

5) Interpolation formulas with equally spaced points. Ordinary differences

Def: The points x_0, x_1, \dots, x_n are equally spaced if
$$x_1 - x_0 = x_2 - x_1 = x_3 - x_2 = \dots = x_n - x_{n-1} = h$$

↑ step

Ex: a) $x_0 = 1$ $x_1 = 1.5$ $x_2 = 2$ $x_3 = 2.5$ $x_4 = 3$

$$x_1 - x_0 = 0.5 \quad x_2 - x_1 = 0.5 \dots$$

If the data are equally spaced, getting the interpolating polynomial is simpler. Also, when we compute the divided differences we would always divide by the same number. In this case it is more convenient to define "ordinary differences"

Def: The first forward difference $\Delta f(x_i)$ is defined as

$$\Delta f(x_i) = f(x_{i+1}) - f(x_i)$$

Then, $f[x_i, x_{i+1}] = \frac{f(x_{i+1}) - f(x_i)}{x_{i+1} - x_i} = \frac{\Delta f(x_i)}{h}$