Topic : Secant Method - Roots of Equations
Simulation : Graphical Simulation of the Method
Language : Mathcad 2001
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Abstract : This simulation illustrates the secant method of finding root of an equation f(x)=0

INPUTS: Enter the following

Function in f(x)=0 $f(x) := x^3 - 0.03 \cdot x^2 + 2.4 \cdot 10^{-6}$

Range of x you want to see the function $x := 0, .001 .. .03$

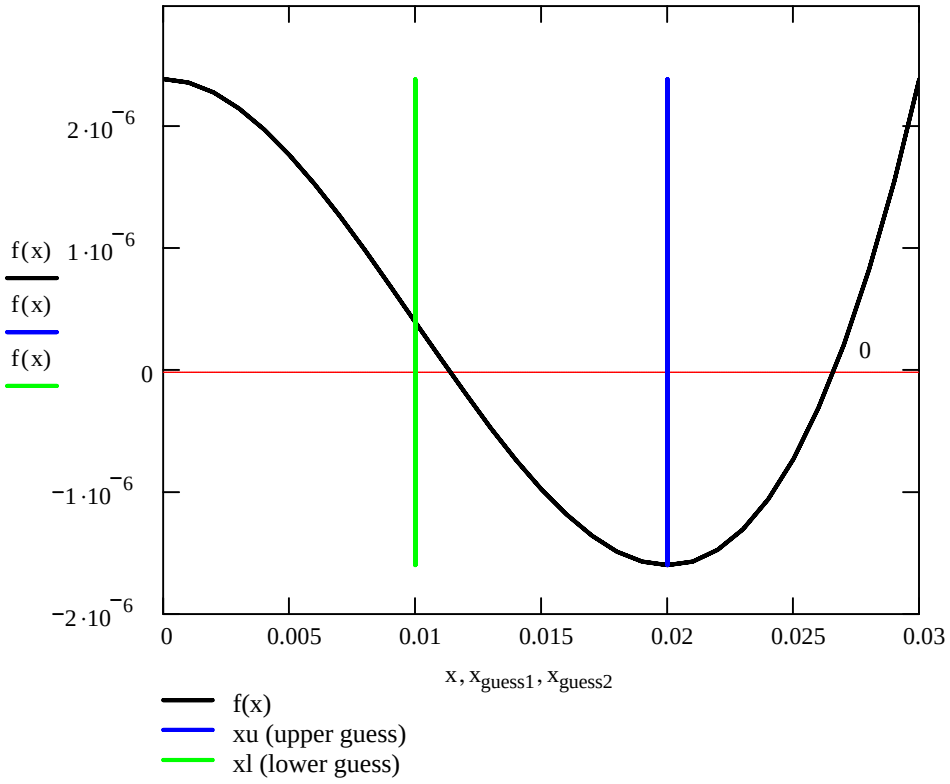
First guess $x_{guess1} := 0.02$

Second guess $x_{guess2} := 0.01$

SOLUTION

The blue line represents the upper initial guess, while the green line represents the lower initial guess.

Entered function at given interval



Iteration 1

Choose two initial guesses of the root.

