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## divided difference interpolation formula

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Newton's *divided difference interpolation formula* is the analogue of the Gregory-Newton and Taylor series for divided differences.

If  $f$  is a real function and  $x_0, x_1, \dots$  is a sequence of distinct real numbers, then we have, for any integer  $n > 0$ ,

$$f(x) = f(x_0) + (x - x_0)\Delta f(x_0, x_1) + \dots + (x - x_0) \cdots (x - x_{n-1})\Delta^n f(x_0, \dots, x_n) + R$$

where the remainder can be expressed either as

$$R = (x - x_0) \cdots (x - x_n)\Delta^{n+1} f(x, x_1, \dots, x_n)$$

or as

$$R = \frac{1}{(n+1)!} (x - x_0) \cdots (x - x_n) f^{(n+1)}(\eta)$$

where  $\eta$  lies between the smallest and the largest of  $x, x_0, \dots, x_n$ .

**Remark.** If  $f$  is a polynomial of degree  $n$ , then  $R$  vanishes.