

## Project 1 Questions

**1. Starting point  $x = (1.2, 1.2)$ , find out how many iterations have the above methods used, what is the convergence rate?**

- According to the iteration counter I included in the two functions, the exact steepest descent method used 524 iterations meanwhile the inexact method used 46566 iterations to get to the outcome of (1,1). The rate of convergence is Q-linear by checking from the formula of  $\|x_{k+1} - x^*\| / \|x_k - x^*\|$ , using iteration  $x_0$  and  $x_1$ , (1.2, 1.2) and (1.112, 1.237) respectively. It is not Q-superlinear because limit does not equal to zero and therefore also not Q-quadratic.

**2. Starting point  $x = (-1.2, 1)$ , find out how many iterations have the above methods used, what is the convergence rate?**

- The exact steepest descent method used 22438 iterations meanwhile the inexact method used 48877 iterations to get to the outcome of (1,1). Similarly to problem one, the convergence rate is Q-linear computing with iteration  $x_0$  and  $x_1$ , (-1.2, 1) and (-0.52, 0.281) respectively, but not Q-superlinear and Q-quadratic.