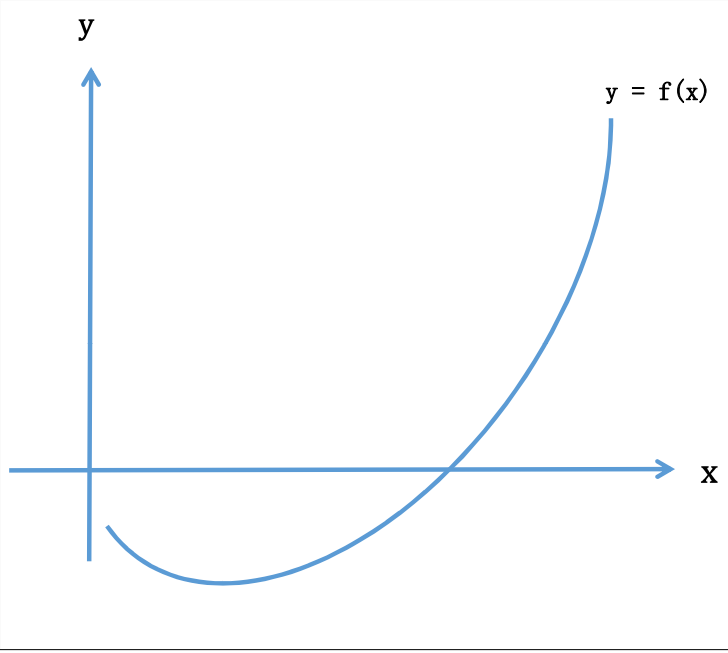
Regula-Falsi Method



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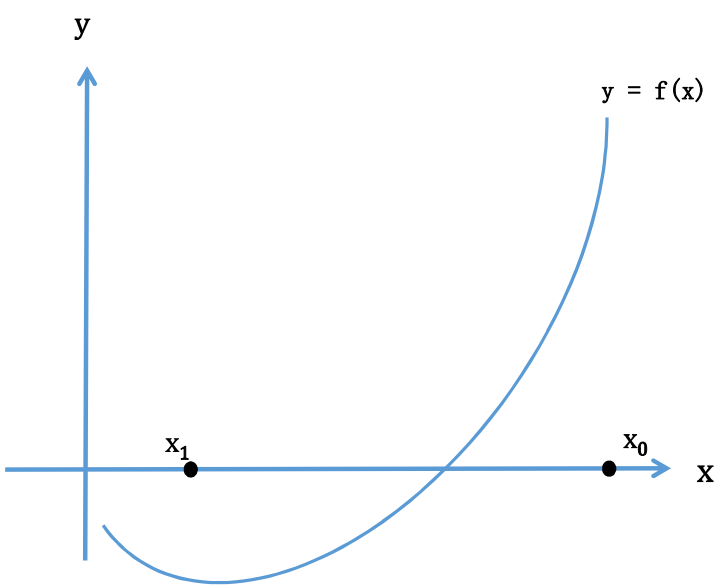

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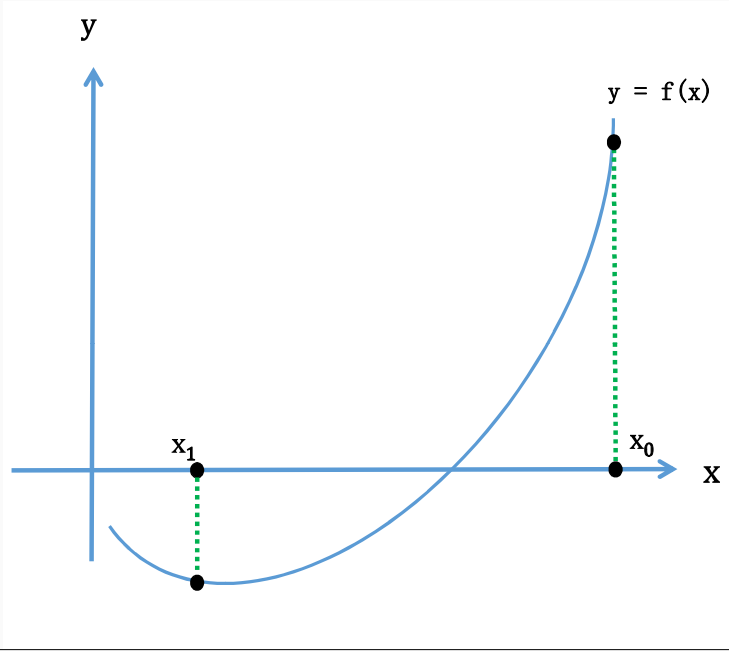

