

Assignment-3 Report

Q1:

$X_{\text{init}} = (0.1, 0.1)$

Observations on number of iterations vs $c1$ for Armijo-Goldstein Line Search

$c1 = 0.33143028484359627$

Took 28 iterations to converge in Armijo-Goldstein Line Search.

Took 34 iterations to converge in Backtracking Armijo Line Search.

$c1 = 0.2667117230872565$

Took 28 iterations to converge in Armijo-Goldstein Line Search.

Took 34 iterations to converge in Backtracking Armijo Line Search.

$c1 = 0.049685846649421994$

Took 30 iterations to converge in Armijo-Goldstein Line Search.

Took 34 iterations to converge in Backtracking Armijo Line Search.

$c1 = 0.322407022570512$

Took 27 iterations to converge in Armijo-Goldstein Line Search.

Took 34 iterations to converge in Backtracking Armijo Line Search.

Submitted:

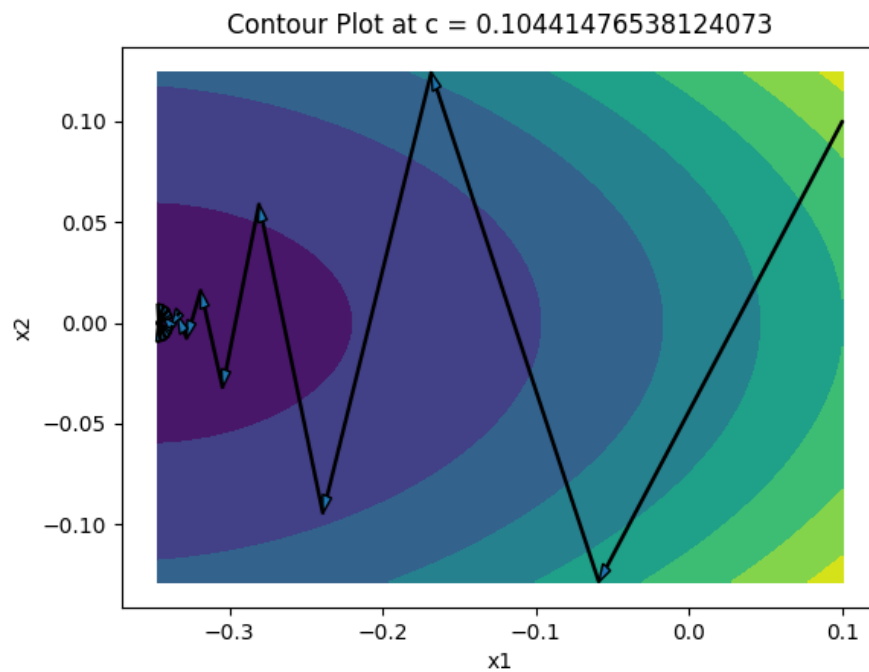
$c1 = 0.10441476538124073$

Took 30 iterations to converge in Armijo-Goldstein Line Search.

