

Assignment#6

Numerical Integration

1. Given that:

x	4.0	4.2	4.4	4.6	4.8	5.0	5.2
log x	1.3963	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

Evaluate $\int_4^{5.2} \log x \, dx$ by

- Trapezoidal rule
 - Simpson's 1/3rd rule
 - Simpson's 3/8th rule & also find the error in each case
- Write an algorithm to calculate the definite integral $\int_a^b f(x)dx$ using composite Simpson's 1/3rd rule.
 - Evaluate $\int_0^2 f(x)dx$ for the function $f(x) = e^x + \sin(2x)$ using Simpson's 3/8th rule taking $h = 0.4$.
 - Evaluate $\int_0^3 (\sin(x) + \cos(x) + 12)dx$ using Simpson's 3/8th rule taking $h = 0.5$, Determine the percent error by comparing the result with the result with exact solution.
 - Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using
 - Trapezoidal rule taking $h = 1/4 = 0.25$
 - Simpson's 1/3rd rule taking $n=4$, $h = 1/4 = 0.25$
 - Simpson's 3/8th rule taking $n=6$, $h = 1/6$

Hence compute an approximate value of π in each case. [Hint: generate two tables]

6. The velocity v of a particle at a distance s from a point on its path is given in the table below:

s (ft)	4.0	0	10	20	30	40	50	60
v (ft/sec)	1.3963	47	58	64	65	61	52	38

Estimate the time taken to travel a distance of 60ft by using Simpson's 1/3rd rule. Compare the result with Simpson's 3/8th rule. [Ans: $I_{1/3} = 1.06352$, $I_{3/8} = 1.06445$]

- Write a pseudo-code to integrate a given function within given limits using Simpson's 3/8th rule.
- Use Romberg's Integration method to compute $\int_0^{0.5} \frac{x}{\sin x} dx$, correct to 3 decimal places.
- Evaluate following using Gaussian Quadrature 3-point formula:
 - $\int_0^1 \frac{\tan^{-1} x}{x} dx$
 - $\int_0^{\pi/2} e^{\sin x} dx$
 - $\int_{0.2}^{1.5} e^{-x^2} dx$
 - $\int_2^3 \frac{\cos 2x}{1+\sin x} dx$
 - $\int_{0.2}^{1.2} (\log(x+1) + \sin 2x) dx$
- Use Gauss-Legendre three-point formula to evaluate $\int_2^4 (x^4 + 1)dx$