4.3

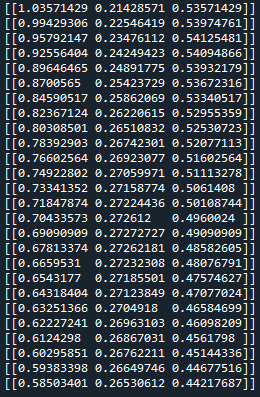
a) To get , solving

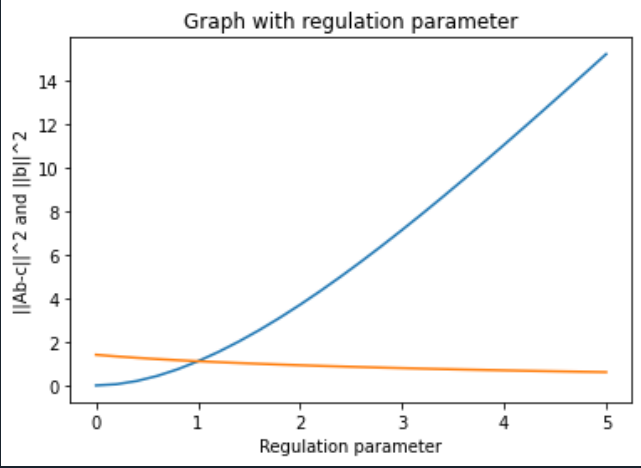
And the answer is

b) By taking derivative of , and set the derivative to 0, we have

The equivalent matrix is

The attached file 4.3.py is used to solve this equation, required matplotlib, scipy and numpy, and the result is shown below





4.4

a) for all real x, so it is both convex and concave

b) for all , so it is concave

c) for all real x, so it is convex

d) The Hessian matrix of this function is , and the eigenvalues are -6 and -8, both less than 0, so this function is concave

e) The Hessian matrix of this function is , and the eigenvalue is 1,which is less than 0, so this function is convex