# Homework 4

**Problem 1:**



If , we can write Hjk as a product of 2 vectors.

Therefore,

For convexity, we have to prove that H is positive semidefinite.

from Eq. 1.

From Eq. 2, .

Let z be any vector. Multiplying the equation by

Hence proved that H is a PSD and L(w) is a convex function.



**Problem 2:**

Since M is symmetric

Since M is PSD, H is also PSD. Therefor, f(x) is convex

1. For f to be convex, prove that:

***– Eq1***

From the above equations, we can say that

Since both g(x) and h(x) are convex,

**– *Eq-2***

From Equation 1 and 2:

**– *Eq-3***

Similarly, we can say this about h(z)

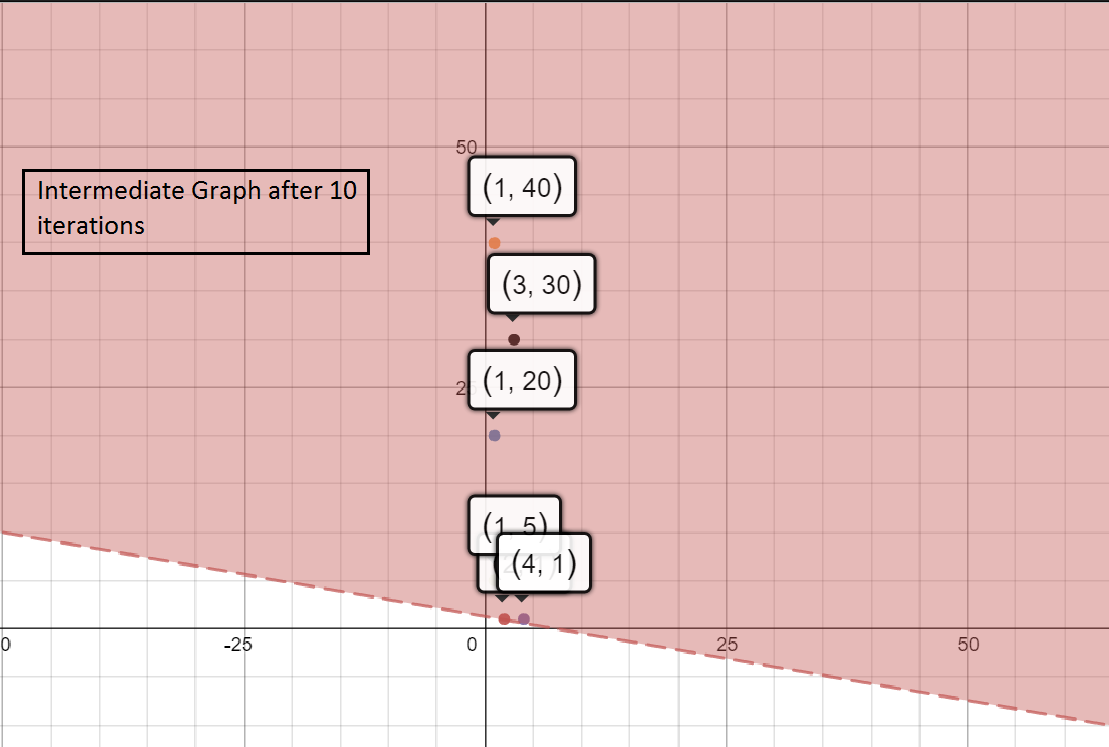
**– *Eq-4***

Thus from equation 1, 3, 4 we can say that f(x) is convex

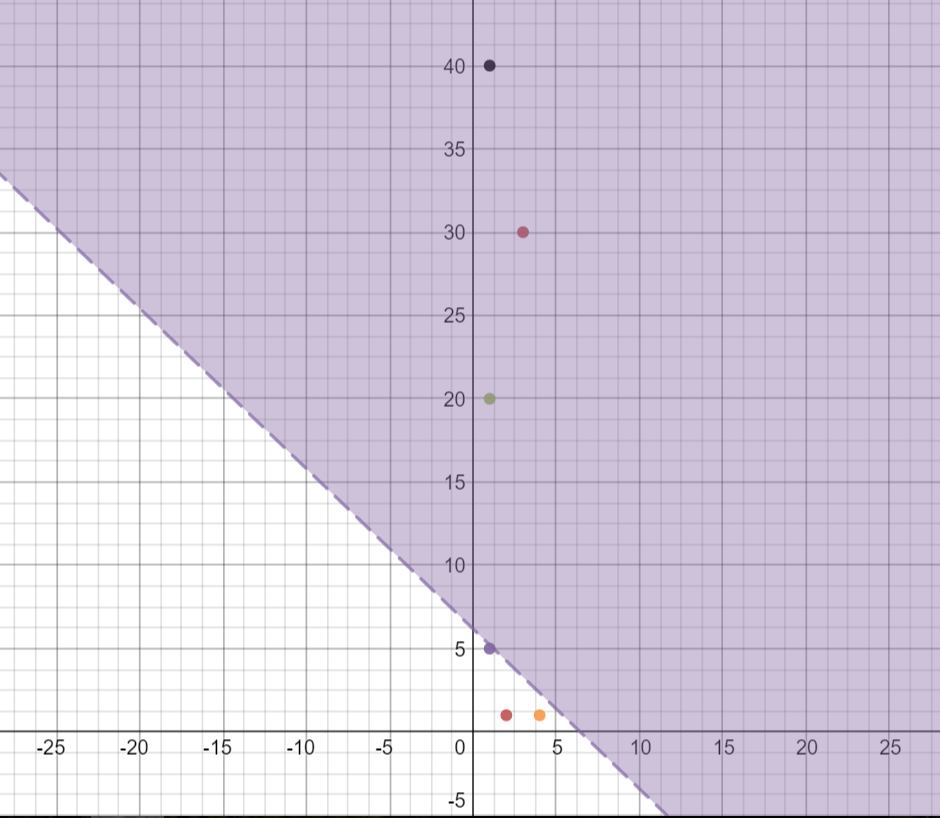
**Problem 3:**

.0001

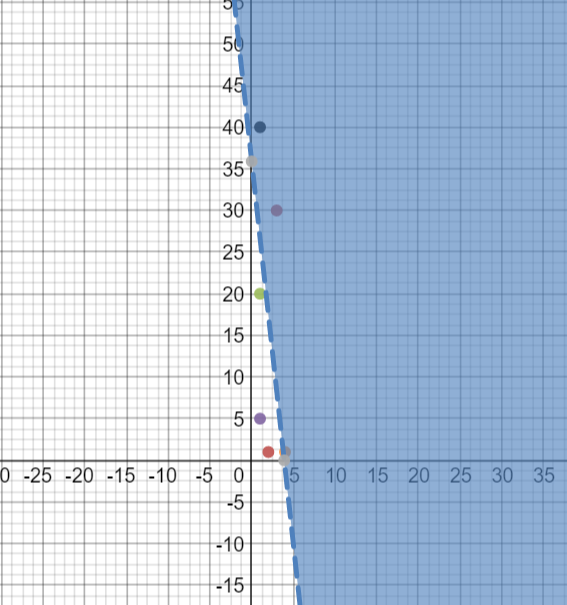
1. Number of iterations to get a good decision boundary = 22164

