2. **Convexity:**

Hessian Matrix:

Eigen values of the Hessian matrix can be computed by:

Here the numerator of has two components: that is equal to , and that is slightly larger than . Therefore, the numerator is either positive or negative.

Therefore, the Hessian matrix has one positive eigen value and one negative eigen value. This means the is not Positive semi definite or PSD.

Therefore function  **is not convex**. This can also be verified by plotting this function. This plot is given by the following figure.



For , the Hessian matrix is given by:

Proof:

For any matrix , it is defined as positive semi definite, only if, for any real valued non zero vector ,

4**. Logistic Sigmoid Identities:**