Topic : Secant Method - Roots of Equations
Simulation : Pitfall - Root jumping several roots away
Language : Mathcad 2001
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Abstract : The following example illustrates how, in the Secant method, an initial guess close to one root can jump to a location several roots away.

**INPUTS: Enter the following**

**Function in f(x)=0** $f(x) := \sin(x)$

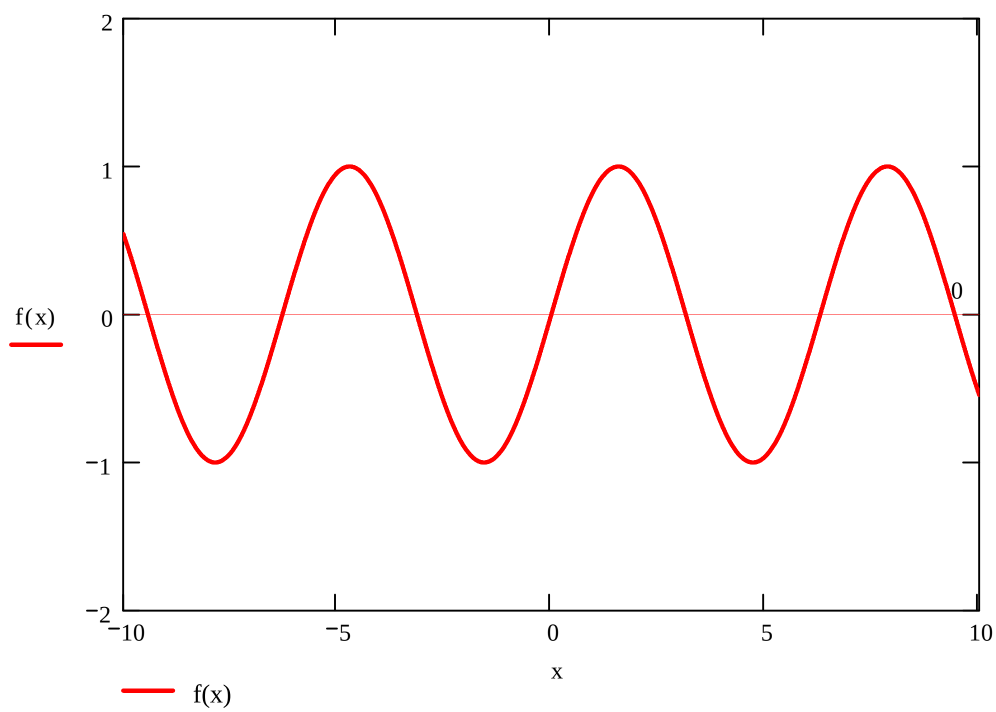
**Range of x you want to see the function** $x := -10, -9.99 .. 10$

**First guess** $x_{guess1} := 7$

**Second guess** $x_{guess2} := 8.5$

**SOLUTION:**

**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**

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

$$x_1 = 0.036$$

**Absolute relative approximate error**

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

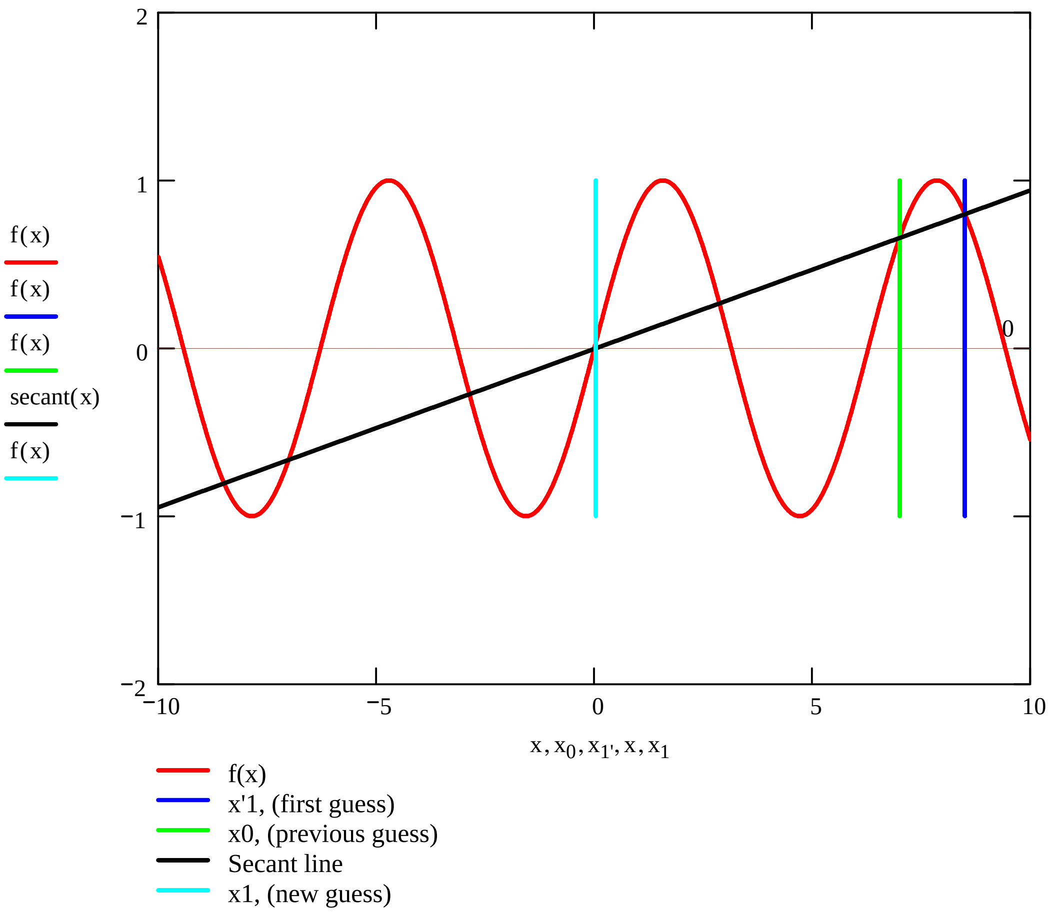
$$\varepsilon_a = 2.384 \times 10^4$$

**Secant line for the graph**

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

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

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



**Iteration 2**

**Estimate of the root**

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

$$x_2 = -0.358$$

**Absolute relative approximate error**

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

$$\varepsilon_a = 109.909$$

**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**