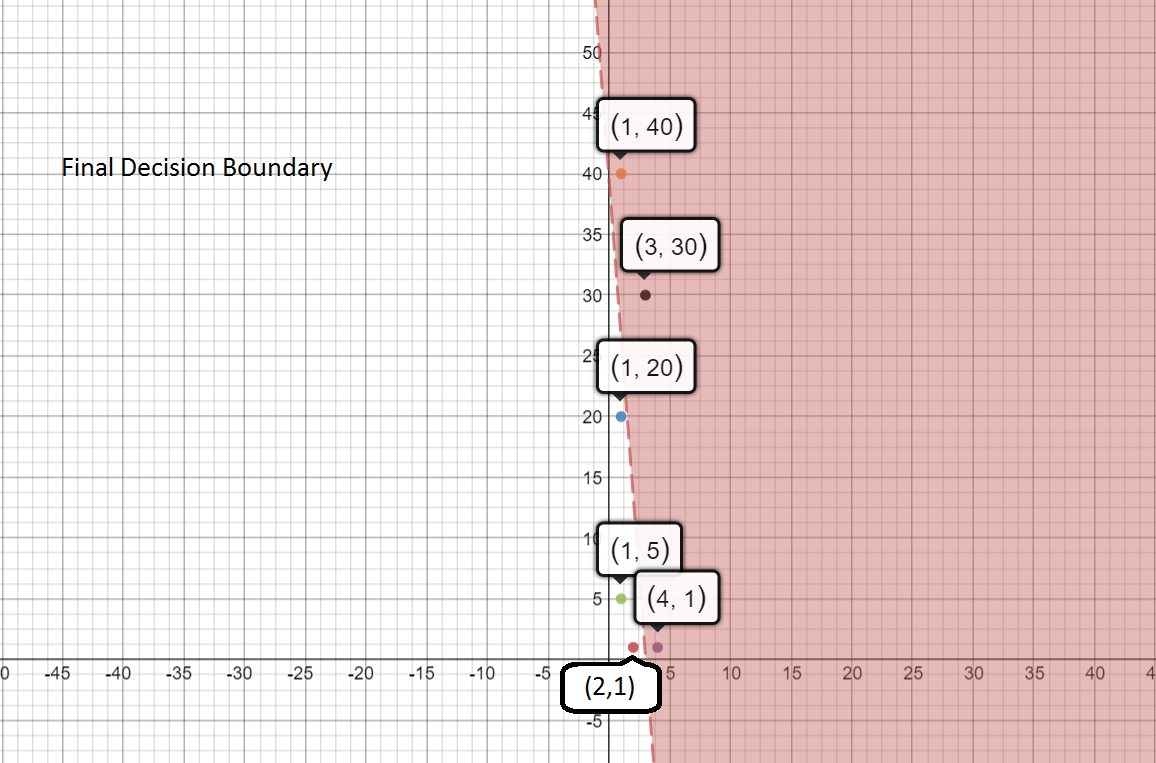
Intermediate Graph (t=10)

Intermediate Graph: (t=1000)