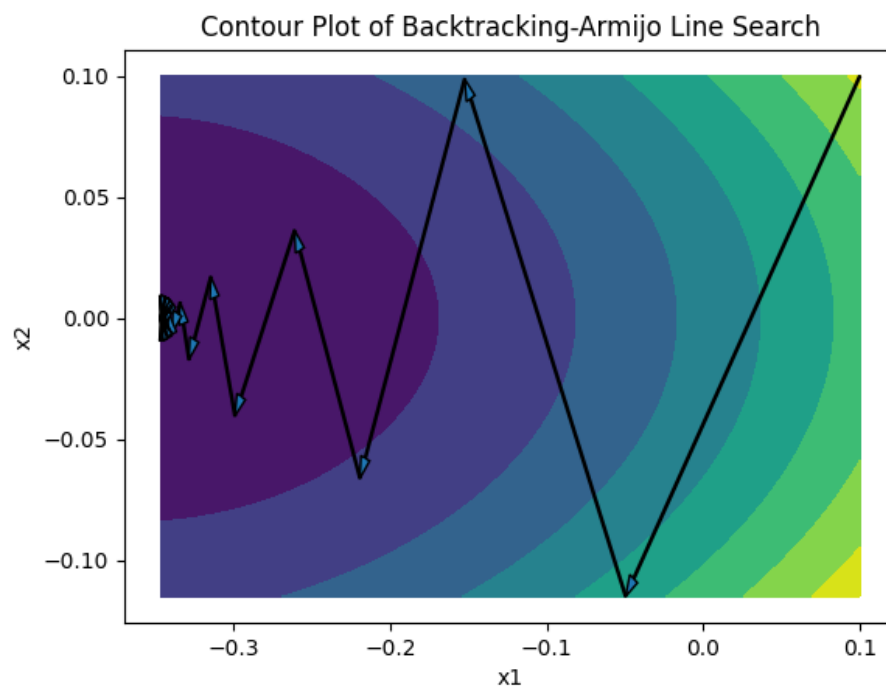
Took 33 iterations to converge in Backtracking Armijo Line Search.

Plots:

Armijo-Goldstein:



Backtracking Armijo:

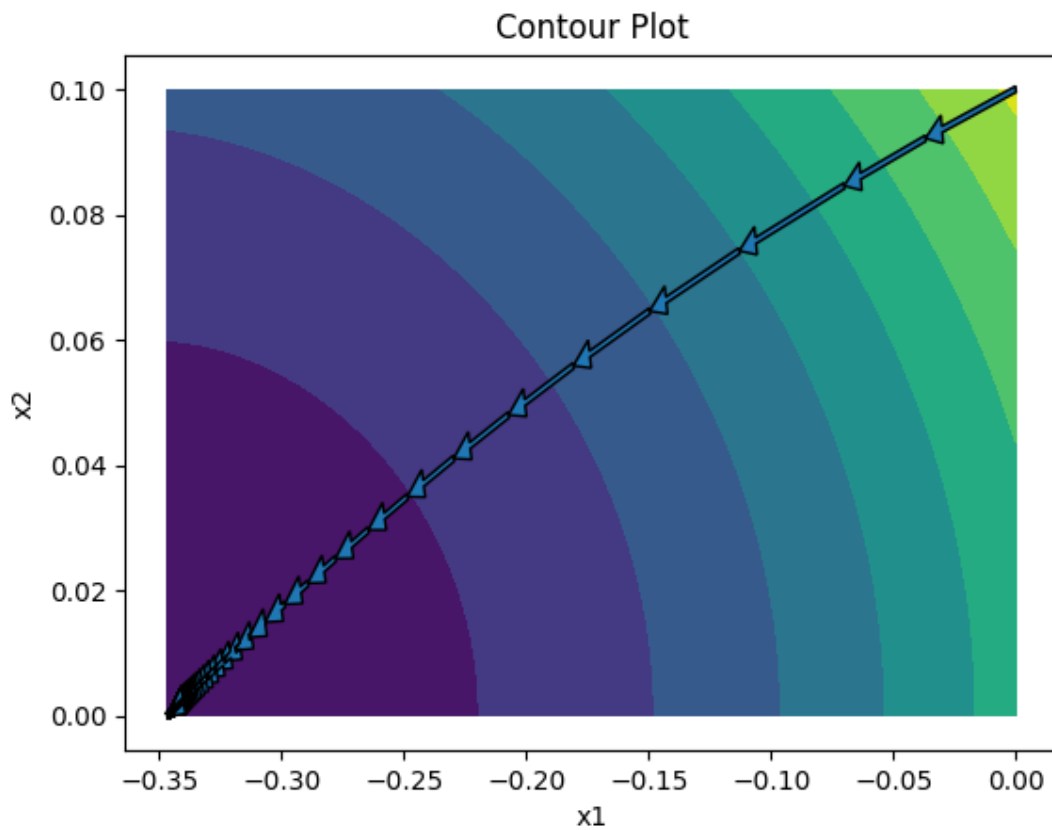


Q2:

Took 80 iterations to converge

$X_{\text{init}} = (0, 0.1)$

$\alpha(k)$ is calculated using Backtracking Armijo with $\beta = 0.1$, $\text{tol} = 0.7$



Q3:

Largest eigenvalue is 11. $X_{\text{init}} = (0.1, 0.2)$

Observations

Took 14 iterations to converge when α is 0.0754405915189916

Took 167 iterations to converge when α is 0.17355543145335822

Took 123 iterations to converge when α is 0.013320986626617858

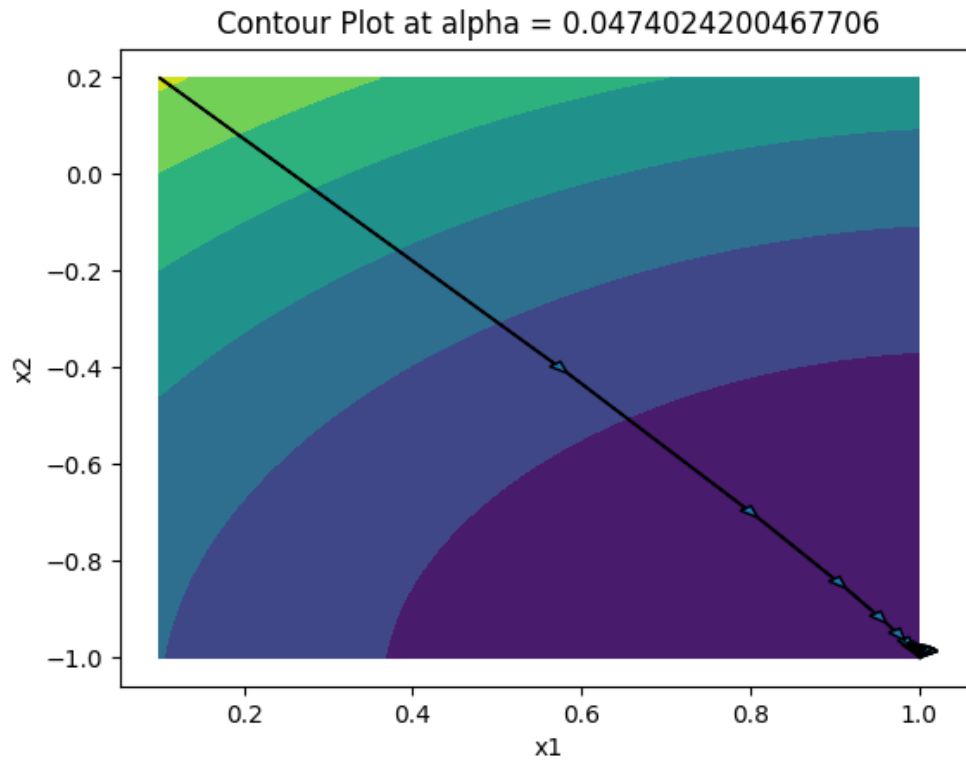
Took 31 iterations to converge when α is 0.14462928700477207