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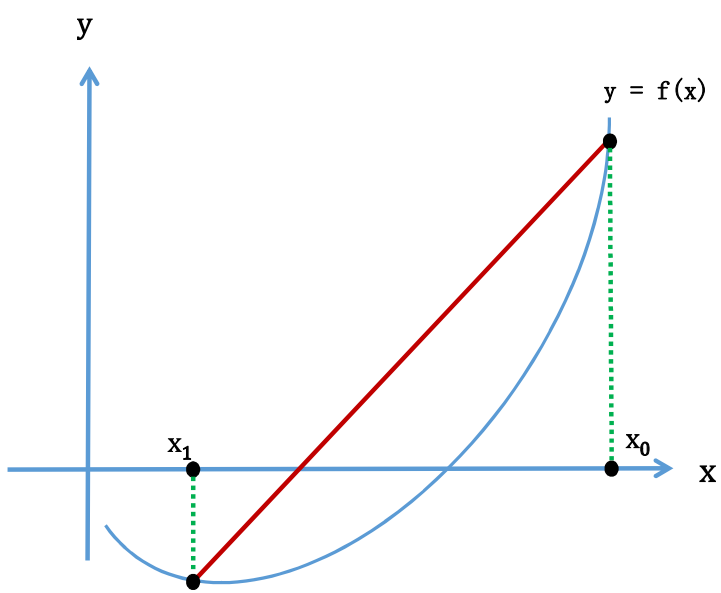

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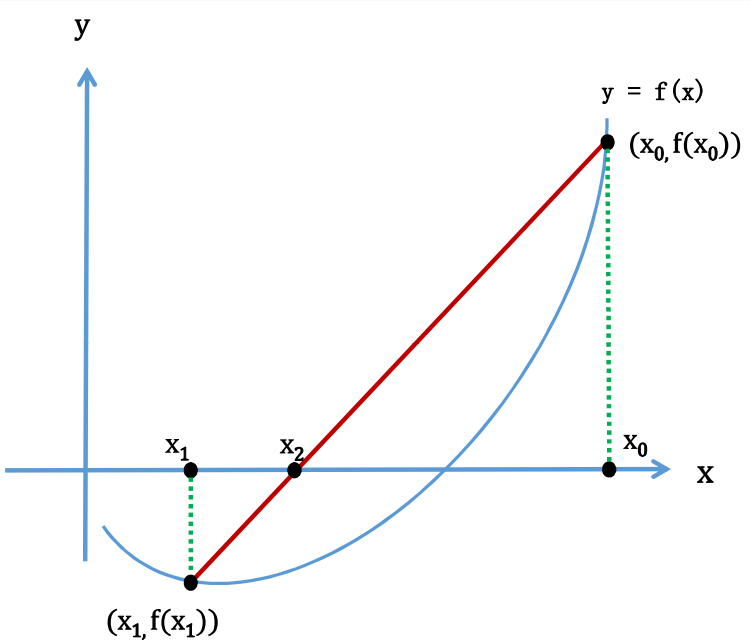