$x_{1'} := x_{guess1}$

$x_0 := x_{guess2}$

Estimate of the root

$$x_1 := x_0 - \frac{f(x_0)\cdot(x_{1'} - x_0)}{f(x_{1'}) - f(x_0)}$$

$x_1 = 0.012$

Absolute relative approximate error

$$\varepsilon_a := \left|\frac{x_1 - x_0}{x_1}\right| \cdot 100$$

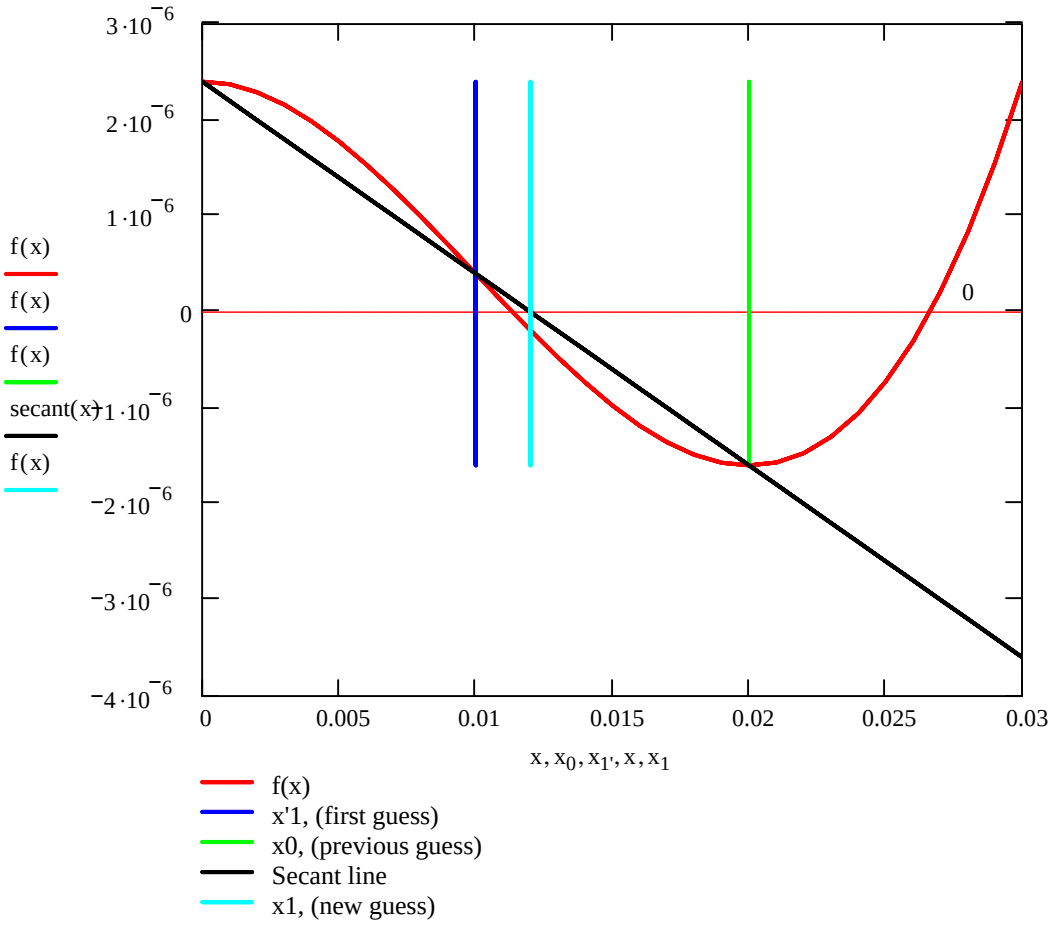
$\varepsilon_a = 16.667$

Secant line for the graph

$$m := \frac{f(x_0) - f(x_{1'})}{x_0 - x_{1'}}$$

$secant(x) := m\cdot x + \left(f(x_0) - m\cdot x_0\right)$

Entered function along given interval with current and next root and the tangent line of the curve at the current root



It should be noted that these two guesses do not have to bracket the root. We have called the two initial guesses xguess and xprev, as that will be the format for subsequent iterations. It does not matter which guess is xprev or xguess (try switching the numbers below and see what happens! You will find that one converges faster than the other).

