

Project 2

Rootfinding with the Fixed Point Iteration method

The equation

$$3x + 1 = 5x^2 + 9x^3 + \sin e^x$$

has three solutions. You will find all three of them using Fixed Point Iteration, and then analyze the convergence rate of FPI to the roots.

1. Use Fixed Point Iteration to calculate the three roots. Round each root to 6 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. [NOTE: If you decide to take a cube root, it is recommended to use the Matlab command `nthroot`].

For each solution of the equation, report the fixed point rounded accurately to 6 decimal places, 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 your knowledge of calculus to determine the convergence rate $S = |g'(r)|$.
3. For each fixed point r , use your Matlab calculations to approximate the convergence rate

$$\lim_{i \rightarrow \infty} \frac{e_{i+1}}{e_i}$$

of the Fixed Point Iteration. The FPI Theorem says that this limiting ratio should be S from Step 2. Show that your approximate limits match with the answers in Step 2, at least to a few decimal places.

Begin your report by stating your conclusions about the three questions above. Save the Matlab code used and your Matlab session, and include these with your report. Save your report as a .pdf file and upload it to Blackboard. (You are allowed to edit your Matlab session as long as you include the important results.)

Due: Thurs., Sept. 12