

Online Learning Session 4: Newton's Method and Minos

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1 Newton's Method

Newton's Method

Newton's Method involves solving a series of subproblems that should converge to a zero. In the case of optimization, we are interested in finding the zero of a derivative of a function. For example, suppose that we are trying to minimize

$$f(x) = \exp[0.03 - 0.03x + 0.0004x^2]. \quad (1)$$

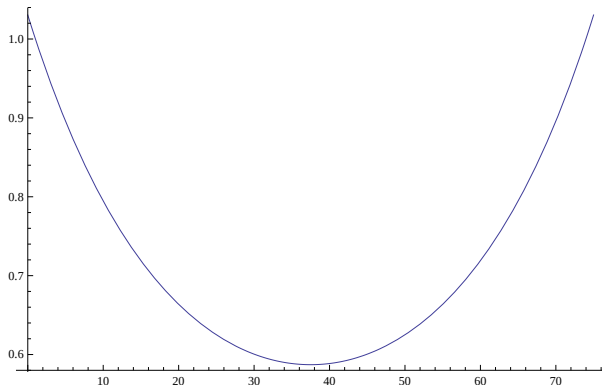
The derivative of the function is

$$f'(x) = [-0.03 + 0.0008x] \exp[-0.03 - 0.03x + 0.0004x^2]. \quad (2)$$

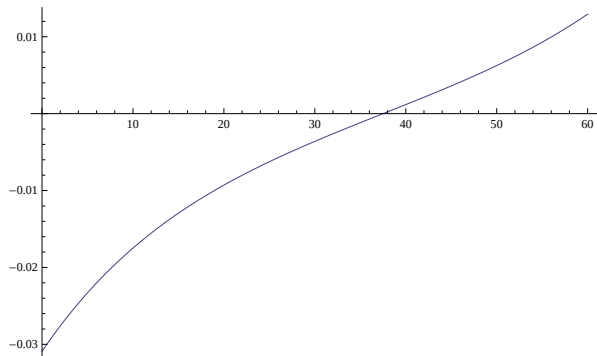
In this case, since $\exp [0.03 - 0.03x + 0.0004x^2] \gg 0$, we could solve for the optimal level by solving

$$-0.03 + 0.0008x = 0 \Rightarrow x = \frac{0.03}{0.0008} = 37.5; \quad (3)$$

Original Function



Derivative



Derivation of Newton's Method

$$\begin{aligned} g''(x_0) &= -\frac{g'(x_0) - 0}{x_1 - x_0} \\ x_1 - x_0 &= -\frac{g'(x_0)}{g''(x_0)} \\ x_1 &= x_0 - \frac{g'(x_0)}{g''(x_0)} \end{aligned} \tag{4}$$

Newton's Method

