

Exercise Sheet 4

Exercise 1: Prepare a script that computes the roots of the problem $f(x) = 0$ with the following methods

- a) Bisection method
- b) Chord's method
- c) Regula Falsi
- d) Secant Method
- e) Newton's Method

INPUT:

- a, b the boundary of the domain,
- f the function
- x_0 the initial condition
- ε the stopping criteria

OUTPUT:

- number of iterations k to converge
- the plot of the sequence $\{x_k\}$ for $k = 0, 1, \dots, k_{max}$
- the approximate value of $\int_a^b f(x)dx$,
- absolute error of the quadrature approximation when the value is known
- order of convergence p_k for each iteration of the method.

You might then test your code for the following functions

- a) $f(x) = x^2 - x - 2$
- b) $f(x) = \sqrt{x+2} - x$
- c) $f(x) = 1 + \frac{2}{x} - x$
- d) $f(x) = x + 2(\log(x) - 1)$
- e) $f(x) = e^x - x^2$
- f) $f(x) = \frac{1}{x} - e^{\sqrt{x}}$
- g) $f(x) = x - e^{-x^2}$
- h) $f(x) = x^3 - \sin(x)$