

IQRA NATIONAL UNIVERSITY



Calculus and analytical geometry

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Assignment

QNO 1

ANCN Given

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

Solution

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

$$\text{let } 4y^3 - y^2 + 4y + 1 = u$$

now taking derivatives

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

$$12y^2 - 2y + 4 = \frac{du}{dy}$$

$$(12y^2 - 2y + 4) dy = du$$

$$(i) \text{ for } 0 =$$

$$= 4(0) - (0)^2 + 4(0) + 1$$

$$= 1$$

(ii)

for $x =$

$$= 4(1)^3 - (1)^2 + 4(1) + 1$$

$$= 8$$

now

$$\int_1^8 u^{-2/3} du$$

$$= \frac{u^{-2/3+1}}{-2/3+1} \Big|_1^8$$

$$= \frac{u^{1/3}}{1/3} \Big|_1^8$$

$$= 3u^{1/3} \Big|_1^8$$

$$= 3(8)^{1/3} - 3(1)^{1/3}$$

$$= 6 - 3$$

$$= 3$$

Q No 2

ANSW Given n

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

Solution

Integration by Part

$$\begin{aligned} (1-\sin t)^{3/2} (\cos 2t) &= \int (1-\sin t)^{3/2} (\cos 2t) (\cos 2t) \, dt \\ &= \frac{3}{2} \left((1-\sin t)^{1/2} (\cos 2t) - \frac{\sin 2t}{2} \right) \end{aligned}$$

$$\left. (1-\sin t)^{3/2} (\cos 2t) \right|_0^{\pi/4} = \frac{6}{4} \int_0^{\pi/4} (1-\sin t) \cos 2t \, dt$$

Now let

$$u = \sin t$$

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

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

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

Now let

$$t = 1-u$$

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

$$dt = -du$$

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

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

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

applying integral

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

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

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

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

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

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

$$= 0.0525 \text{ ANS.}$$