Secant Method

Advantages of secant method:

1. It converges at faster than a linear rate, so that it is more rapidly convergent than the bisection method.
2. It does not require use of the derivative of the function, something that is not available in a number of applications.
3. It requires only one function evaluation per iteration, as compared with Newton's method which requires two.

Disadvantages of secant method:

1. It may not converge.
2. There is no guaranteed error bound for the computed iterates.
3. It is likely to have difficulty if f 0(a) = 0. This means the x-axis is tangent to the graph of y = f (x) at x = a.
4. Newton's method generalizes more easily to new methods for solving simultaneous systems of nonlinear equations.

Algorithms

Step 1

Calculate the next estimate of the root from two initial guesses

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

Find the absolute relative approximate error

$$\left| \in_a \right| = \left| \frac{x_{i+1} - x_i}{x_{i+1}} \right| \times 100$$

Step 2

Find if the absolute relative approximate error is greater than the prespecified relative error tolerance.

If so, go back to step 1, else stop the algorithm.

Also check if the number of iterations has exceeded the maximum number of iterations.

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This method requires two initial guesses, but unlike the bisection method, the 2 initial guesses do not need to bracket the root of the equation.

The secant method is an open method and may or may not converge.