Module 2 - Non Linear Equations

ME3001 - Mechanical Engineering Analysis

Mechanical Engineering

Tennessee Technological University

Topic 1 - Solving Non-Linear Equations

Topic 1 - Solving Non-Linear Equations

- What is a Non-Linear Equation ?

- Solving Nonlinear Equations

- Analytical vs. Numerical Methods

- Example

What is a Non-Linear Equation ?

" an equation whose graph does not form a straight line"

What is a Non-Linear Equation ?

Different Types of Non-Linear Equations

- **Polynomials (excluding first order)**

- **Transcendentals**

  " a transcendental function "transcends" algebra in that it
  cannot be expressed in terms of a finite sequence of the
  algebraic operations of addition, multiplication, and root
  extraction. Examples of transcendental functions include the
  exponential function, the logarithm, and the trigonometric
  functions. "
  - Exponentials
  - Logarithms
  - Trigonometrics

Solving Nonlinear Equations

What does *Solve the Equation* **mean?**

Example: $\quad y = x^2 + 2x - 10$
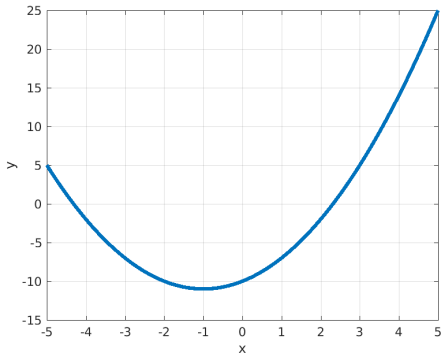
Analytical vs. Numerical Methods

Analytical

- solution to a problem that can be written in **closed form**
- solution in terms of known functions, constants, etc.
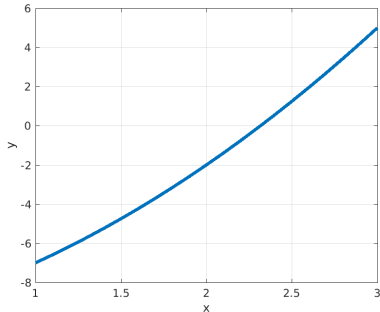- gives an **exact answer**

Numerical

- an **approximation** to the solution of a mathematical equation
- iterative procedure or algorithm
-

Example

Method 1 - *Algebra*

We are looking for where the line crosses the x-axis, so how can we tell where this happens?

$$y = x^2 + 2x - 10$$
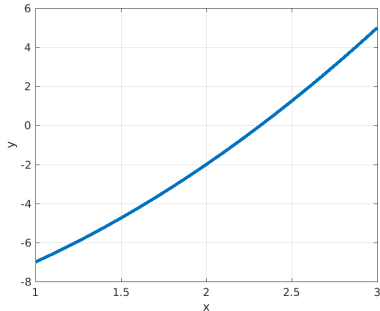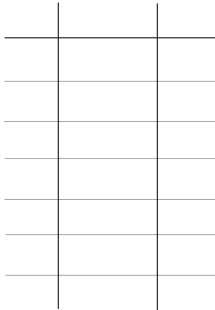
Example

Method 1 - *Algebra*

Example

 Method 2 - *The Incremental Search*
We are looking for where the line crosses the x-axis, so how can we
tell where this happens?

$y = x^2 + 2x - 10$

Example

Method 2 - *The Incremental Search*