1. Given $f(x) = x_1^2 + 2x_2^2 + 4x_1 + 4x_2$

(just verifying the min(f(x))

$$f(x) = (x_1+2)^2 + 2(x_2+1)^2 - 6$$

So by simply checking $\min(f(x)) = -6$ @ $(-2,-1)$

$$\text{grad} = \begin{bmatrix} 2x_1+4 \\ 4x_2+4 \end{bmatrix}$$

lets take uncertainity $= 10^{-5}$

$\epsilon = 10^{-3} \times$ uncertainty (let's say)

the code is in Q1.sce file

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2. Generally update rule for newton is

$$x^{(k+1)} = x^{(k)} - \text{Hess}_x^{-1}(f(x)) * (\nabla f(x))$$

in code for sake of simplicity I assumed $p = x(1)$ $q = x(2)$