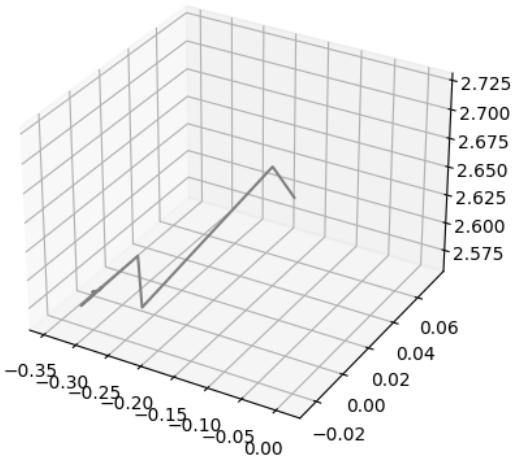
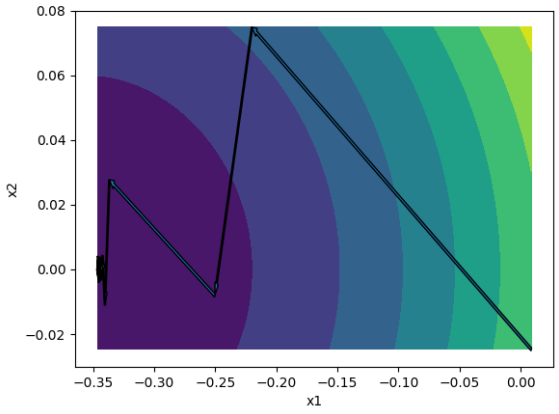
QUESTION 1:
Starting point:[0.1,0.2]

```
~/De/3_2/o/assign3  python3 1.py                    ✔  8s  10:09:25 PM
armijo goldstein
No of iterations = 28
backtrack armijo
No of iterations = 28
```

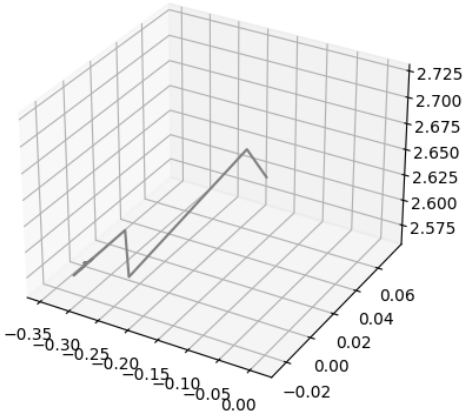
armijo goldstein line search:
xk vs f(xk) plot:



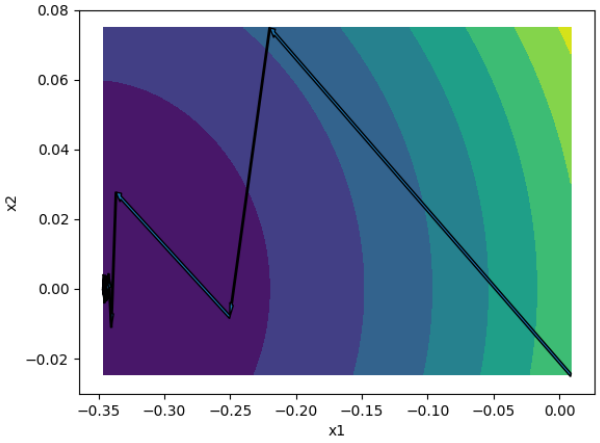
contour plot:



backtracking armijo line search:
xk vs f(xk) plot:



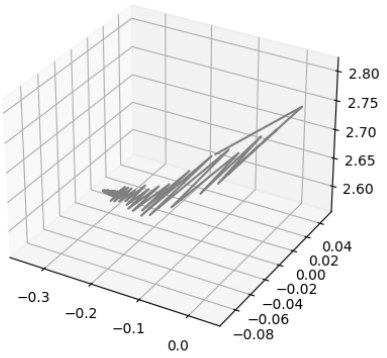
contour plot:



