1. For the Sentosa data created by the code:

```
Setosa <- data.frame(iris3[,,'Setosa'])
```

Calculate the 95% confidence ellipsoid using the cut off for the T^2 statistic using the method in Point 7 of the notes. Show the matrix of the ellipsoid and the cut off point or constant for defining the ellipsoid. **Ans: Cutoff point is 6.514**

2. Now calculate the 95% confidence ellipsoid using the cut off for the chi-square statistic. Compare the cut-off points obtained by both methods, are they the same? **Ans: Same as 1)**

```
> Setosa <- data.frame(iris3[,,'Setosa'])
> summary(Setosa)
    Sepal.L.        Sepal.W.        Petal.L.        Petal.W.
 Min.   :4.300   Min.   :2.300   Min.   :1.000   Min.   :0.100
 1st Qu.:4.800   1st Qu.:3.200   1st Qu.:1.400   1st Qu.:0.200
 Median :5.000   Median :3.400   Median :1.500   Median :0.200
 Mean   :5.006   Mean   :3.428   Mean   :1.462   Mean   :0.246
 3rd Qu.:5.200   3rd Qu.:3.675   3rd Qu.:1.575   3rd Qu.:0.300
 Max.   :5.800   Max.   :4.400   Max.   :1.900   Max.   :0.600
> xbar=apply(Setosa,2,mean)
> xbar
Sepal.L. Sepal.W. Petal.L. Petal.W.
   5.006    3.428    1.462    0.246
> S=var(Setosa)
> S
           Sepal.L.    Sepal.W.    Petal.L.    Petal.W.
Sepal.L. 0.12424898 0.099216327 0.016355102 0.010330612
Sepal.W. 0.09921633 0.143689796 0.011697959 0.009297959
Petal.L. 0.01635510 0.011697959 0.030159184 0.006069388
Petal.W. 0.01033061 0.009297959 0.006069388 0.011106122
> cor(Setosa)
          Sepal.L.  Sepal.W.  Petal.L.  Petal.W.
Sepal.L. 1.0000000 0.7425467 0.2671758 0.2780984
Sepal.W. 0.7425467 1.0000000 0.1777000 0.2327520
Petal.L. 0.2671758 0.1777000 1.0000000 0.3316300
Petal.W. 0.2780984 0.2327520 0.3316300 1.0000000
> mu0=c(4,3,2,1)
> Sinv=solve(S)
> n=nrow(Setosa)
> n
[1] 50
> n*t(xbar-mu0)%*%Sinv%*%(xbar-mu0)
         [,1]
[1,] 4063.314
> (n-1)/(n-4)*4*qf(0.95,4,n-4)
[1] 10.96763
> Zval=4063.314/(49/46*4)
> 1-pf(Zval,4,46)
[1] 0
```

```
> theta=(1:100)*2*pi/100
> x=cbind(cos(theta),sin(theta))
> k=sqrt(2*49/48/50*qf(0.95,2,48))
> s=S[1:2,1:2]
> xbar=xbar[1:2]
> v=eigen(s)$vectors
> ei=diag(eigen(s)$values)
> h=(v%*%sqrt(ei)%*%t(v))
> plot(Setosa[,1],Setosa[,2])
> lines(t(t(k*x%*%h)+xbar))
> lines(t(t(x%*%h)+xbar))
> xbar
Sepal.L. Sepal.W.
   5.006    3.428
> s
           Sepal.L.   Sepal.W.
Sepal.L. 0.12424898 0.09921633
Sepal.W. 0.09921633 0.14368980
> s1=sqrt(diag(s))
> s1
 Sepal.L.  Sepal.W.
0.3524897 0.3790644
> k=s1/sqrt(50)*qt(0.975,49)
> kk=cbind(xbar-k,xbar+k)
> cbind(xbar-k,xbar+k)
             [,1]     [,2]
Sepal.L. 4.905824 5.106176
Sepal.W. 3.320271 3.535729
```