Took 16 iterations to converge when α is 0.07012168517910182

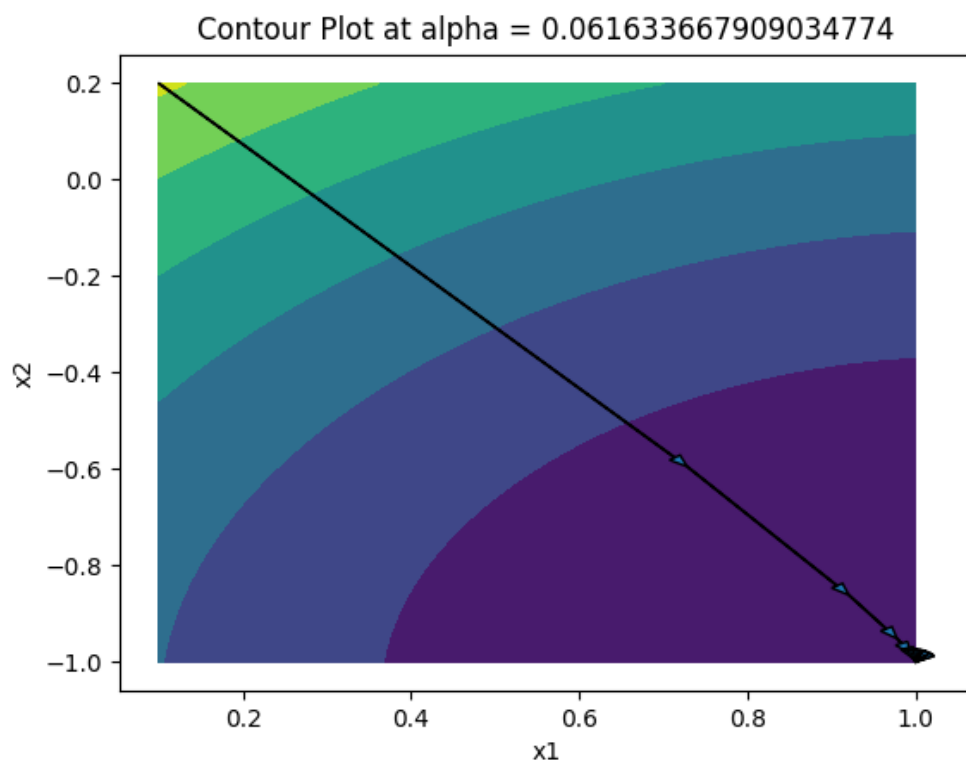
Took 461 iterations to converge when α is 0.5169402164927875

Submission:

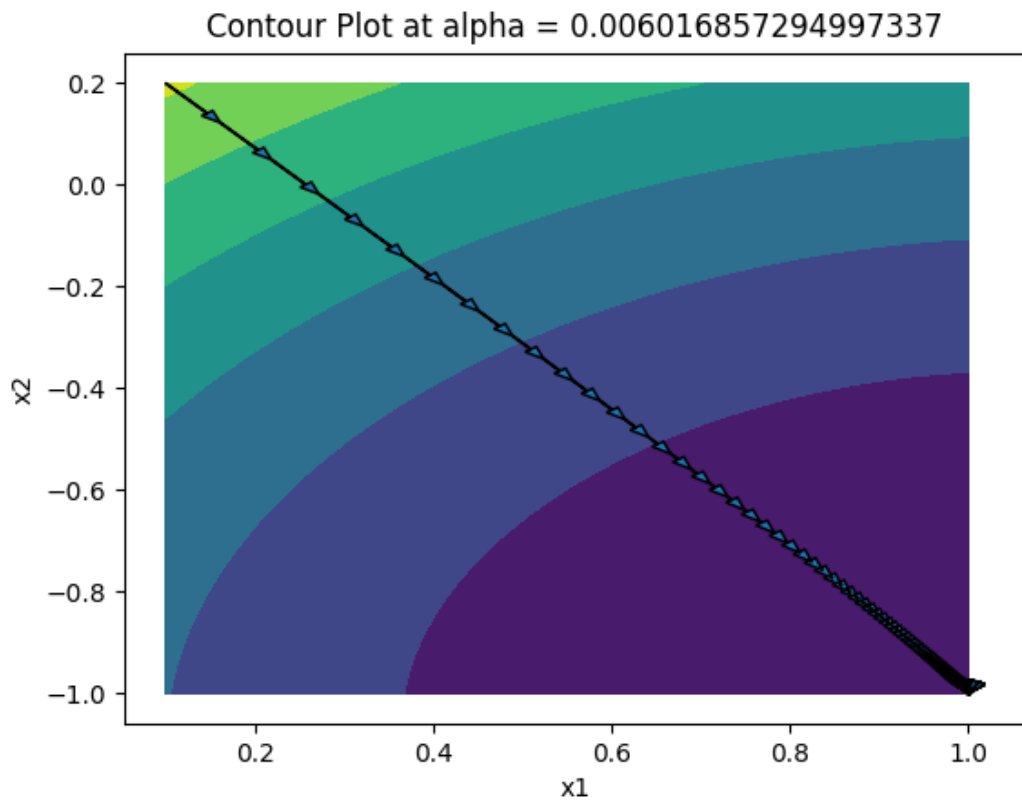
Took 27 iterations to converge when alpha is 0.0474024200467706



