3}{4}(1-\sin)^{1/2} \times \cos t \left[\frac{2\sin t\cos t}{2}\right] dt}$$

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$\Rightarrow (1-\sin t)^{3/2} \times \left[\frac{\sin 2t}{2}\right] - \int \left[6/4 (1-\sin)^{1/2} \sin^2 t \cos t \cdot dt \right.$

Let

$\sin t = u$

$\frac{d \sin t}{du} = du/du$

$\cos t \, dt/du = 1$

$\cos t \, dt = du.$

$\Rightarrow \int 6/4 \, (1-u)^{1/2} (u)^2 \cdot du.$

~~Now again by part~~

~~6/4 1-u~~

Again suppose.

$(1-u) = t \Rightarrow du = -dt.$

$-\int 6/4 \, (t)^{1/2} (1-t)^2 \, dt.$

$-6/4 \int (t)^{1/2} (1-2t+t^2) \, dt$

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$$-6/4 \int (t)^{1/2} + t^{5/2} - 2t^{3/2}\,)\,dt$$

$$-6/4 \left[\frac{t^{1/2+1}}{1/2+1} + \frac{t^{5/2+1}}{\frac{5}{2}+1} - 2\,\frac{t^{3/2+1}}{3/2+1} \right]$$

$$-6/4 \left[2/3\, t^{3/2} + \frac{2}{7} t^{7/2} - \frac{4}{5} t^{5/2} \right]$$

substitud t with original value then apply limit

$$-6/4 \left[2/3 (\sin t)^{5/2} \Big|_0^{\pi/4} + \left(\frac{2\sin t}{7}\right)^{7/2} \Big|_0^{\pi/4} \right.$$

$$\left. - 4/5 (\sin)^{5/4} \Big|_0^{\pi/4} \right.$$

$$\Rightarrow -6/4 \left[\frac{2}{3} (\sin(45))^{5/2} + 2/7 (\sin 45)^{7/2} - 4/5 (\sin 45)^{5/4} \right.$$

$$-6/4 \left[0.28 + 0.086 - 0.33 \right)$$

$$-6/4 \left(0.035 \right)$$

$\boxed{0.0525}$ → Ans.