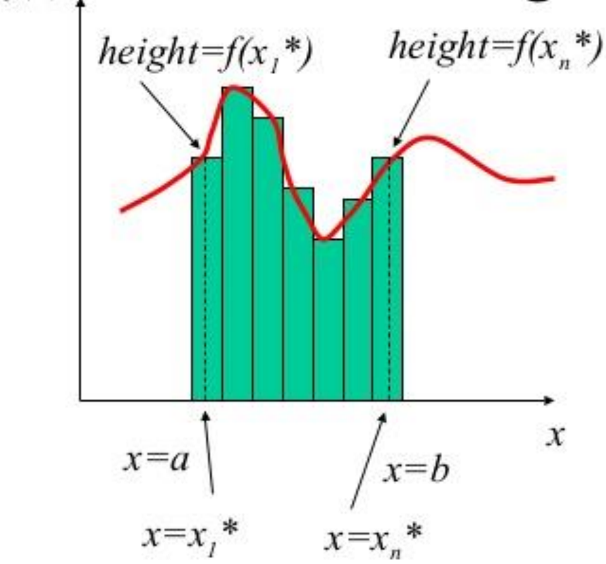
Rectangular Rule

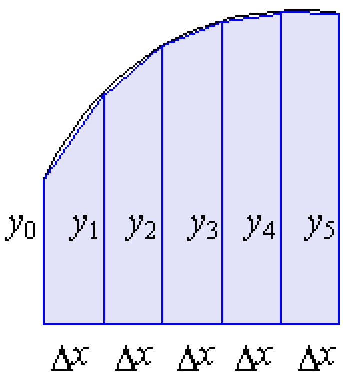


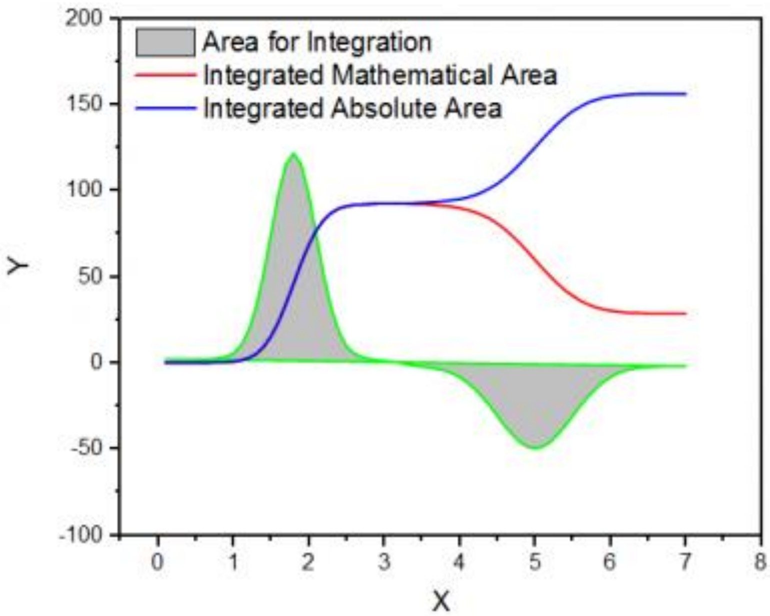
Approximate the integration, $\int_a^b f(x)dx$, that is the area under the curve by a series of rectangles as shown.

The base of each of these rectangles is $\Delta x = (b-a)/n$ and its height can be expressed as $f(x_i^*)$ where x_i^* is the midpoint of each rectangle

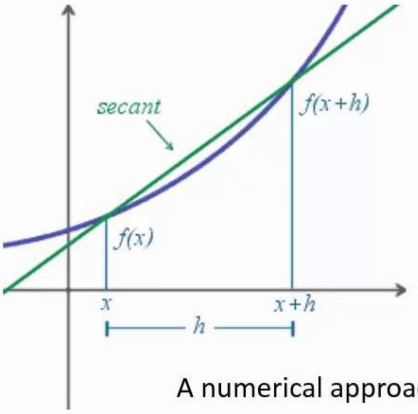
$$\int_a^b f(x)dx = f(x_1^*)\Delta x + f(x_2^*)\Delta x + ..f(x_n^*)\Delta x$$

$$= \Delta x[f(x_1^*) + f(x_2^*) + ..f(x_n^*)]$$





Numerical Differentiation



The derivative of a function $y = f(x)$ is a measure of how y changes with x.

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

A numerical approach to the derivative of a function $y = f(x)$ is:

$$\frac{dy}{dx} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

NUMERICAL DIFFERENTIATION

The derivative of $f(x)$ at x_0 is:

$$f'(x_0) = \underset{h \to 0}{Limit} \frac{f(x_0 + h) - f(x_0)}{h}$$

An approximation to this is:

$$f'(x_0) \approx \frac{f(x_0 + h) - f(x_0)}{h}$$ **for small values of *h*.**

Forward Difference Formula