1. **SECANT METHOD:**

In numerical analysis, the secant method is a root-finding algorithm that uses a succession of roots of secant lines to better approximate a root of a function f. The secant method can be thought of as a finite-difference approximation of Newton's method.

**FORMULA:**

**=**

**ADVANTAGES:**

* It converges at faster than a linear rate, so that it is more rapidly. convergent than the bisection method.
* It does not require use of the derivative of the. Function something that is not available in a number. of applications.
* It requires only one function evaluation per iteration.

**DISADVANTAGES:**

It does not require use of the derivative of the function, something that is not available in a number of applications.

**EXAMPLE:**

F(x) = x-

First we find its roots:

* F(0) = 0-= -1

For second root:

* F(1) = 1-= 0.632

These roots are not close to each other so if I take 0.5 and 0.6.

Roots are (0.5, 0.6)

Now:

And: f () = 0.0511

By using formula for secant method

=

For n=1

=

=

Put value, we get:

=

= 0.5675

Now for n=2

Now for n=3

**Error:**

**Formula for error is**: =

= 0%

1. **FIXED POINT METHOD:**

In numerical analysis, fixed-point iteration is a method of computing fixed points of a function. More specifically, given a function f defined on the real numbers with real values and given a point

F(x) = 0 also written in x = Ø(x)

Where <1

**Advantages**:

Operations can be applied on the number just like on integers.

**Disadvantages:**

It requires a starting interval containing a change of sign. Therefore it cannot find repeated roots. It has a fixed rate of convergence, which can be much slower than other methods, requiring more iterations to find the root to a given degree of precision.

**Example:**

***F(0)= -1***

***F(1)=1***

Roots are **(-1,1)**

**Take any initial guess which lies between 1 and -1**

**=0.5 (initial value)**

**=x**

**Derivative**

**Then**

**Also**

**X=**

**Again**

**=Ø(x)**

**Now take the value which is closer to zero like our first iteration**

**Taking to formula for fixed point method:**

**Solving: = = 0.793**

**=**

**=**

**=**

**ERROR:**

=

= = 10%

1. **FALSE POSITION:**

In mathematics, the regula falsi, method of false position, or false position method is a very old method for solving an equation with one unknown; this method, in modified form, is still in use.

**Formula:**

**Advantages:**

1. **This method is used for the numerical solution of algebraic equations which have a single equation**. 2. The equations which predict the atmospheric emissions can also be solved by this method.

**Disadvantages:**

* Slow Rate of Convergence: Although convergence of Regula Falsi method is guaranteed, it is generally slow.
* Cannot find root of some equations. ...
* It has linear rate of convergence.
* It fails to determine complex roots.
* It cannot be applied if there are discontinuities in the guess interval.

**Example:**

So roots are (0,1)

By using formula

Now roots are (0, 0.3145)

F(0.3145)=cos(57.3×0.3145)-0.3145

0.950-0.3145(1.3695)

=0.5192f

Now for

=25%

3.**NEWTON RAPHSON METHOD**:

The Newton-Raphson method (also known as Newton's method) is a way to quickly find a good approximation for the root of a real-valued function f(x) = 0f(x)=0. It uses the idea that a continuous and differentiable function can be approximated by a straight line tangent to it. FORMULA: xn+1= xn+1=xn− 𝑓 ′ (𝑥𝑛) (𝑥𝑛)

**ADVANTAGES**:

1. Converges fast (quadratic convergence) ,if it converges.

2. Requires only one guess.

**DISADVANTGES:**

Divergence at inflection points: Selection of the initial guess or iteration of the root that is close to the inflection point of the function f(x) may start diverging away from the root in the Newton-Raphson method.

Example:

f(x)=

f(0) =1

f(1) =-2.17

So, points are (0 , 1).

𝑓 ′=

Now put in:

1. **NEWTON DIVIDER DIFFERENCE INTERPOLATION**:

Interpolation is an estimation of a value within two known values in a sequence of values. Newton's divided difference interpolation formula is **a interpolation technique used when the interval difference is not same for all sequence of values**.