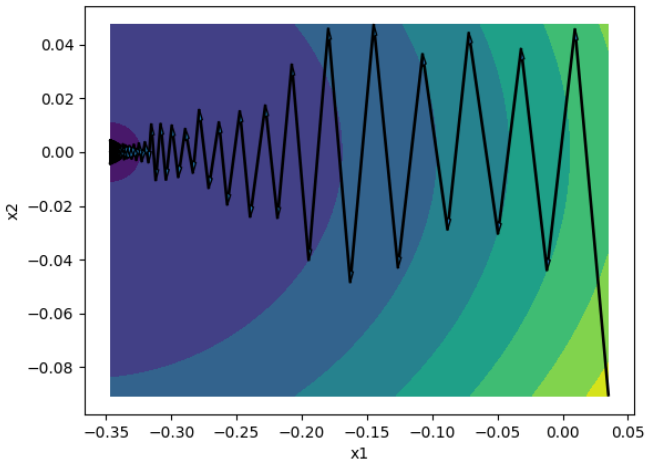
QUESTION 2:

```
~/De/3_2/o/assign3  python3 2.py                    ✔  5s  10:49:10 PM
starting point is :  [0.1, 0.2]
No of iterations = 148
```

xk vs f(xk) plot:



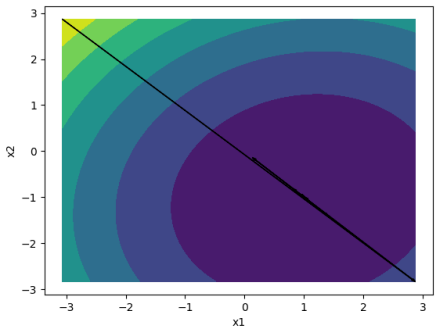
contour plot:

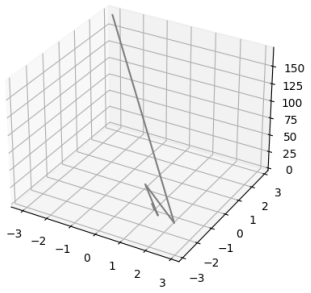


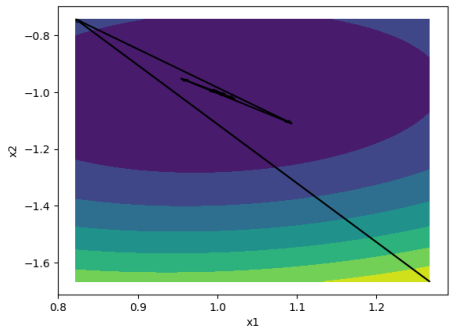
QUESTION 3:
lambda max = 11
case 1: alpha< 2/11 : took alpha = 2/15

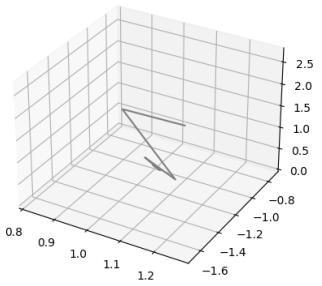
```
~/De/3_2/o/assign3  python3 3.py                    ✔  22s  10:50:21 PM
starting point is :  [10, -9]
26
starting point is :  [1, 1]
23
starting point is :  [-1, 4]
25
starting point is :  [3, 5]
24
starting point is :  [-1, 0]
24
```

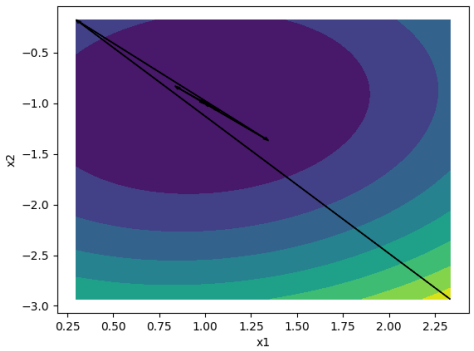
Below are the graphs for each of the starting points in order.

