Assignment - 2

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(Q2.) $I_1 = \int_1^3 \left(\frac{x^3}{12} - 8x\right) dx$

$I_2 = \int_0^2 e^{(3x+1)} dx$

Taking 3 points:-

$I_1 = \int_1^3 \left(\frac{x^3}{12} - 8x\right) dx \Rightarrow \int_{-1}^{1} \left(\frac{(\xi+2)^3}{12} - 8(\xi+2)\right) d\xi$

$\xi = x - 2$

$\Rightarrow \sum_{i=1}^{3} w_i \left(\frac{(\xi_i+2)^3}{12} - 8(\xi_i+2)\right)$

$\xi_i = [-0.7746, 0, 0.7746]$

$w_i = [0.55555, 0.88888, 0.55555]$

$\Rightarrow$ Substituting values, we get

$I_1 = 30.333$ ⇝ Accurate Value

$I_2 = \int_0^2 e^{(3x+1)} dx \Rightarrow \int_{-1}^{1} e^{(3(\xi+1)+1)} d\xi$

$\xi = x - 1 \Rightarrow \int_{-1}^{1} e^{(3\xi+4)} d\xi$

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$$\Rightarrow \sum_{i=1}^{3} w_i \times e^{(3\xi_i + 4)}$$

$$0.5555 \times e^{(3\times(-0.7746)+4)} + 0.8888 \times e^{(4)} + 0.5555 \times e^{(3\times 0.7746+4)}$$

$$\approx 361.3250$$

Actual Value → 364.64

Error ≈ 0.5%

Going to next Gauss Quadrature Values

Taking 4 points

$\xi_i \Rightarrow [-0.8611, -0.33998, 0.33998, 0.8611]$

$W_i \Rightarrow [0.34785, 0.65214 5, 0.65214 5, 0.34785 4]$

Substituting the values into

$$\sum_{i=1}^{4} w_i \times e^{(3\xi_i + 4)}$$

$$\Rightarrow 0.34785 \times e^{(3\times(-0.8611)+4)} + 0.652145 \times e^{(3\times(-0.33998)+4)} + 0.652145 \times e^{(3\times 0.33998+4)} + 0.34785 \times e^{(3\times 0.8611+4)}$$

$$\Rightarrow 364.50981$$

↳ This is within 0.5% of 364.64