Calculus

Assignment

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Assignment No

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(1)

Q1 $\int_0^{\pi/4} (1-\sin t)^{3/2} \cos 2t \, dt$

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

Integration by part

$$(1-\sin t)^{3/2}(\cos 2t) = \int (1-\sin t)^{3/2} \cos 2t \; \&$$
$$\int \cos t \int dt$$

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

$$\int (1-\sin t)^{3/2}((\cos 2t) \int_0^{\pi/4} = \frac{6}{4}\int_0^{\pi/4} (1-\sin t)(\cos t \sin t^2$$

Now let

$$u = \sin t$$

$$\frac{d}{dt} u = \cos t$$

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

$$(1-\sin t)^{3/2}(\cos 2t) = \frac{6}{4}\int_0^{\pi/4} (1-u)^{1/2} u^2 \, du$$

Now let

$$t = 1-u$$

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$$\frac{dt}{du} = -1$$

$$dt = -du$$

$$(1-\sin t)^{3/2}(\cos 2t) = \frac{6}{4}\int_0^{\pi/4} (t)^{1/2}(1-t)^2\, dt$$

$$= -\frac{6}{4}\int_0^{\pi/4} (1-2t+t^2)(t^{1/2})\, dt$$

$$= -\frac{6}{4}\int_0^{\pi/4} (t^{1/2} - 2t^{3/2} + t^{5/2})\, dt$$

Apply integrat

$$= -\frac{6}{4}\int_0^{\pi/4} \left| \frac{t^{5/2+1}}{5/2+1} - \frac{2t^{3/2+1}}{3/2+1} + \frac{t^{1/2+1}}{1/2+1} \right|_0^{\pi/4}$$

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$$= -\frac{6}{4}\left[\left[\frac{2t^{7/3}}{7} - \frac{4}{5}t^{5/2} + \frac{2}{3}t^{3/2}\right]\right]_0^{\pi/4}$$

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

$$= \frac{-6}{4}\left[\frac{2}{7}(\sin 45)^{7/2} - \frac{4}{5}(\sin 45)^{5/4} + \frac{2}{3}(\sin 45)^{3/2}\Big|_0^{\pi/4}\right.$$

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

$$= \frac{-6}{4}(0.28 + 0.085 - 0.33$$

$$= -\frac{6}{4}(0.035)$$

$$\boxed{= 0.0525 \text{ Ans}}$$

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(4)

Q2 $\int_0^1 (4y - y^2 + 4y^3 + 1)^{-2/3}(12y^2 - 2y + 4)\,dy$

Solution:

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

By using Subsitution method

Let $x = 4y - y^2 + 4y^3 + 1$

$$\frac{dx}{dy} = 4 - 2y + 12y^2 \Rightarrow dx = (4 - 2y + 12y^2)\,dy$$

$$\int_0^1 x^{-2/3}\,dx$$

$$= \frac{x^{-2/3+1}}{-2/3+1} + c$$

$$= \frac{x^{1/3} + c}{1/3}$$

$$= 3x^{1/3} + c$$

$$\Rightarrow (3(4y - y^2 + 4y^3 + 1) + 1$$

Putting the Limits

$$= (3(4(1) - (1)^2 + 4(1)^3 + 1)^{1/3} + c$$

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$= 3(4-\cancel{x}+4+\cancel{x})^{1/3}+c$

$= 3(8)^{1/3} + c \longrightarrow$ arbitrary constant

$= 3(2^3)^{1/3}$

$= 3(2) \Rightarrow 6$

$\boxed{= 6}$

Q2