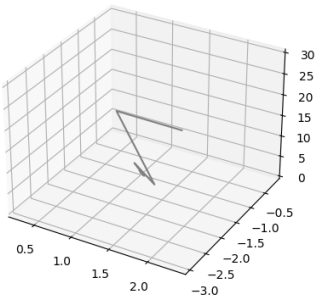


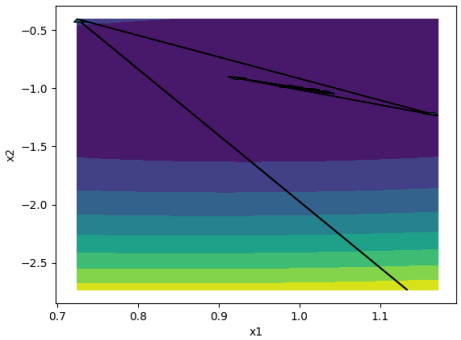


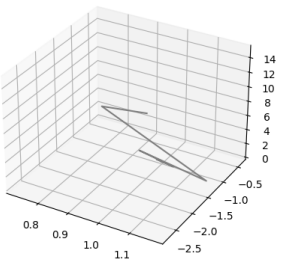


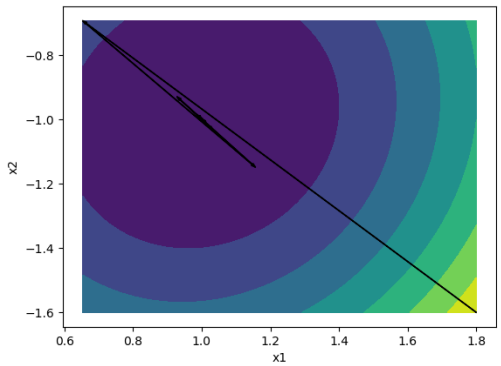


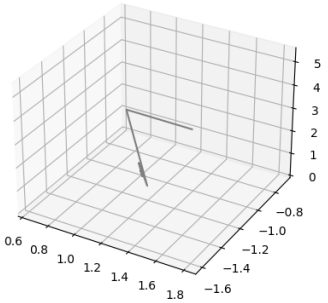










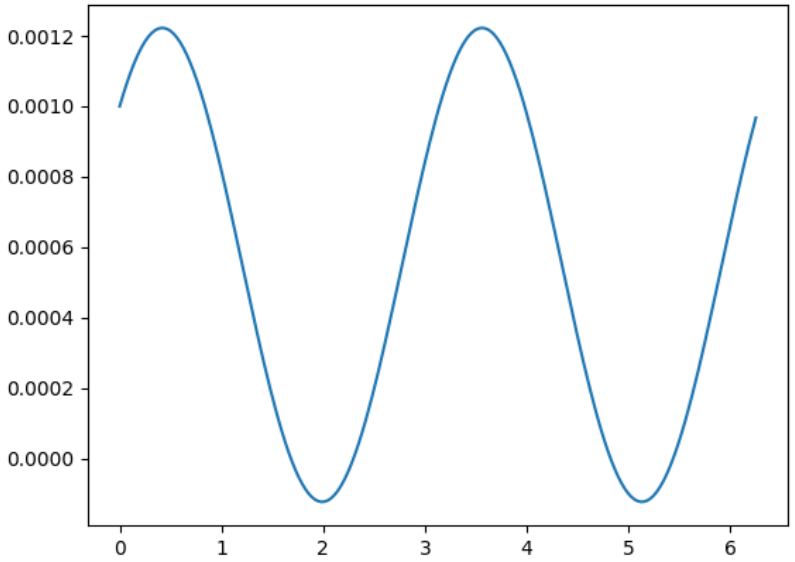


case2: alpha > 2/11 : took alpha as 2/8
GOT OVERFLOW ERROR RESULT OUT OF RANGE . the algorithm did not converge. The alpha was large so the value overshooted. So we have to take alpha < 2/lambda max for the algorithm to converge.

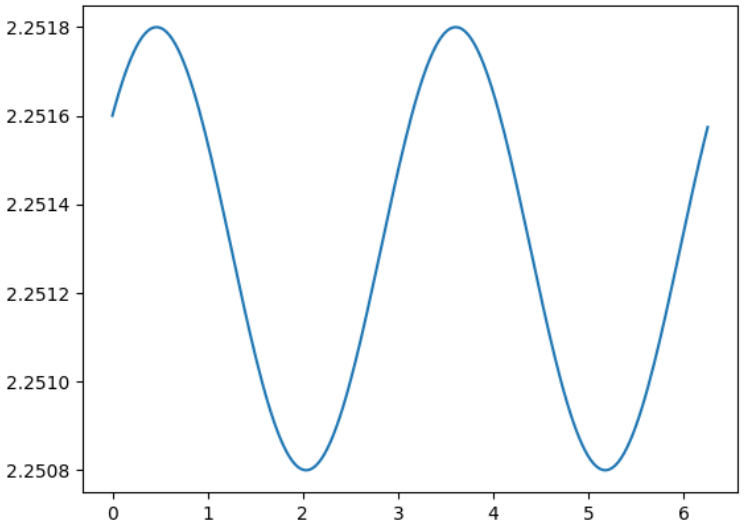
QUESTION 4:
Table answers given below.

```
 1. the gradient of f is :  (0.0, 0.0)
2. the eigen values of H(f) :  [-2.45362405 24.45362405]
3. the point :  [1.8, -4]  is a saddle point
 1. the gradient of f is :  (0.0, 0.0)
2. the eigen values of H(f) :  [16. 36.]
3. the point :  [-0.5, 0.5]  is a local minima
```

FUNCTION 1



FUNCTION 2:


2.2518
2.2516
2.2514
2.2512
2.2510
2.2508
0
1
2
3
4
5
6