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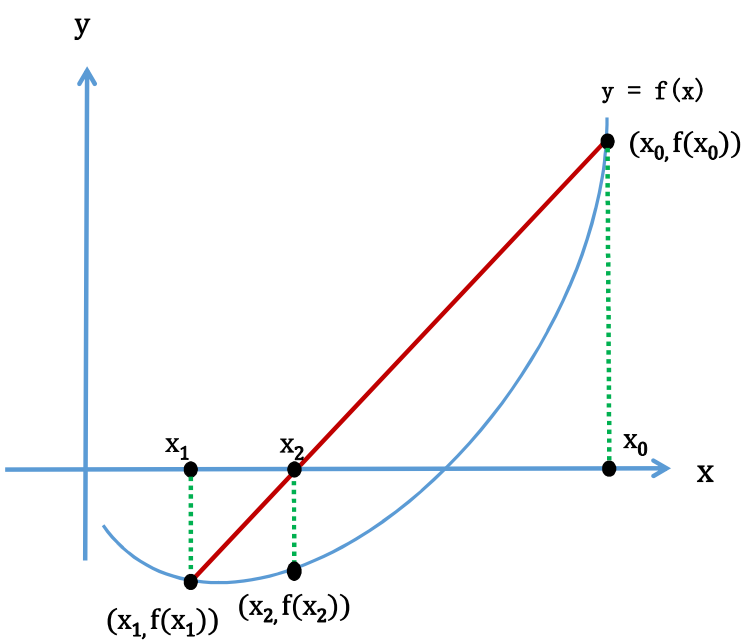

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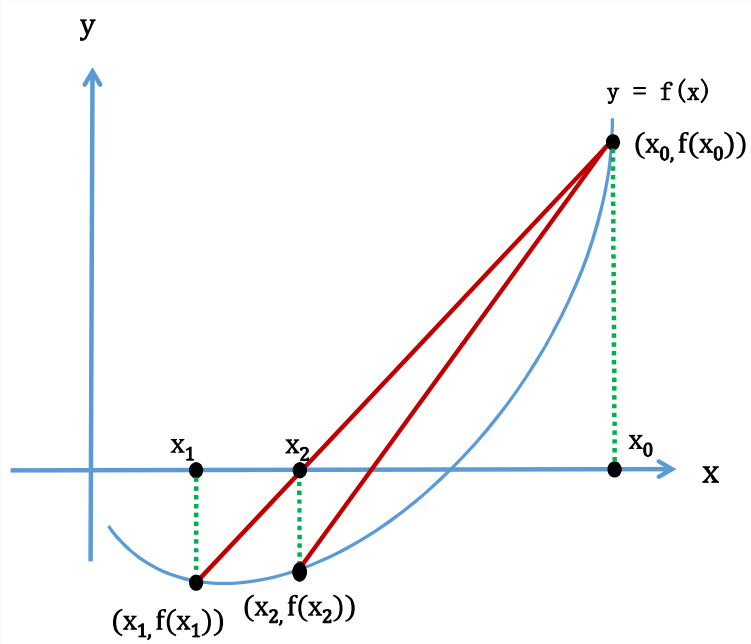

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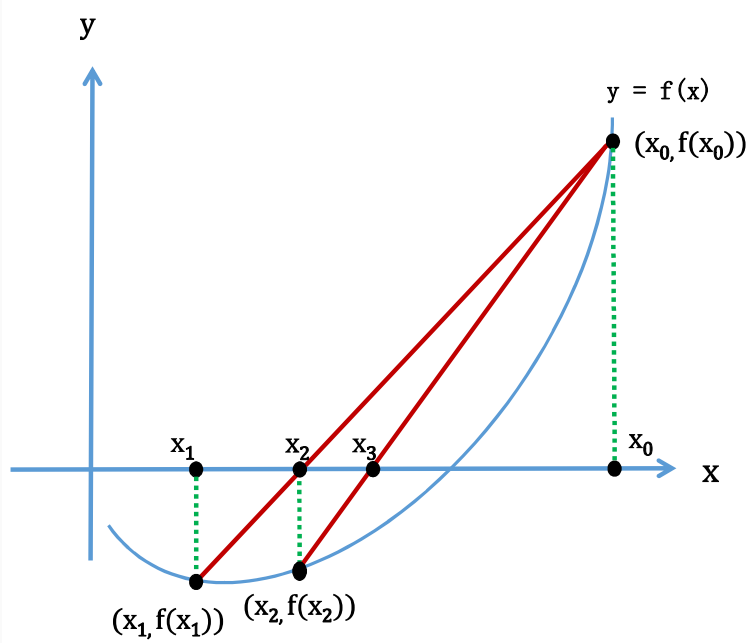

