Bare Essentials

At the end of this chapter you should be able to

1. Write any scalar equation in the form $f(x) = 0$
2. Give a graphical interpretation of the location of a root on the x axis (when equation is written as $f(x) = 0$).
3. Explain the role of bracketing.
4. Write a simple equation that expresses the condition for finding a root in a bracket interval.
5. Manually perform a few steps of the bisection method
6. Identify the one situation where bisection will return an incorrect value for x as a root.
7. Manually perform a few steps of Secant method
8. Identify situations that cause Newton's method to fail.
9. Manually perform a few steps of Newton's method
10. Identify situations that cause Newton's method to fail.
11. List the methods used by the built in `fzero` command.
12. List reasons why simple root-finding schemes are not recommended to search for roots of polynomials.
13. Name the procedure used by `roots` to find the roots of a polynomial.

To perform basic root-finding with MATLAB you will need to

14. Plot any $f(x)$ as a means of graphically identifying the location of roots.
15. Write an m-file that evaluates $y = f(x)$ for use with `bisect`, `secant`, and `fzero`
16. Write an m-file that evaluates $f(x)$ and $f'(x)$ for use with the `newton` function
17. Find zeros of a function with the `bisect`, `newton`, and `fzero`.
18. Find roots of polynomials with the `roots` command.

An Expanded Core of Knowledge

After mastering the bare essentials you should move on to a deeper understanding of the fundamentals. Doing so involves being able to

1. Qualitatively compare the convergence rates of bisection, secant and Newton's method
2. Describe the `fzero` command, and how it relates to bisection, secant and reverse interpolation.

Developing Mastery

Working toward mastery of root-finding you will need to

1. Analyze the convergence rate of bisection.
2. Identify the behavior of Newton's method for repeated roots.