Lab 9

Quadrature formulas (2)

1. a) Use the rectangle formula to evaluate the integral

$$\int_1^{1.5} e^{-x^2} dx.$$

b) Plot the graph of the function f and the graph of the rectangle which area approximates the integral, using rectagle (midpoint) formula.

c) Use the repeated rectangle formula, for $n = 150$ and 500, to evaluate the integral

$$\int_1^{1.5} e^{-x^2} dx.$$

(*Result:* 0.1094)

2. Consider the integral

$$\int_0^1 \frac{2}{1+x^2} dx.$$

a) Approximate the integral using the Romberg algorithm for trapezium formula, for precision $\varepsilon = 10^{-4}$.

b) Approximate the integral using the Romberg algorithm in Aitken's form, for precision $\varepsilon = 10^{-4}$.

3. Plot the graph of $f : [1, 3] \to \mathbb{R}$, $f(x) = \frac{100}{x^2} \sin \frac{10}{x}$. Use an adaptive quadrature algorithm for Simpson's formula to approximate the integral

$$\int_1^3 f(x)dx,$$

with precision $\varepsilon = 10^{-4}$. Compare the obtained result with the one obtained applying repeated Simpson's formula for $n = 50$ and 100. (The exact value is -1.4260247818.)