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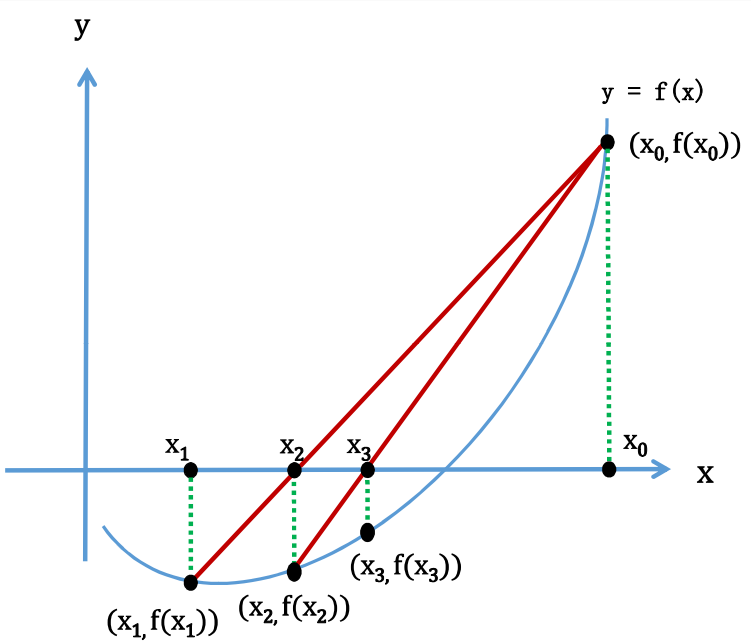

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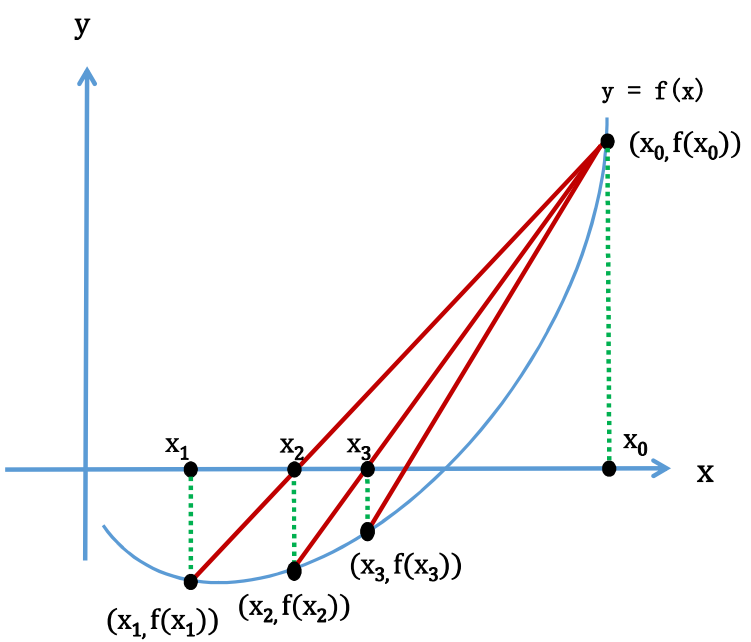

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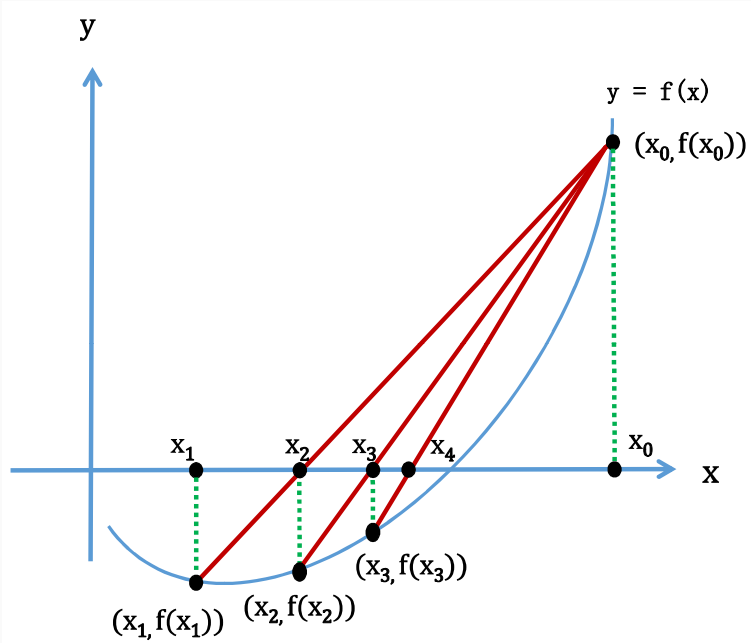

