

CH5170 - Class Work 4

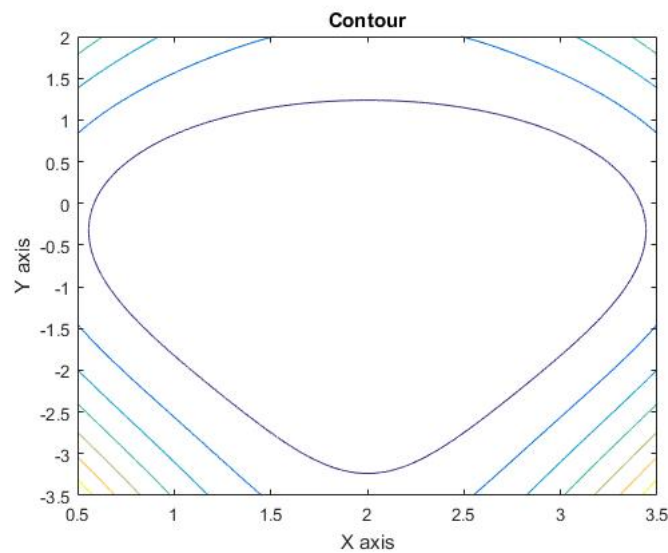
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1 Problem

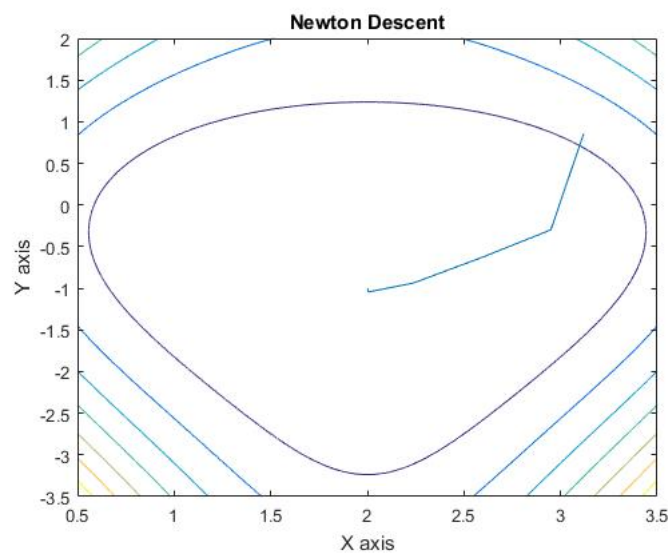
1.1 Details

1. **Starting Point** : $[3.12, 0.86]$.
2. **Equation** : $(x - 2)^4 + (x - 2)^2 y^2 + (y + 1)^2$.



2 Newton descent solution

2.1 Geometric Interpretation



2.2 Values of X for few iterations

Iteration Number	x_1	x_2
0	3.1200	0.8600
1	2.9498	-0.2981
2	2.5884	-0.6333
3	2.2375	-0.9371
4	2.0047	-1.0447
5	2.0004	-1.0000
6	2.0000	-1.0000

2.3 Calculation for few Iterations

2.3.1 Iteration 1

$$\text{Hessian} : \begin{bmatrix} 16.5320 & 3.8528 \\ 3.8528 & 4.5088 \end{bmatrix}, \text{Gradient} : \begin{bmatrix} 7.2764 \\ 5.8776 \end{bmatrix}, \mathbf{p} : \begin{bmatrix} -0.1702 \\ -1.1581 \end{bmatrix}, x_1 : \begin{bmatrix} 2.9498 \\ -0.2981 \end{bmatrix}.$$

2.3.2 Iteration 2

$$\text{Hessian} : \begin{bmatrix} 11.0022 & -1.1325 \\ -1.1325 & 3.8041 \end{bmatrix}, \text{Gradient} : \begin{bmatrix} 3.5957 \\ 0.8660 \end{bmatrix}, \mathbf{p} : \begin{bmatrix} -0.3613 \\ -0.3352 \end{bmatrix}, x_2 : \begin{bmatrix} 2.5884 \\ -0.6333 \end{bmatrix}.$$

2.3.3 Iteration 3

$$\text{Hessian} : \begin{bmatrix} 4.9573 & -1.4907 \\ -1.4907 & 2.6925 \end{bmatrix}, \text{Gradient} : \begin{bmatrix} 1.2870 \\ 0.2948 \end{bmatrix}, \mathbf{p} : \begin{bmatrix} -0.3510 \\ -0.3038 \end{bmatrix}, x_3 : \begin{bmatrix} 2.2375 \\ -0.9371 \end{bmatrix}.$$

2.3.4 Iteration 4

$$\text{Hessian} : \begin{bmatrix} 2.4330 & -0.8901 \\ -0.8901 & 2.1128 \end{bmatrix}, \text{Gradient} : \begin{bmatrix} 0.4706 \\ 0.0201 \end{bmatrix}, \mathbf{p} : \begin{bmatrix} -0.2328 \\ -0.1076 \end{bmatrix}, x_4 : \begin{bmatrix} 2.0047 \\ -1.0447 \end{bmatrix}.$$

2.4 Points for which $f(x_1) > f(x_0)$

There are Infinitely many points for which such a state is possible some of which are :

S.No	x_1	x_2
1	3.1200	1.7600
2	1.0000	1.5600
3	5.0000	4.3600
4	4.0000	2.9600
5	3.0000	1.5600