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False position and Secant methods:

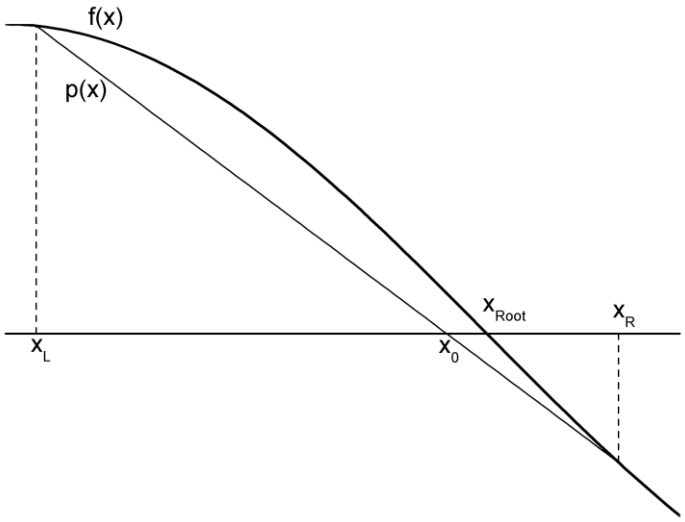
The goal of the exercise is to implement the false position and Secant methods to find the root of a function $f(x)$. The interest of these methods is that, contrary to the Newton-Raphson method, they do not require the derivative of the function ($f'(x)$).

- In the false position method it is assumed that $f(x)$ has a root in the interval $[x_L, x_R]$. The root is approximated by the straight line passing through the points $(x_L, f(x_L))$ and $(x_R, f(x_R))$. The equation of this line is given by

$$p(x) = \frac{x - x_R}{x_L - x_R} f(x_L) + \frac{x - x_L}{x_R - x_L} f(x_R)$$

and crosses the x axis at

$$x_0 = \frac{x_L f(x_R) - x_R f(x_L)}{f(x_R) - f(x_L)}$$



Then, the bounds of the interval $[x_L, x_R]$ should be adjusted and the process should be iterated until the *Error* is below a given *Tolerance*:

$$Error \equiv \left| \frac{x_{i+1} - x_i}{x_{i+1}} \right| \leq Tolerance$$

- The Secant method starts with two initial values x_0 and x_1. The next approximation of the root is calculated from:

$$x_{i+1} = \frac{x_{i-1} f(x_i) - x_i f(x_{i-1})}{f(x_i) - f(x_{i-1})}$$

Exercise:

- Use both methods to find the root of the function $f(x) = \cos x - x$ in the interval $[0,1]$.