**Formula:**

Let

Table:

|  |  |  |  |
| --- | --- | --- | --- |
| **x** | **y=** | **First order D.D** | **Second order D.D** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Example:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | 1 | 3 | 4 | 8 |
| y | 2 | 5 | 9 | 11 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | y | First order | Second order | Third order |
| 1 | 2 |  |  |  |
|  |  |  |  |  |
| 3 | 5 |  |  |  |
|  |  |  |  |  |
| 4 | 9 |  |  |  |
|  |  |  |  |  |
| 8 | 11 |  |  |  |

Now put in formula

=

After simplification and putting in formula it gives:

**+**

1. **JORDAN METHOD:**

Gauss-Jordan Elimination is **an algorithm that can be used to solve systems of linear equations and to find the inverse of any invertible matrix**. It relies upon three elementary row operations one can use on a matrix: Swap the positions of two of the rows. Multiply one of the rows by a nonzero scalar.

Gaussian Elimination is a structured method of solving a system of linear equations. Thus, it is an algorithm and can easily be programmed to solve a system of linear equations. The main goal of Gauss-Jordan Elimination is:

* to represent a system of linear equations in an **augmented matrix form**
* then performing the 3 row operations on it until the **reduced row echelon form**

**Example:**

**Row operation can be used to express the matrix in reduced rowechelon form**

The matrix now says that x=1,y=4,z=-2

1. **GUASS ELIMINATION METHOD:**

**In matrix form: AX=B**

**=**

**C = [A: B] =**

**Now find echelon form**

C =

And then back substitute:

**Example:**

**AX = B**

By making augmented matrix:

C = [A: B] =

Now equate the equation by echelon method by performing row operations :

The corresponding system of equation:

x+3y+2z=5

y+5z=7

-9z=-9

Solving by back substitution we get;

1. **GUASS SEIDLE METHOD:**

In numerical linear algebra, the **Gauss**–**Seidel method**, also known as the Liebmann **method** or the **method** of successive displacement, is an iterative **method**.

Diagonal dominance property must be satisfies:

Rewriting the equations for x,y,z

For second approximation we get;

For third:

**Example:**

**Solution:**

Magnitude of first row is greater to other and so on so the diagonal property satisfies:

Rewriting the equations.

**Now assume**

=3.1481

=3.5408

=1.9132

=2.4322

=3.5720

=1.9258

=2.4256

=3.5730

=1.9260

**But formula for error is:**

**∞sign means maximum value….**

* **SPLINE CUBIC RULE:**

**Example: construct a cubic spline that passes through the (1,2)(2,3)and(3,5)**

Solution:

[1,2]:

[2,3]:

By making augmented matrices:

S(x)={2+

S(x)={3+)+

1. **SIMPSONS**

**Formula**:

**find solution using this rule:**

|  |  |
| --- | --- |
| **x** | **F(x)** |
| **1.4** | **4.0552** |
| **1.6** | **4.9530** |
| **1.8** | **6.0436** |
| **2.0** | **7.3891** |
| **2.2** | **9.0250** |

**Solution:**

**The value of table for x and y**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **x** | **1.4** | **1.6** | **1.8** | **2.0** | **2.2** |
| **y** | **4.0552** | **4.9530** | **6.0436** | **7.3891** | **9.0250** |

**By using formula:**

**Solution by Simpsons rule is 4.5636**

1. **TRAPEZOIDAL RULE:**

**Formula:**

**Example:**

**Find solution by this method:**

|  |  |
| --- | --- |
| **x** | **F(x)** |
| **0.0** | **1.0000** |
| **0.1** | **0.9975** |
| **0.2** | **0.9900** |
| **0.3** | **0.9776** |
| **0.4** | **0.8604** |

**Solution:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **x** | **0** | **0.1** | **0.2** | **0.3** | **0.4** |
| **y** | **1** | **0.9975** | **0.99** | **0.9776** | **0.8604** |

**Using formula:**

**Solution by trapezoidal rule is:**