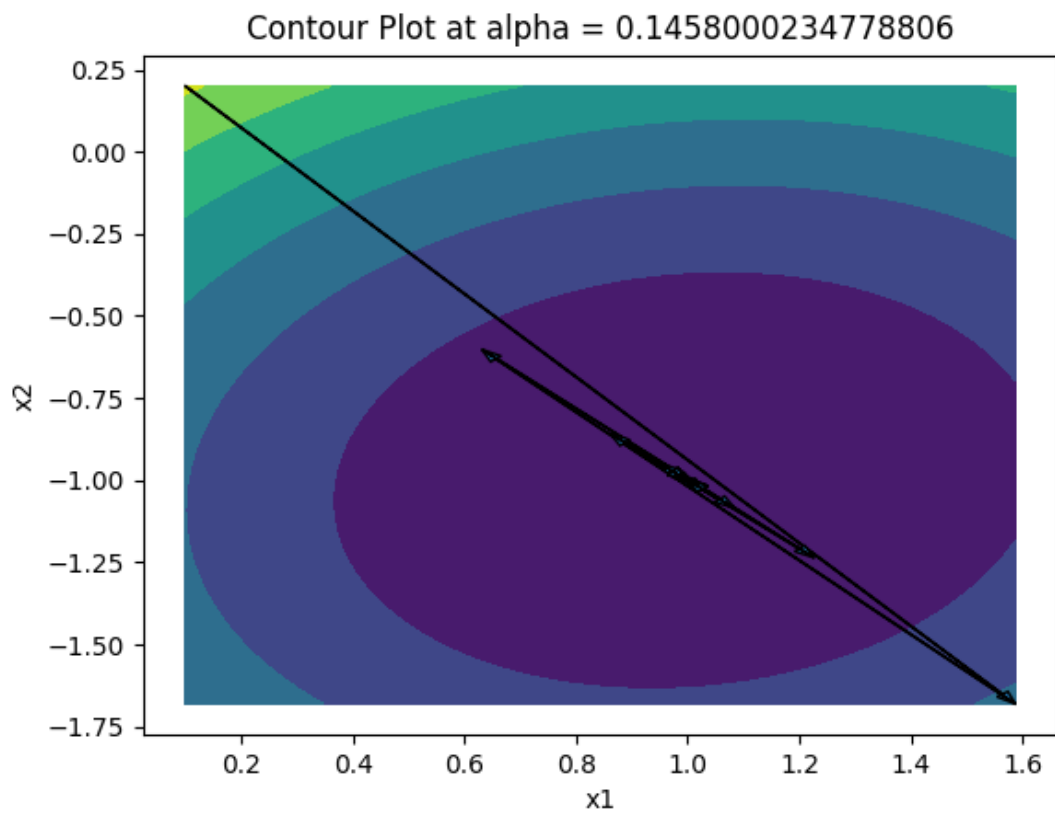
Took 18 iterations to converge when alpha is 0.061633667909034774



