

Def: The second divided difference, $f[x_i, x_{i+1}, x_{i+2}]$ is defined as

$$f[x_i, x_{i+1}, x_{i+2}] = \frac{f[x_{i+1}, x_{i+2}] - f[x_i, x_{i+1}]}{x_{i+2} - x_i}$$

Thus, if the $(k-1)^{\text{st}}$ divided differences $f[x_i, x_{i+1}, \dots, x_{i+k-1}]$, $f[x_{i+1}, \dots, x_{i+k}]$ are given, then the k^{th} divided difference relative to $x_i, x_{i+1}, \dots, x_{i+k}$ is given by

$$f[x_i, x_{i+1}, \dots, x_{i+k}] = \frac{f[x_{i+1}, \dots, x_{i+k}] - f[x_i, \dots, x_{i+k-1}]}{x_{i+k} - x_i}$$

The divided differences are usually computed in a table

x	$f(x)$	I st DD	II nd DD	III rd DD	IV th D.D.
x_0	f_0				
x_1	f_1	$f[x_0, x_1]$			
x_2	f_2	$f[x_1, x_2]$	$f[x_0, x_1, x_2]$		
x_3	f_3	$f[x_2, x_3]$	$f[x_1, x_2, x_3]$	$f[x_0, x_1, x_2, x_3]$	
x_4	f_4	$f[x_3, x_4]$	$f[x_2, x_3, x_4]$	$f[x_1, x_2, x_3, x_4]$	$f[x_0, x_1, x_2, x_3, x_4]$
\vdots					
\vdots					