

Numerical Analysis

Assignment 6

M202161029 Assignment 6
Chapter 4.3, Ex: 1b, c, d & 3.

1) Integral using trapezoidal Rule:-

b) $\int_0^{0,5} \frac{2}{x-4} dx = \int_a^b x dx$

$f(x) = \frac{2}{x-4} \Rightarrow f(0) = \frac{2}{0-4} = -\frac{1}{2}$
 $f(0,5) = \frac{2}{0,5-4} = -\frac{2}{3,5}$

Using the formula:-

$$\int_a^b f(x) = (b-a) \cdot \frac{f(a) + f(b)}{2}$$

$\int_0^{0,5} \frac{2}{x-4} dx = 0,5 - 0 \left(-\frac{1}{2} + \left(-\frac{2}{3,5} \right) \right) = \underline{\underline{0,2678571}}$

c) $\int_1^{1,5} x^2 \ln x dx \Rightarrow \int_a^b x dx$

$f(x) = x^2 \ln x \quad \therefore f(1) = 1^2 \ln(1) \Rightarrow 0$
 $\therefore f(1,5) = (1,5)^2 \ln(1,5) \Rightarrow 0,912286$

Applying the formula:-

$\int_1^{1,5} x^2 \ln x dx = 1,5 - 1 \left(\frac{0 + 0,912286}{2} \right) = \underline{\underline{0,22807}}$

$$d) \int_0^1 x^2 e^{-x} dx = \int_a^b x dx$$

$$f(x) = x^2 e^{-x} \Rightarrow f(0) = 0^2 e^{-0} = 0$$

$$\therefore f(1) = 1^2 e^{-1} \Rightarrow 0,3678796$$

Formular :- $\int_a^b f(x) dx = (b-a) \frac{f(a) + f(b)}{2}$

$$\int_0^1 x^2 e^{-x} \Rightarrow \left(\frac{1-0}{2} \right) \left(\frac{0 - 0,3678796}{2} \right) \Rightarrow \underline{\underline{0,1834397}}$$

3) Repeating using Simpson's rule

b) $\int_0^{0,5} \frac{2}{x-4} dx \quad \therefore f(x) = \frac{2}{x-4} \quad \text{where } x_0 = 0 \text{ \& } x_1 = 0,5$

$$h = \frac{x_1 - x_0}{2} = \frac{0,5}{2} = 0,25$$

Applying the formular :-

$$\int_0^{0,5} \frac{2}{x-4} dx = \frac{h}{3} [f(x_0) + 4f(h) + f(x_1)]$$

$$= \frac{0,25}{3} [-0,5 - 2,133333 - 0,571428571]$$

$$\Rightarrow \underline{\underline{0,267063}}$$

3) c) $\int_1^{1,5} x^2 \ln x \, dx$ where $f(x) = x^2 \ln x$ while $x_0 = 1$ & $x_1 = 1,5$

$$h = \frac{x_1 - x_0}{2} = \frac{1,5 - 1}{2} = 0,25$$

By formula :-

$$\Rightarrow \frac{0,25}{3} [f(1) + 4f(1,25) + f(1,5)]$$

$$\Rightarrow \frac{1}{12} [(2,25)(6,4054651)] = \underline{\underline{0,192245}}$$

d) $\int_0^1 x^2 e^{-x} \, dx$ where $f(x) = x^2 e^{-x}$ while $x_0 = 0$ & $x_1 = 1$

$$h = \frac{x_1 - x_0}{2} = \frac{1 - 0}{2} = 0,5$$

By formula :- $\frac{0,5}{3} [f(0) + 4f(0,5) + f(1)]$

$$\Rightarrow \frac{1}{6} (0 + 0,6665 + 0,3768) \Rightarrow \underline{\underline{0,16290168}}$$

Sum