Andrew Rosen

\[ \text{Absolute error} = |c - x| \]
\[ \text{Relative error} = \frac{|c - x|}{|x|} \]

\(c\) is a computed value and \(x\) is the real value

**Midpoint Rule:**

\[ M(n) = \sum_{k=1}^{n} f \left( \frac{x_{k-1} + x_k}{2} \right) \Delta x \]
\[ E_M \leq \frac{k(b-a)}{24} (\Delta x)^2 \quad |f''(x)| < k \]

To find each midpoint, draw a number line with the \(a\) and \(b\) values at the beginning and end. Then, divide the interval into however many subintervals given by the value of \(n\). Now break these subintervals in half and find those midpoints. The amount of midpoints should equal the \(n\) value.

**Trapezoidal Rule:**

\[ T(n) = \left( \frac{1}{2} f(x_0) + \sum_{k=1}^{n-1} f(x_k) \right) \Delta x + \frac{1}{2} f(x_n) \Delta x \]
\[ E_T \leq \frac{k(b-a)}{12} (\Delta x)^2 \quad |f''(x)| < k \]

To find the values of \(x_k\) to plug in, find the \(\Delta x\) and add it to the \(x_0\) value. This is one point. Continue until it reaches every value but \(x_n\).

**Simpson’s Rule:**

\[ S(n) = \left[ f(x_0) + 4 f(x_1) + 2 f(x_2) + 4 f(x_3) + \cdots + 4 f(x_{n-1}) + f(x_n) \right] \frac{\Delta x}{3} \]
\[ E_S \leq \frac{k(b-a)}{180} (\Delta x)^4 \quad |f^4(x)| < K \]