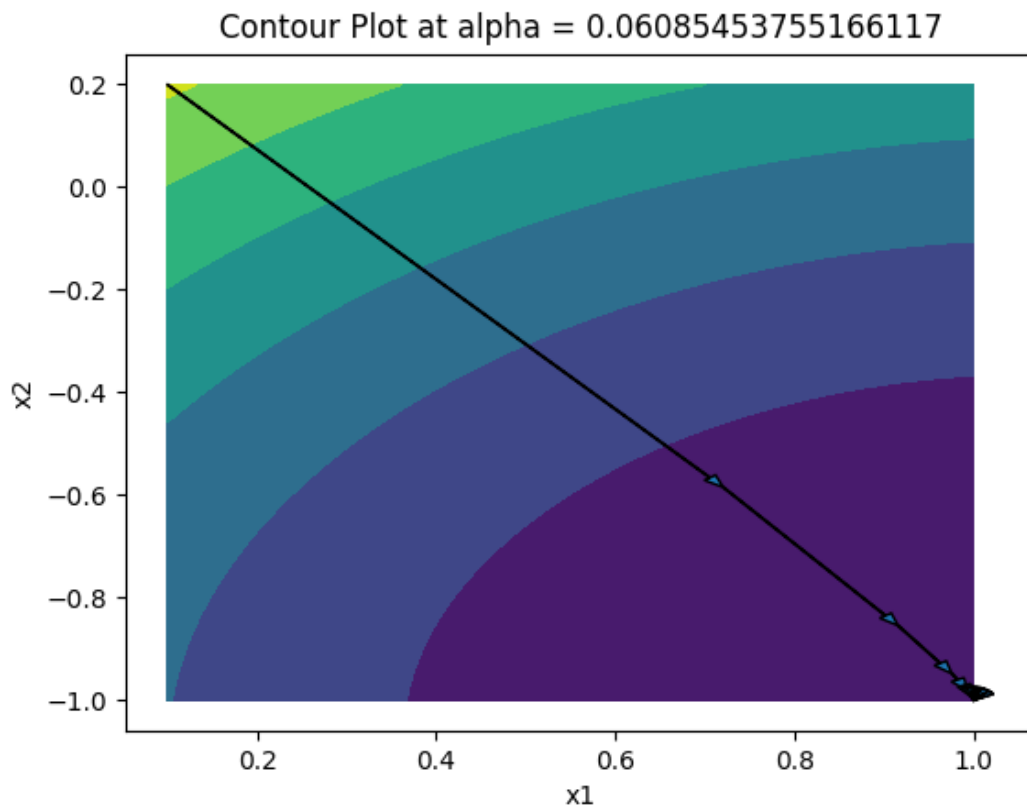
Took 261 iterations to converge when alpha is 0.006016857294997337