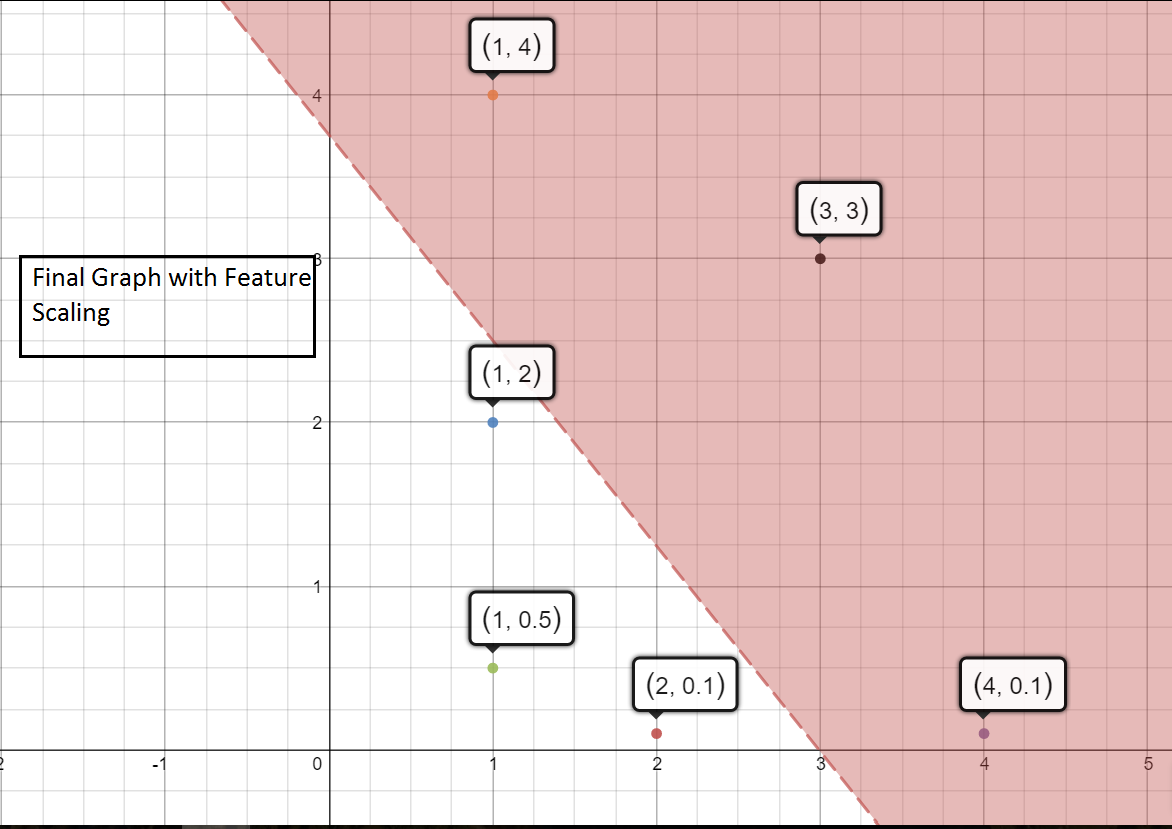


Intermediate Graph (t=15000)



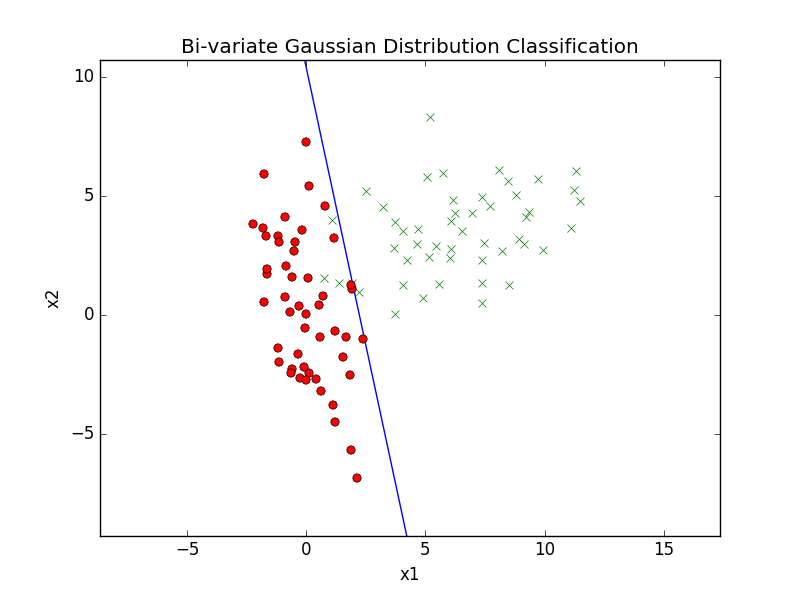
Graph of Final Decision Boundary (iter=22164)  


Final Graph by feature scaling:



1. Yes, the number of iterations to get a good decision boundary reduces to 4632
2. Graph with random bivariate gaussians:

Overlapping boundaries: **(iter = 82)**



Non-overlapping boundaries: **(iter = 78)**

