

MA332 Project 1

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1 Introduction

Newton's Method is a numerical root-finding algorithm. To find a root $f(x_*) = 0$, the algorithm uses f , its derivative f' , and some starting value x_0 .

2 Failure to Converge

Depending on the function and starting value, Newton's Method may not converge.

3 Basins of Attraction

For a given root $f(x_*) = 0$, the *basin of attraction* is the set of starting values x_0 for which Newton's Method will converge to x_* .

3.1 Real-Valued Functions

Consider the function

$$g(x) = (x - 1)(x + 3)$$

3.2 Complex-Valued Functions

4 Discussion

Figure 1: Basins of convergence for $g(x) = (x - 1)(x + 3)$

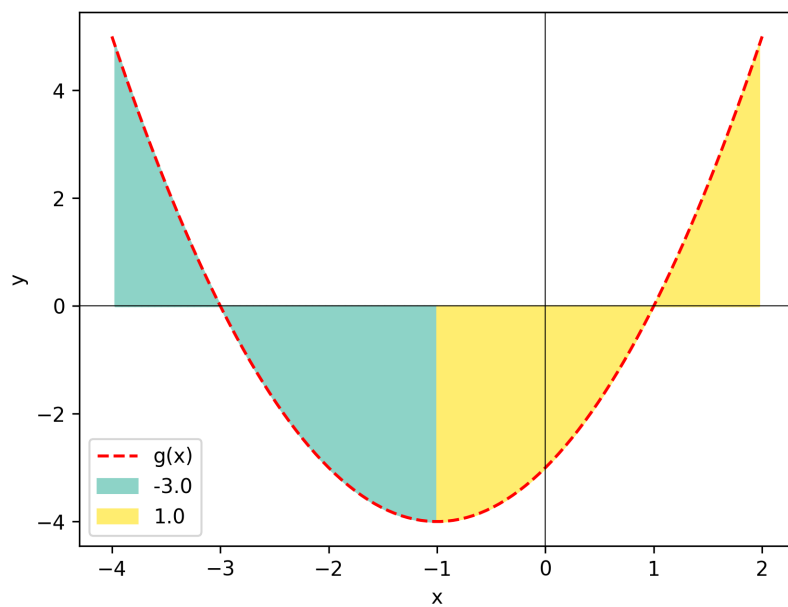


Figure 2: Basins of convergence for $h(x) = (x - 4)(x - 1)(x + 3)$

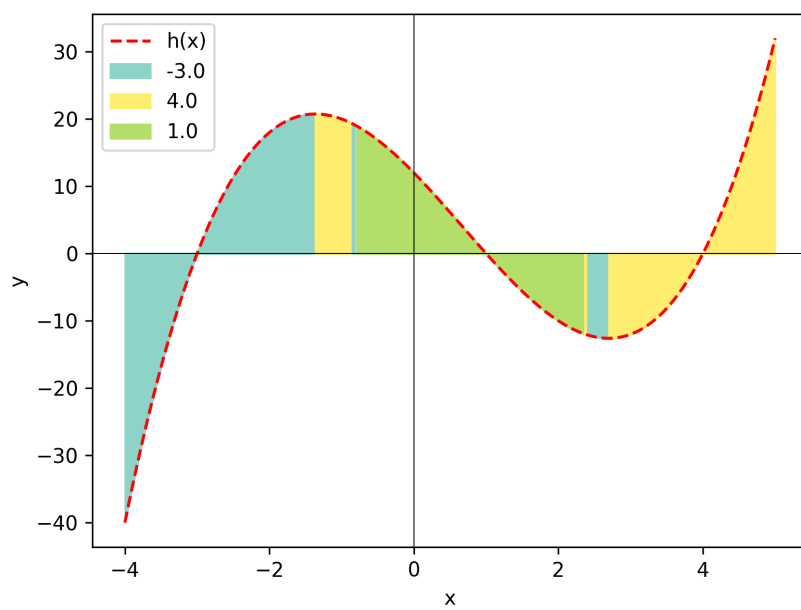


Figure 3: Zooming in shows the fractal pattern of the basins

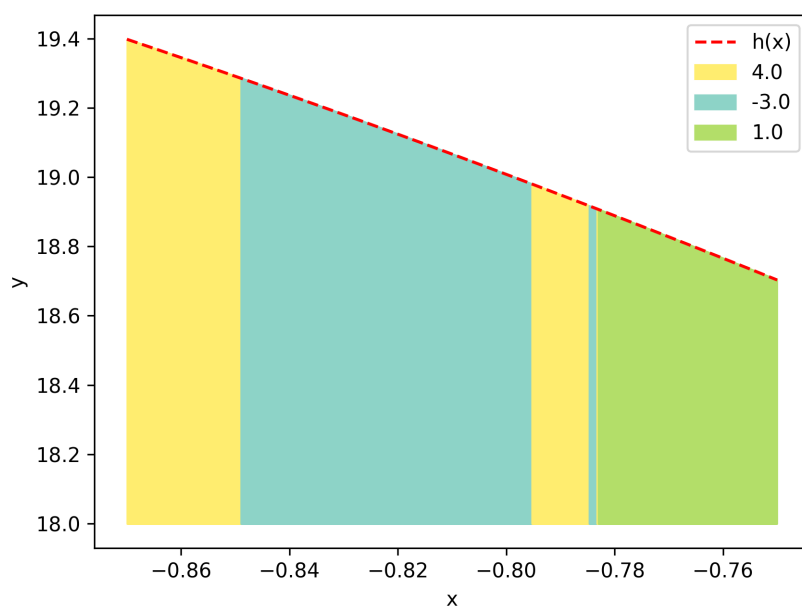


Figure 4: Basins of convergence for $f(z) = z^3 - 1$ on the complex plane $a + bi$

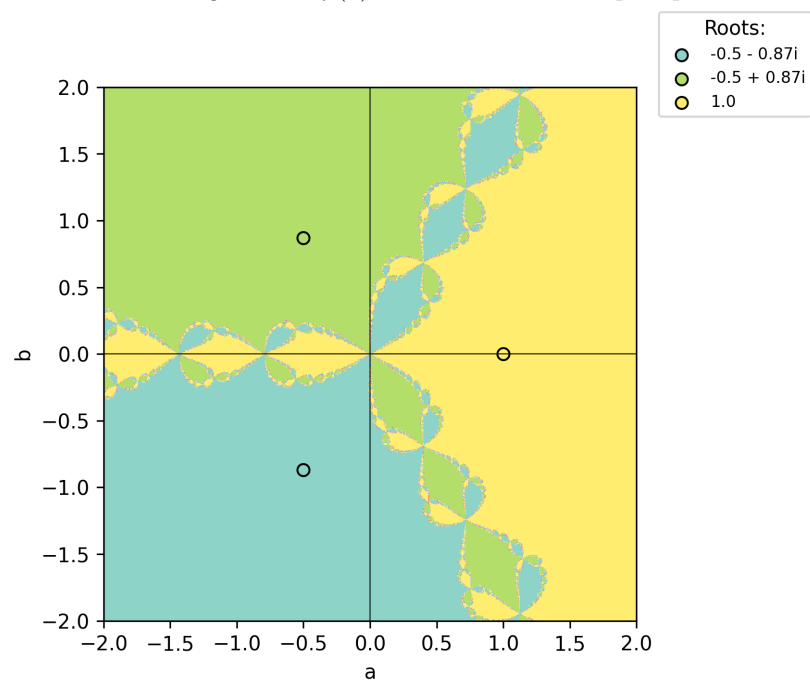


Figure 5: Basins of convergence for $g(z) =$ on the complex plane $a + bi$

