2.1/

Bisection Technique

1. **What?**

2. **Why?**

3. **Method:**

4. **Algorithm:**

5. **Drawbacks:**

6. **Stopping Criterions:**

> **The best criterion is:**

7. **Convergence:**

> **It:**

8. **Rate of Convergence \ Error Bound:**

9. **The problem of Percision:**

   We use,

10. **The Signum Function:**

    We use,

2.2/

Fixed-Point Problems

1. **Fixed Point:**

2. **Root-finding problems and Fixed-point problems:**

   > Root Finding and Fixed-point problems are

3. **Why?:**

4. **Existence and Uniqueness of a Fixed Point.:**

Fixed-Point Iteration

1. **Approximating Fixed-Points:**

2. **Algorithm:**

3. **Convergence:**
    - **Fixed-Point Theorem:**
    - **Error bound in using p_n for p:**

    > Notice:

4. **Using Fixed-Points:**

> **Question**:
>
> **Answer**:

5. **Newton’s Method as a Fixed-Point Problem:**

2.3/

Newton’s Method

1. **What?:**
    - **Newton’s (or the Newton-Raphson) method is**:
    -
    -
2. **Derivation:**

3. **Algorithm:**

4. **Stopping Criterions:**

Convergence using Newton's Method

1. **Convergence Theorem:**

   Theorem:

   > The crucial assumption is

> Theorem 2.6 states that,
>
> (1)
>
> (2)

The Secant Method

1. **What?**

   In Newton's Method

   We approximate $f'(p_n - 1)$ as:

   To produce:

2. **Why?**

   > :
   >
   > > Frequently,

> Note:

3. **Algorithm:**

4. **Convergence Speed:**

The Method of False Position

1. **What?**

2. **Why?**

3. **Method:**

4. **Algorithm:**

2.4/

Order of Convergence

1. **Order of Convergence:**

2. **Important, Two cases of order:**

3. **An arbitrary technique that generates a convergent sequences does so only linearly:**

> Theorem 2.8 implies

4. **Conditions to ensure Quadratic Convergence:**

5. **Theorems 2.8 and 2.9 imply:**

   (i)

   (ii)

6. **Newtons' Method Convergence Rate:**

Multiple Roots

1. **Problem:**

2. **Zeros and their Multiplicity:**

3. **Identifying Simple Zeros:**
    - **Theorem:**
    - **Generalization of Theorem 2.11:**

    > The result in Theorem 2.12 implies

    ```
    </xmp>
    ```

4. **Why Simple Zeros:**

> Example:

5. **Handling the problem of multiple roots:**
    - We
    - We define as:

- **Derivation:**

- **Properties:**
  -
  -
  -
  -

$2.5/$

Aitken's Δ^2 Method

1. **What?**

2. **Why?**

3. **Derivation:**

4. **Del [Forward Difference]:**

5. $\hat{p}_n$ **[Formula]:**

6. **Generating the Sequence [Formula]:**

Steffensen's Method

1. **What?:**

2. **Zeros and their Multiplicity:**

3. **Difference from Aitken's method:**

- **Aitken's method:**

- **Steffensen's method:**

> Notice

4. **Algorithm:**

5. **Convergance of Steffensen's Method:**

2.6/

Algebraic Polynomials

1. **Fundamental Theorem of Algebra:**

2. **Existance of Roots:**

3. **Polynomial Equivalence:**

> This result implies

Horner’s Method

1. **What?**

2. **Why?**

3. **Horner’s Method:**

4. **Algorithm:**

5. **Horner's Derivatives:**

6. **Deflation:**

7. **MatLab Implementation:**

Complex Zeros: Müller's Method

1. **What?**
    - **It is a:**

- Müller's method uses

2. **Why?**
    1. **First:**
    2. **Second:**

    > If the initial approximation is a real number,

3. **Complex Roots:**

4. **Algorithm:**

5. **Calculations and Evaluations:**

    Müller's method can: