Lab 12

Numerical methods for solving nonlinear equations

1. Solve the equation

$$x = cosx.$$

using Newton's method for: $x_0 = \frac{\pi}{4}$, $\varepsilon = 10^{-4}$ and maximum number of iterations $N = 100$.

2. For finding the position of a satellite for $t = 9$ minutes, we have to solve Kepler's equation

$$f(E) = E - 0.8 \sin E - \frac{2\pi}{10} = 0.$$

Type the results obtained applying Newton's method 6 times, starting with $E = 1$. (Notice the quadratic precision.)

3. Use the secant method with $x_0 = 1$ and $x_1 = 2$ to solve $x^3 - x^2 - 1 = 0$, with $\varepsilon = 10^{-4}$ and maximum number of iterations $N = 100$.

4. Let $f : [1, 2] \to \mathbb{R}$, $f(x) = (x - 2)^2 - \ln x$. Solve the equation $f(x) = 0$, using bisection and false position methods, for $\varepsilon = 10^{-4}$ and maximum number of iterations $N = 100$. (Use $abs(f(c) < \varepsilon$ as a stopping criterion.)