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CSCI 3656 Numerical Computation Problem Set 3

* 1. Newton’s method for function f(x) = x^2 – x – 2 and initial guess x = 1.5.

Number of iterations required for |f(x)| < 0.0001 = 2.

* 1. Newton’s method for function f(x) = x^3 – 3x^2 + 4 and initial guess x = 1.5.

Number of iterations required for |f(x)| < 0.0001 = 6

* 1. Yes the method shows some degree of quadratic convergence for both polynomials. Newton’s method was able to find the root for the first function in very few steps, jumping from 0.0144 to 2.3040e-05, certainly demonstrating a high degree convergence rate. As for the second function, the method still only took 6 iterations with each step getting exponentially closer, thus matching the expected quadratic convergence, starting at 0.0328 and ending 3.0906e-05.
  2. The bisection method error convergence is linear, halving at each step, so it shouldn’t matter whether the function has a multiple root or not. It’s also noted that multiple roots trip up many other rootfinders making them slower and less accurate, but not bisection.
  3. If a rootfinder were cubically convergent that would mean that the error would get exponentially smaller by a degree of 3 per each step, for example 0.285 => 0.02315 => 0.00001
  4. Next-term rule: when using a series and choose a stopping point for your answer, use the next term of the series as an approximation of the error.
  5. Linear Algebra:
     + f(x) = 5x + 20 is linear
     + f(x) = 3x^5 – x^2 + 2 is nonlinear
     + 1 possible unique solution
     + If A inverse exists, then |A| is nonzero.