Iteration 2

Estimate of the root

$$x_2 := x_1 - \frac{f(x_1)\cdot(x_0 - x_1)}{f(x_0) - f(x_1)}$$

$$x_2 = 0.011$$

Absolute relative approximate error

$$\varepsilon_a := \left|\frac{x_2 - x_1}{x_2}\right| \cdot 100$$

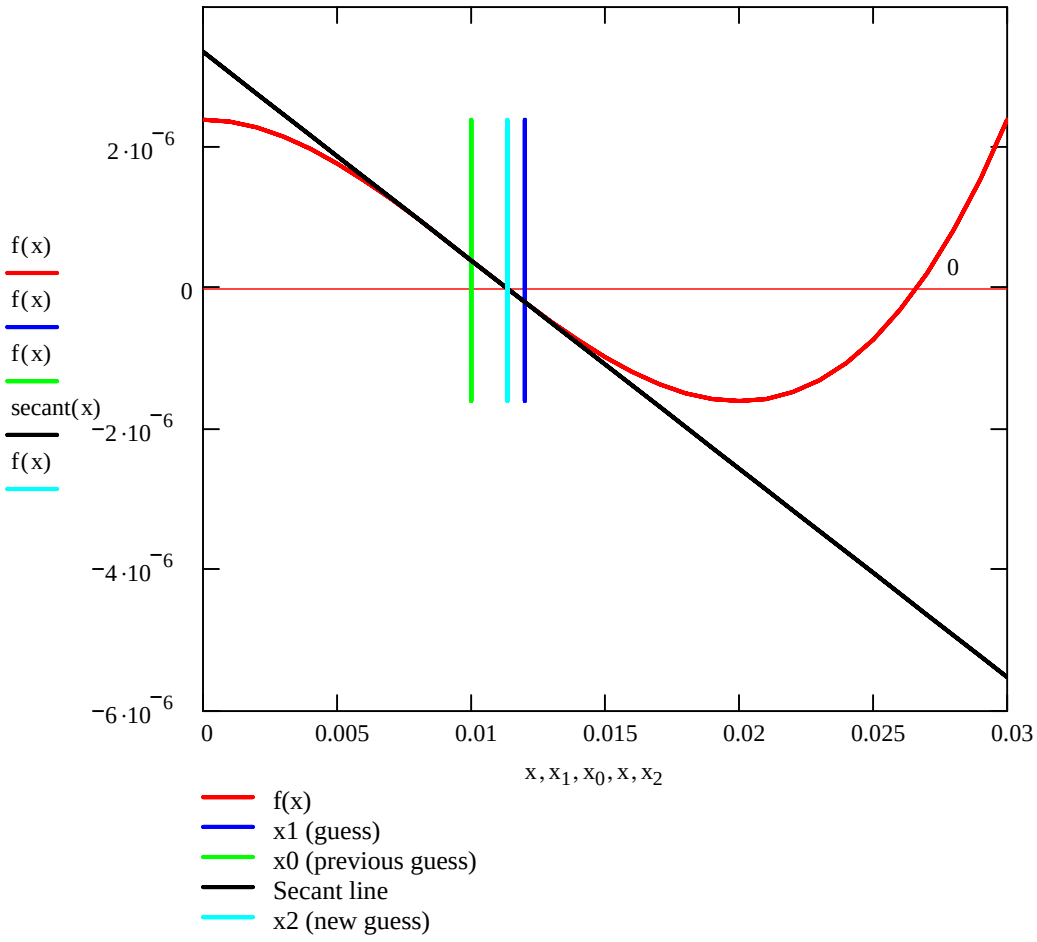
$$\varepsilon_a = 5.714$$

Secant line for the graph

$$m := \frac{f(x_1) - f(x_0)}{x_1 - x_0}$$

$$\text{secant}(x) := m\cdot x + \left(f(x_1) - m\cdot x_1\right)$$

Entered function along given interval with current and next root and the tangent line of the curve at the current root



Iteration 3

Estimate of the root

$$x_3 := x_2 - \frac{f(x_2)\cdot(x_1 - x_2)}{f(x_1) - f(x_2)}$$

$$x_3 = 0.011$$

Absolute relative approximate error

$$\varepsilon_a := \left|\frac{x_3 - x_2}{x_3}\right| \cdot 100$$

$$\varepsilon_a = 0.089$$

Secant line for the graph

$$m := \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

$$\text{secant}(x) := m\cdot x + \left(f(x_2) - m\cdot x_2\right)$$

Entered function along given interval with current and next root and the tangent line of the curve at the current root