Math 5601 Homework 2

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Problem 1.

Define $f(x) = 1 - \frac{1}{Rx}$. Then $f(x) = 0$ if and only if $x = \frac{1}{R}$, so solving $f(x) = 0$ is equivalent to computing $\frac{1}{R}$. Since $f'(x) = \frac{1}{Rx^2}$, the Newton's method for solving $f(x) = 0$ is given by

$$\begin{aligned} x_{k+1} &= x_k - \frac{f(x_k)}{f'(x_k)} = x_k - Rx_k^2\left(1 - \frac{1}{Rx_k}\right) = x_k - Rx_k^2 + x_k \\ &= x_k(2 - Rx_k) \end{aligned} \tag{1}$$