

## Project 2

### Finding Roots by Fixed Point Iteration

Use Fixed Point Iteration to find all roots of the equation

$$3x^3 - 7x^2 + 3x - e^x + 2 = 0$$

and analyze the linear convergence rate of FPI to the roots as follows.

1. Use Fixed Point Iteration to calculate all roots, rounded to 8 correct decimal places. Each root  $r$  will be a fixed point of FPI with a particular  $g(x)$ . You may find it necessary to use more than one  $g(x)$  to find them all, and you may need to vary the initial guesses as well. For each root of the equation, report the fixed point accurate to eight decimal places, along with the  $g(x)$  and initial guess you used, and the number of FPI steps required to reach this accuracy.
2. For each fixed point  $r$ , use calculus to determine  $S = |g'(r)|$ .
3. For each fixed point  $r$ , use your Matlab calculations to approximate the convergence rate

$$\lim_{k \rightarrow \infty} \frac{e_{k+1}}{e_k}$$

of the Fixed Point Iteration, and match your approximations with the answers in part 2.

Extra 10 points will be awarded to the student who finds the fastest convergence to a root, as measured by the smallest nonzero  $S$ .

Begin your report by answering the three questions above. Print out the Matlab code used and your Matlab session, and include these with your report.