1. Trapezoidal (n = no condition)

$$\frac{h}{2}\left[Y_0 + 2(Y_1 + Y_2 + Y_3 \ldots + Y_{n-1}) + Y_n\right]$$

2. Simpsons 1/3 rule (n = even no.)

$$\frac{h}{3}\left[Y_0 + 4(Y_1 + Y_3 + Y_5 \ldots + Y_{n-1}) + 2(Y_2 + Y_4 + Y_6 \ldots + Y_{n-2}) + Y_n\right]$$

3. Simpsons 3/8 rule (n = multiple of 3).

$$\frac{3h}{8}\left[Y_0 + 3(Y_1 + Y_2 + Y_4 \ldots Y_{n-2} + Y_{n-1}) + 2(Y_3 + Y_6 + Y_9 \ldots Y_{n-9}) + Y_n\right]$$

4. Booles rule (n = multiple of 4)

$$\frac{2h}{45}\left[(7Y_0 + 32Y_1 + 12Y_2 + 32Y_3 + 7Y_4) + (7Y_4 + 32Y_5 + 12Y_6 + 32Y_7 + 7Y_8)\ldots\right]$$

5. Weddles Rule (n = multiple of 6)

$$\frac{3h}{10}\left[(Y_0 + 5Y_1 + Y_2 + 6Y_3 + Y_4 + 5Y_5 + Y_6) (Y_6 + 5Y_7 + Y_8 + 6Y_9 + Y_{10} + 5Y_{11} + Y_{12})\right]$$

6. $h = \frac{b-a}{n}$

7. Bisection

$$x_n = \frac{x_l + x_u}{2}$$

8. Regula falsi (False position)

$$x_n = \frac{x_l\, f(x_u) - x_u\, f(x_l)}{f(x_u) - f(x_l)}$$

9. Newton Raphson.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

10. Secant

$$x_{n+1} = \frac{x_{n-1}\, f(x_n) - x_n\, f(x_{n-1})}{f(x_n) - f(x_{n-1})}$$

11. Lagrange interpolation

$$y = f(x) = \frac{(x-x_1)(x-x_2)(x-x_3)(x-x_4)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)(x_0-x_4)} * y_0$$

$$+ \frac{(x-x_0)(x-x_2)(x-x_3)(x-x_4)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)(x_1-x_4)} * y_1$$

$$+ \frac{(x-x_0)(x-x_1)(x-x_3)(x-x_4)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)(x_2-x_4)} * y_2$$

....

12. Newton Forward formula / gregory formula.

steps

1. construct forword diff table
2. find n

x_0 = first value of x

A = value to be found

h = difference in x values.

→ $x_0 + nh = A$

3. formula

$$f(A) = f(x_0) + \frac{n}{1!} \Delta f(x_0) + \frac{n(n-1)}{2!} \Delta^2 f(x_0)$$

$$+ \frac{n(n-1)(n+1)}{3!} \Delta^3 f(x_0)$$

13. Newton Backward formula / gregory.

steps

1. create backward difference table.
2. find n $\longrightarrow$ $x_0 + nh = A$
3. formula

$$= y_n + \frac{n}{1!} \nabla y_n + \frac{n(n+1)}{2!} \nabla^2 y_n + \frac{n(n+1)(n+2)}{3!} \nabla^3 y_n$$

14. gauss forward method.

steps

1. construct central diff table.
2. label the values of x, y
3. find n $\rightarrow$ $x_0 + nh = A$
4. formula.

$$f(A) = f(x_0)$$
$$+ \frac{n}{1!} \Delta f(x_0)$$
$$+ \frac{(n-1)n}{2!} \Delta^2 f(x_{-1})$$
$$+ \frac{n(n-1)(n+1)}{3!} \Delta^3 f(x_{-1})$$
$$+ \frac{n(n-1)(n+1)(n-2)}{4!} \Delta^4 f(x_{-2})$$

15. gauss backward

steps:

1. construct central diff table.
2. find n $\rightarrow$ $x_0 + nh = A$
3. formula.

$$
\begin{aligned}
f(A) = {} & f(x_0) \\
& + \frac{n}{1!} \Delta f(x_{-1}) \\
& + \frac{n(n+1)}{2!} \Delta^2 f(x_{-1}) \\
& + \frac{n(n+1)(n-1)}{3!} \Delta^3 f(x_{-2}) \\
& + \frac{n(n+1)(n-1)(n+2)}{4!} \Delta^4 f(x_{-2})
\end{aligned}
$$

16 gauss Jordan.

steps.

1. form augumented matrix $\left[\begin{array}{cc|c} a & c & 0 \\ b & d & 1 \end{array}\right]$
2. convert into reduced row - echelon matrix.

17. gauss - seidel.

steps

1. form augumented matrix
2. check if coefficient matrix is diagonally dominant.
3. rewrite the equations.
4. iterations