

Numerical Calculus: Questions 28 Jun 2023

Trapezoidal Method

Approximate the area under $y = 2^x$ from $x = [-1, 3]$ using $n = 5$ points

$$I_{trap} = \frac{\Delta x}{2} [f(x_0) + 2f(x_1) + 2f(x_2) + 2f(x_3) + f(x_4)]$$

Simpson's 1/3 method

Approximate the area under $y = 3^x$ from $x = [-2, 2]$ using $n = 5$ points

$$I_{simp} = \frac{\Delta x}{3} [f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + f(x_4)]$$

Codes

Write the pseudocode or the code to solve the above two questions.

Gauss Quadrature

Calculate the integral $\int_{-1}^1 \cos x dx$ using 1 and 2 point Gauss-Legendre quadrature

Compare the error with the analytical result 1.68294 and determine the number of rectangles required if this integral was solved by midpoint method.

$$I_1 = w_1 \cos x_1 =$$

$$I_2 = w_1 \cos x_1 + w_2 \cos x_2 =$$

Remember $n = \frac{b-a}{h}$ and obtain h from $E \approx (b-a) \frac{h^2}{24}$