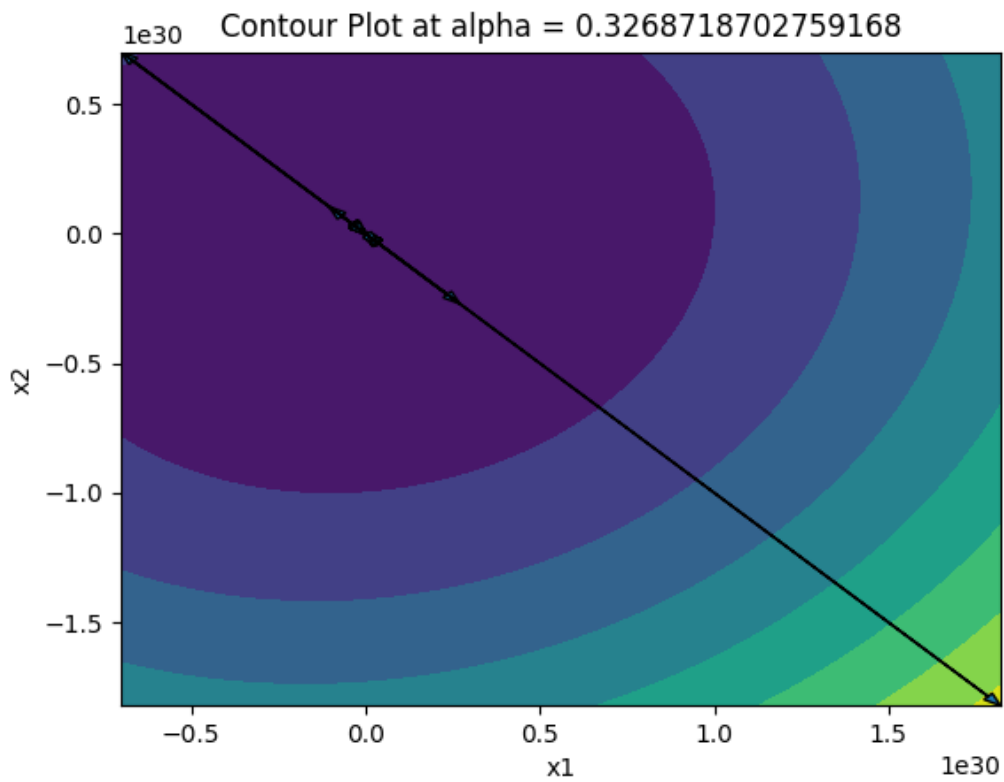
Took 33 iterations to converge when alpha is 0.1458000234778806



Took 19 iterations to converge when alpha is 0.06085453755166117



($\alpha > 2/\lambda_{\max}$) Took 73 iterations to converge when alpha is 0.3268718702759168



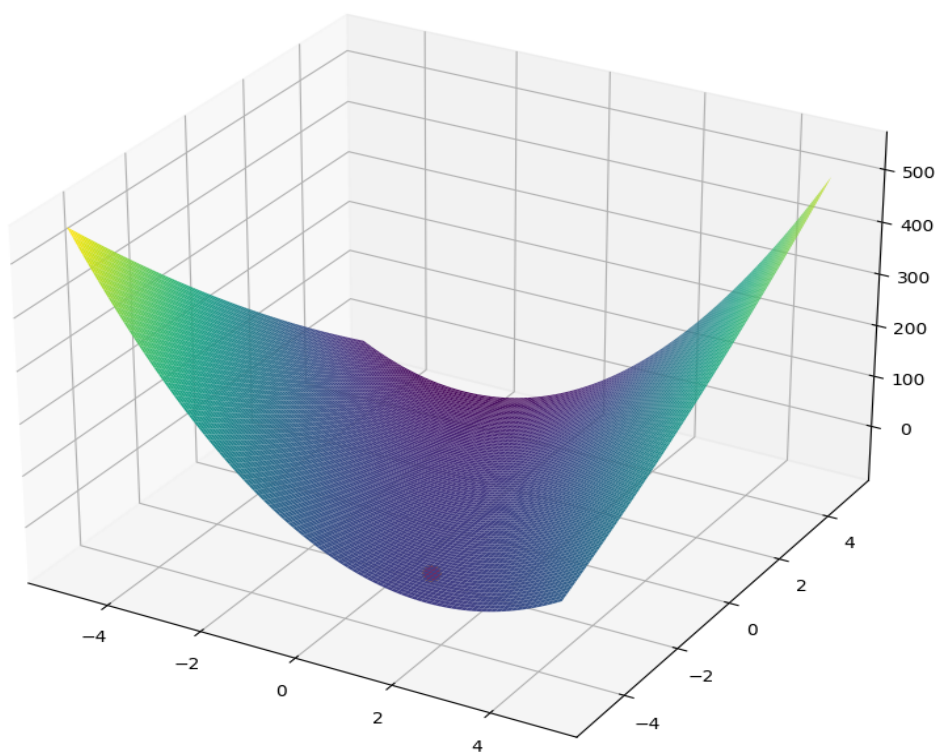
Q4:

