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Trapezoidal rule numerical integration

Numerical integration method This article is about the quadrature rule for approximating integrals. For the implicit trapezoidal rule for solving initial value problems, see Trapezoidal rule (differential equations). For the explicit trapezoidal rule for solving initial value problems, see Heun's method. The function f(x) (in blue) is approximated by a linear function (in red). In mathematics, and more specifically in numerical analysis, the trapezoidal rule (also known as the trapezoid rule or trapezium rule—see Trapezoid for more information on terminology) is a technique for approximating the definite integral. $\int_a^b f(x)\,dx$. $\textstyle{\int_{a}^{b}f(x)\,dx.}$ The trapezoidal rule works by approximating the region under the graph of the function $f(x)$ $\textstyle{f(x)}$ as a trapezoid and calculating its area. It follows that $\int_a^b f(x)\,dx \approx (b-a)\cdot\frac{1}{2}(f(a)+f(b))$. $\textstyle{\int_{a}^{b}f(x)\,dx\approx (b-a)\cdot\tfrac{1}{2}(f(a)+f(b)).}$ The trapezoidal rule may be viewed as the result obtained by averaging the left and right Riemann sums, and is sometimes defined this way. The integral can be even better approximated by partitioning the integration interval, applying the trapezoidal rule to each subinterval, and summing the results. In practice, this "chained" (or "composite") trapezoidal rule is usually what is meant by "integrating with the trapezoidal rule". Let $\{x_k\}$ $\textstyle{\{x_{k}\}}$ be a partition of $[a,b]$ $\textstyle{[a,b]}$ such that $a = x_0 < x_1 < \cdots < x_{N-1} < x_N = b$ $\textstyle{a=x_{0}}$