

Computational Methods Summer 2021 I  
**HOMEWORK 2**

**Due Date:** Friday, June 4

Homework should be handed in *individually*, though you may work with others and collaboration is encouraged. For MATLAB problems please follow the guidelines specified in ELMS (in particular see the file “Formatting MATLAB assignments”)

1. (a) Write a MATLAB program to implement Newton’s method for root finding.  
(b) To compare root finding algorithms, we will approximate  $\sqrt{2}$  using two methods: Newton and Bisection. Using the equation  $f(x) = x^2 - 2 = 0$ , use your program from part (a) to ensure  $\sqrt{2}$  is obtained. For Newton, use  $x_0 = 2$ , and for Bisection use the starting bracket  $[1, 2]$ . In each case use  $10^{-8}$  for the error tolerance. You can use the bisection method code from class.  
(c) Modify the algorithms to keep track of the absolute error  $e_n = |r - x_n|$  at each iteration. Store these errors in a vector (for plotting purposes). Then plot the absolute errors on the same graph, and with a semilogarithmic y-axis (use `semilogy` in MATLAB). Which algorithm used the least steps to achieve the required error tolerance?