Part	$\nabla f(x^*)$	eigenvalues of $\nabla^2 f(x^*)$	at x^* local maxima/minima/saddle point?
1	(0,0)	-2.45362405 24.45362405	Saddle Point
2	(0,0)	16 36	Local Minima

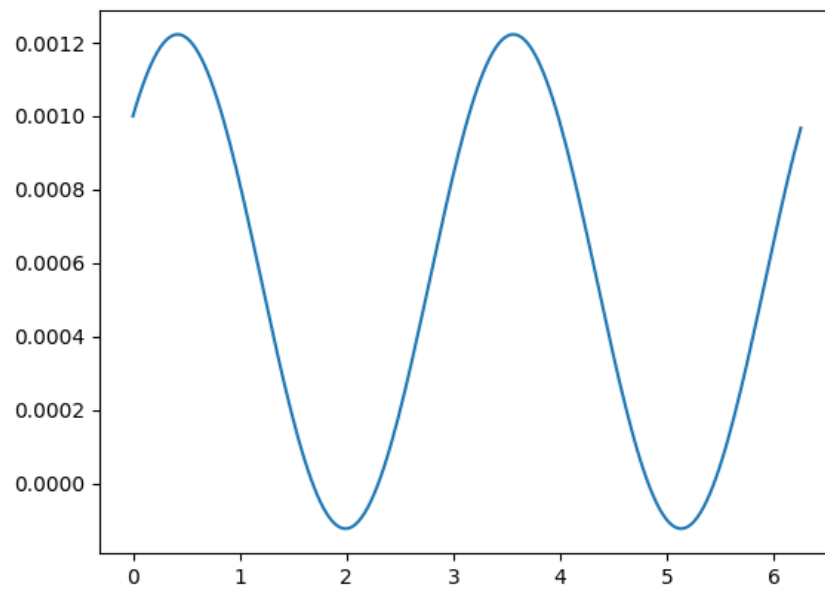
Plots:

Part 1:

3D line plot

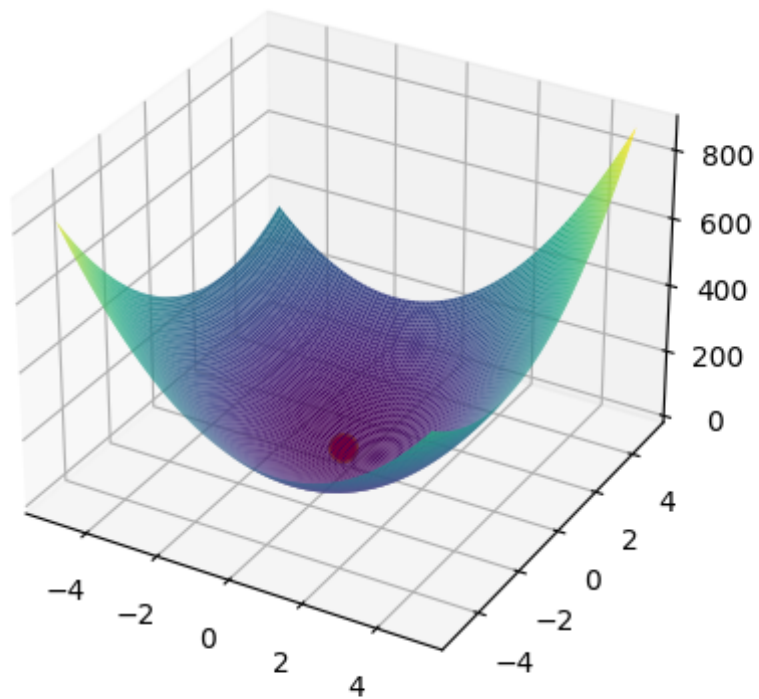


$[f(x^* + \alpha d\theta) - f(x^*)] \text{ vs } \theta$



Part 2:

3D line plot



$[f(x^* + \alpha d\theta) - f(x^*)] \text{ vs } \theta$

