Topic : Newton Raphson Method - Roots of Equations
Simulation : Graphical Simulation of the Method
Language : Mathcad 2001
Authors : Nathan Collier, Autar Kaw, Ginger Fisher
Date : 28 June 2002
Abstract : This simulation illustrates the Newton-Raphson method of finding roots of an equation f(x)=0.

INPUTS: Enter the following

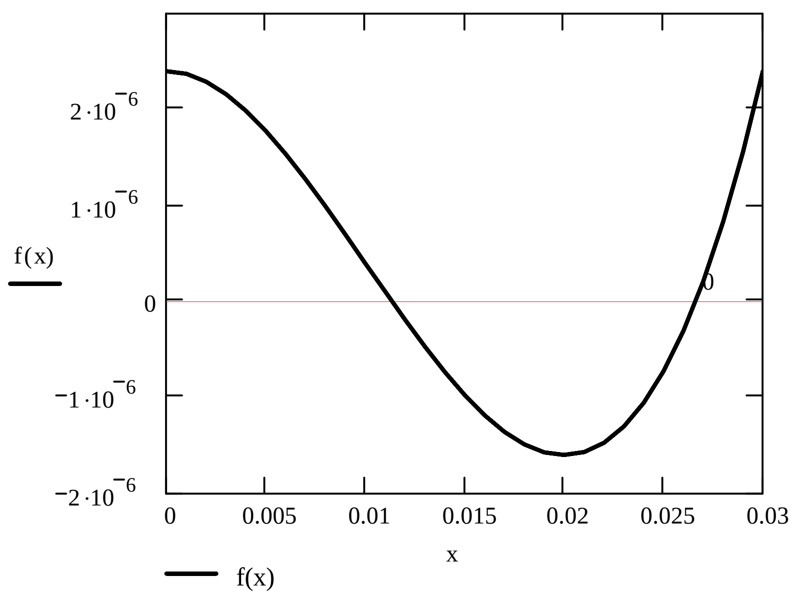
Function in f(x)=0 $f(x) := x^3 - 0.03 \cdot x^2 + 2.4 \cdot 10^{-6}$

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

Initial guess $x_{initial} := 0.005$

SOLUTION

Entered function at given interval



Because the method uses a line tangent to the function at the initial guess, we must calculate the derivative of the function to find the slope of the line at this point. Here we will define the derivative of the function f(x) as g(x).

