Mon Tue Wed Thu Fri Sat Sun   Date: 27 - 8 - 2024

Numerical (3) Computing

θ		$y = \sin\theta$		Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$
10	θ_0	0.1736	y_0				
				Δy_0 0.1684			
20	θ_1	0.3420	y_1		$\Delta^2 y_0$ -0.0104		
				0.1580		$\Delta^3 y_0$ -0.0048	
30	θ_2	0.5000	y_2		-0.0152		$\Delta^4 y_0$ 0.0004 $\Delta^4 y_4$
				0.1428		$\Delta^3 y_4$ -0.0044	
40	θ_3	0.6428	y_3		$\Delta^2 y_4$ -0.0196		
				Δy_4 0.1232			
50	θ_4	0.7660	y_4				

$y(25) = ?$

Using Forward Difference Formula:

Given:

$x = 25$

$x_0 = \theta_0 = 10^\circ$

$y_0 = 0.1736$

$\Delta y_0 = 0.1684$

$$y_p = y_0 + p\Delta y_0 + \frac{p(p-1)}{2!}\Delta^2 y_0 + \frac{p(p-1)(p-2)}{3!}\Delta^3 y_0 + \frac{p(p-1)(p-2)(p-3)}{4!}\Delta^4 y_0$$

$\theta = \theta_0 + ph$

$25 = 10 + p10$

$1.5 = p$

$$y = 0.1736 + 1.5(0.1684) + \frac{(1.5)(0.5)(-0.0104)}{2!} + \frac{(1.5)(0.5)(-0.5)(-0.0048)}{3!} + \frac{(1.5)(0.5)(-0.5)(-1.5)(0.0004)}{4!}$$

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$\sin(25^\circ) = y_p = 0.422609375$

Exact $= 0.4226$ Abs. Error $= |0.4226 - 0.4226| = 0$

Approx $= 0.4226$

Relative Error $= 0$

$y(45^\circ) = \theta = 45^\circ$

$x = x_n + ph$

$p = \frac{x - x_n}{h} = \frac{45 - 50}{10} = -0.5$

$$y_p = y_4 + p\nabla y_4 + \frac{p(p+1)}{2!}\nabla^2 y_4 + \frac{p(p+1)(p+2)}{3!}\nabla^3 y_4$$

$$+ \frac{p(p+1)(p+2)(p+3)}{4!}\nabla^4 y_4$$

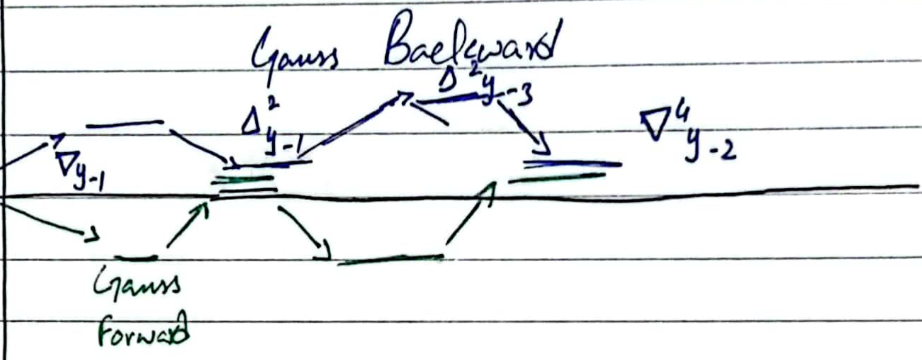
$$y_{45} = 0.7660 + (-0.5)(0.1232) + \frac{(-0.5)(0.5)(-0.0196)}{2!} + \frac{(-0.5)(0.5)(1.5)(-0.00}{3!}$$

$$+ \frac{(-0.5)(0.5)(1.5)(2.5)(0.0004)}{4!} = 0.7071$$

$\sin 45^\circ = 0.7071$

No errors.

x_{-4}	y_{-4}
x_{-3}	y_{-3}
x_{-2}	y_{-2}
x_{-1}	y_{-1}
x_0	y_0
x_1	y_1
x_2	y_2
x_3	y_3
x_4	y_4



Interpolation

- Equally Spread Data
  - NG Forward + Backward ($x = x_n + ph$; $x = x_0 + ph$)
  - Central Difference Formula. ($x = x_0 + ph$.)
    - Gauss Forward
    - Gauss Backward
    - Stirling Formula
    - Laplace Everett's Formula
    - Bessel Formula
- un-equally spaced data
  - Newton Divided Difference Formula.
  - Lagrange Formula.