Lab-session week 14 (1MA930/1MA931, VT2024)

1. Consider the function

$$f(x) = x - 4\sin(2x) - 3 - \frac{3}{80}.$$

Find the zeros of f using the command `fzero` in Matlab for appropriate initial values based on your crude graphical localization of the zeros (obtained in lab session 1).

2. Use the Bisection method to find the root closest to 1.7.

a) Use the interval [1 2] as starting interval and do a few iterations by hand (you can use Matlab or a pocket calculator for the function evaluations). What is the answer and estimated error after 3 iterations?

b) How many iterations do you have to do for the estimated error to be smaller than 10^{-6}?

c) Check your answer by running the code from the book (page 27 in Sauer).
Hint: remove a semi-colon in order to see what the code is doing.

3. Solve the equation $1 + 2x + x^3 = 0$ using `roots` in Matlab.

Remark: Use a graphical solution to get a crude estimate and to check your result! Calculate the "method independent error estimate" $H = p(\alpha)/p'(\alpha)$. In the case of using `roots`, we should get $H \sim 10^{-15}$ or smaller. If not, some roots might be inaccurate.

4. Try using the Newton Raphson method to solve the equation in Problem 1 above to find the zeros for f with *eight* correct decimals by implementing appropriate `for` or `while` loop(s) in Matlab. Can you find the two distinct roots close to $x = 7$?

By eight correct decimals we here mean that the method independent error estimate (see previous problem) of the root obtained should be less than $0.5 \cdot 10^{-8}$.

5. Rewrite the equation in Problem 3 and solve it using fix point iteration. Does it converge? Test with different initial guesses. Do the same for the equation in Problem 1.

6. Solve computer problems 1.1(5), 1.1(7), 1.4(11) and 1.4(13) in the book of Sauer.