$$g(x) := \frac{d}{dx} f(x)$$

$$x_0 := x_{initial}$$

Iteration 1

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

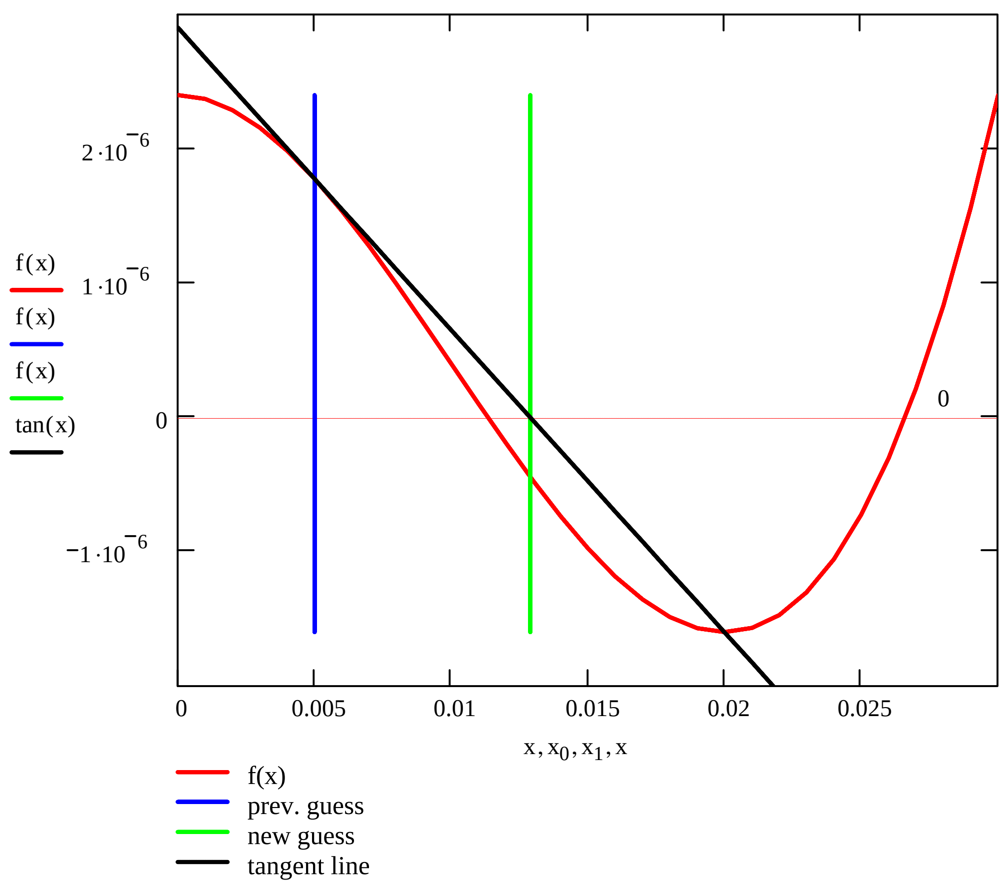
$$x_1 = 0.01289$$

$$\varepsilon_a := \left|\frac{x_1 - x_0}{x_1}\right| \cdot 100 \qquad \varepsilon_a = 61.2069$$

$$\tan(x) := f(x_0) + \frac{(0 - f(x_0))}{x_1 - x_0}(x - x_0)$$

Graphically,

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



Iteration 2

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

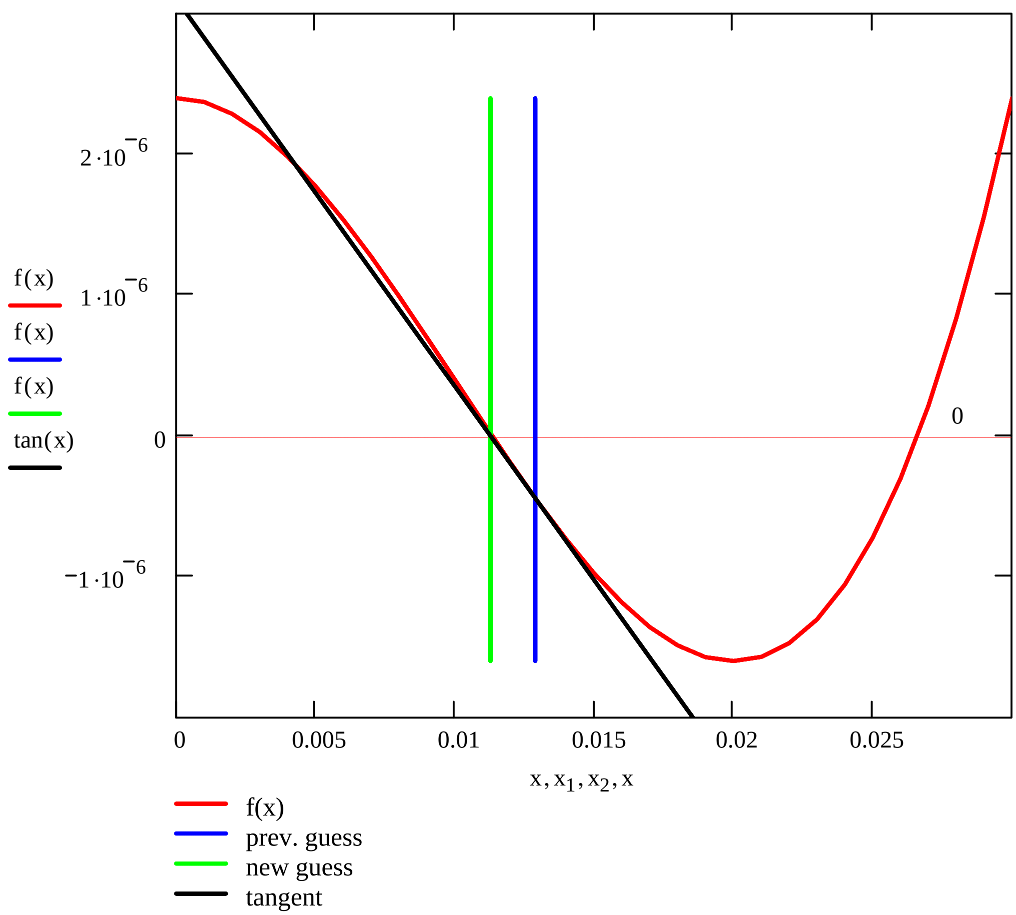
$x_2 = 0.01128$

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

$\varepsilon_a = 14.26954$

$$\tan(x) := f(x_1) + \frac{(0 - f(x_1))}{x_2 - x_1}(x - x_1)$$

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



Iteration 3

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

$x_3 = 0.01134$

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

$\varepsilon_a = 0.54626$

$$\tan(x) := f(x_2) + \frac{(0 - f(x_2))}{x_3 - x_2}(x - x_2)$$

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