

MAT – 112: Calculus I and Modeling

Numerical Integration

Instructor: Thomas R. Cameron

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Instructions

Below is a review of the numerical integration techniques you should know from this course. For each rule, the interval $[a, b]$ is being split into n subintervals of length $h = (b - a)/n$. The subintervals are denoted by $[x_i, x_{i+1}]$ for $i = 0, 1, 2, \dots, n-1$, where $a = x_0 < x_1 < x_2 < \dots < x_n = b$.

Left-Hand Rule. The definite integral is approximated as follows:

$$\int_a^b f(x)dx \approx h(f(x_0) + f(x_1) + \dots + f(x_{n-1})).$$

Trapezoidal Rule. The definite integral is approximated as follows:

$$\int_a^b f(x)dx \approx h\left(\frac{1}{2}f(x_0) + f(x_1) + \dots + f(x_{n-1}) + \frac{1}{2}f(x_n)\right)$$

Simpson's Rule. The definite integral is approximated as follows:

$$\begin{aligned} \int_a^b f(x)dx \approx \frac{h}{6} & \left(f(x_0) + 4f\left(\frac{x_0 + x_1}{2}\right) + 2f(x_1) + 4f\left(\frac{x_1 + x_2}{2}\right) + \dots \right. \\ & \left. + 2f(x_{n-1}) + 4f\left(\frac{x_{n-1} + x_n}{2}\right) + f(x_n) \right) \end{aligned}$$