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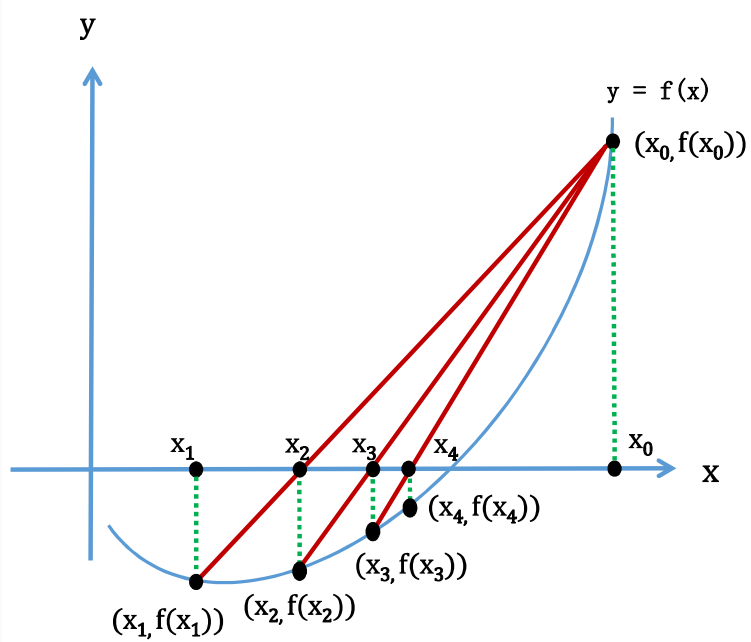

Computational Steps

Let us suppose that $[a_1, b_1]$ be the initial interval of uncertainty for the root of $f(x) = 0$, where $f(a_1)$ and $f(b_1)$ have opposite signs.

Consider the straight line joining the points $(a_1, f(a_1))$ and $(b_1, f(b_1))$. The point where the straight line cuts the x-axis is an estimate of the root. The equation of the line is,

$$y - f(a_1) = \frac{f(b_1) - f(a_1)}{b_1 - a_1}(x - a_1), \tag{1}$$

and the point where it intersects the x-axis is given by putting y=0 in (1), as

$$c_1 = \frac{a_1 f(b_1) - b_1 f(a_1)}{f(b_1) - f(a_1)} \tag{2}$$

Computational Steps

- If $f(c_1) = 0$, then $c = c_1$, and we are done.
- If $f(c_1) \neq 0$, then $f(c_1)$ has the same sign as either $f(a_1)$ or $f(b_1)$.
  - If $f(c_1)$ and $f(a_1)$ have the same signs, $c \in (c_1, b_1)$. Set $a_2 = c_1, f(a_2) = f(c_1)$ and $b_2 = b_1, f(b_2) = f(b_1)$.
  - If $f(c_1)$ and $f(a_1)$ have opposite signs, $c \in (a_1, c_1)$. Set $a_2 = a_1, f(a_2) = f(a_1)$ and $b_2 = c_1, f(b_2) = f(c_1)$.

Then re-apply the process to the interval $[a_2, b_2]$, etc. until the termination criteria is satisfied.

Assignment

1. Write pseudo code for Regula-falsi method.
2. Find the root of the following problem in the interval $[1, 2]$ using Regula-falsi method considering $\epsilon = 10^{-2}$ as the length of the final interval of uncertainty.

$$f(x) = x^3 + 4x^2 - 10 = 0$$