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Homework number: 5 Homework
Title: Exercise 5.1

Problem description:
Consider the nonlinear equation
$f(x) = x^2 - 2 = 0$.
a) With $x_0 = 1$ as a starting point, what is the value of x_1 if you use Newton's method for solving this problem?
b) With $x_0 = 1$ and $x_1 = 2$ as starting points, what is the value of x_2 if you use the secant method for the same problem?

Problem solution:
$a_)$ Newton's method: $x_{k+1} = x_k - \frac{f(x_k)}{f'(x_k)}$
With $x_0 = 1$, and $f'(x) = 2x$ follows for x_1 using the Newton method:
$x_1 = 1 - \frac{1-2}{2}$
$x_1 = 1 - \frac{-1}{2}$
$x_1 = \frac{3}{2}$
$b_)$ Secant method: $x_{k+1} = x_k - f(x_k) * \frac{(x_k - x_k - 1)}{f(x_k) - f(x_{k-1})}$
With $x_0 = 1$, and $x_1 = 2$ follows for x_2 using the Secant method:
$x_2 = 2 - 2 * \frac{2-1}{2-(-1)}$
$x_2 = 2 - \frac{2}{3}$
$x_2 = \frac{4}{3} = 1.333...$
Conclusion:

a) Solution for Newton method: $x_1 = 1.5$.
b) Solution for Secant method: $x_2 = 1.3333$.