

**Topics:**

- Error Growth
- Difference Equations
- Convergence Rates
- Root Multiplicity
- Fixed Points (Single and Multiple Variable)
- Fixed Point Methods: Newton, Secant, Modified Newton, False Position

**Study Questions–I**<sup>1</sup>

1. If a computational process can be described by a linear constant coefficient difference equation, under what conditions will exponential error growth result?.
2. What is a fixed point and can the existence of all fixed points be guaranteed? Why or why not?.
3. Can a fixed point iteration be guaranteed to converge? What conditions are required to prove convergence for *some* starting value? For *all* starting values on an interval  $[a, b]$ ?.
4. Define convergence rate in a asymptotic sense. Under what conditions is a fixed point iteration quadratically convergent?
5. When is Newtons method quadratically convergent? Linearly convergent? .
6. What is the rationale for the development of modified Newtons method? Why does it work?.
7. What are the advantages and disadvantages of the Secant method? How fast does it converge?
8. What is a root multiplicity and how does it effect the convergence rate of various methods?
9. Show graphically the difference between the Secant method and the method of False Position.
10. What conditions are necessary for convergence of a fixed point iteration involving multiple variables (and equations)? What conditions are need for such a process to be quadratically convergent?

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<sup>1</sup>Posted on: August 26, 2021.