



**Worksheet 5-1: Q2**

Consider the function  $f(x) = \sqrt{1+x^2}$  defined over  $\mathbb{R}$ . The first and second derivatives are given by  $f'(x) = \frac{x}{\sqrt{1+x^2}}$  and  $f''(x) = \frac{1}{(1+x^2)^{3/2}}$ , respectively.

1. Find the Newton direction  $d_k$  in terms of  $x_k$ .
2. Use pure Newton method to derive an expression for  $x_{k+1}$  in terms of  $x_k$ .
3. What choices of  $x_0$  will lead to convergence to  $x^* = 0$ ?

*When you're done with the worksheet, go download the Jupyter notebook to try coding this.*