- f has Jacobian Matrix $J = [-1+x_1+2x_1^3-2x_1x_2, -x_1^2+x_2]$, so we solve $J = \mathbf{0}$ and get $(x, y) = (1, 1)$, and we see that $det(H(1, 1)) = 1 > 0$ and $f_{xx}(1, 1) = 3 > 0$, so $(1, 1)$ is a local maximum of f.

- Since our starting point is $\mathbf{x}_0 = [2, 2]^T$, then we solve $\mathbf{Hs} = -\nabla f$ and get $\mathbf{s0} = [-0.2, 1.2]^T$. As a result, we get $\mathbf{x}_1 = \mathbf{x}_0 + s_0 = [1.8, 3.2]^T$.

- $f(\mathbf{x_1}) = 2.5$ and $f(\mathbf{x_2}) = 0.32$. This is good because new $\mathbf{x}$ decreases the f value.

- $||\mathbf{x}_0 - \mathbf{x}^*||_2 = 1.414$, $||\mathbf{x}_1 - \mathbf{x}^*||_2 = 2.34$. This step is bad because the norm of error increases.