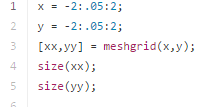
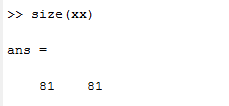
Part2\_1(a)

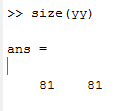
Code as shown below

x and y are array that contains 81 elements, from -2 to 2, step of 0.25.

After using the meshgrid function, xx and yy became a 2 x 2 matrix, where each row of the matrix is identical, in order to create a grid.

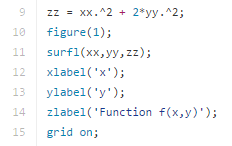
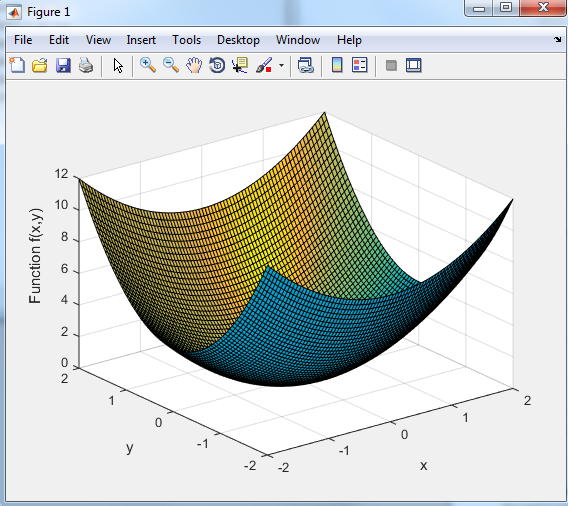






(b)

Identical to lecure note(Page16)

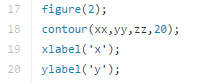
As shown in above, the 3D surface plot by the surf function of the grid that has been created ealier is identical to the one in the lecture slide.

(c)

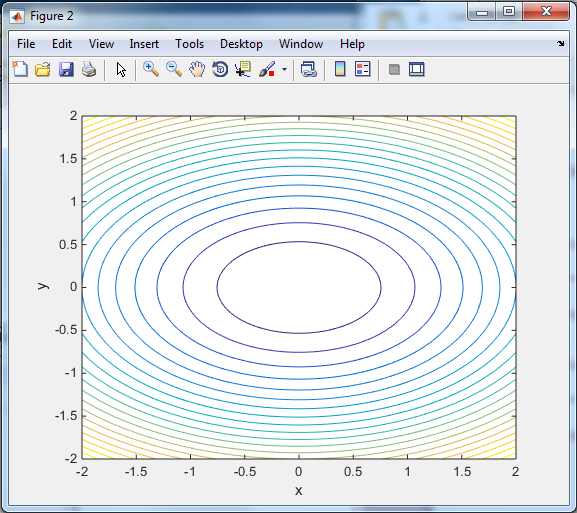
By taking arbitrary values of c, we expect different cross sections of the plot in Figure 1 (3D quadratic shape) at different levels of elevation (z-axis). Therefore, we expect the contours to be an elliptic shape.

(d)

Code:



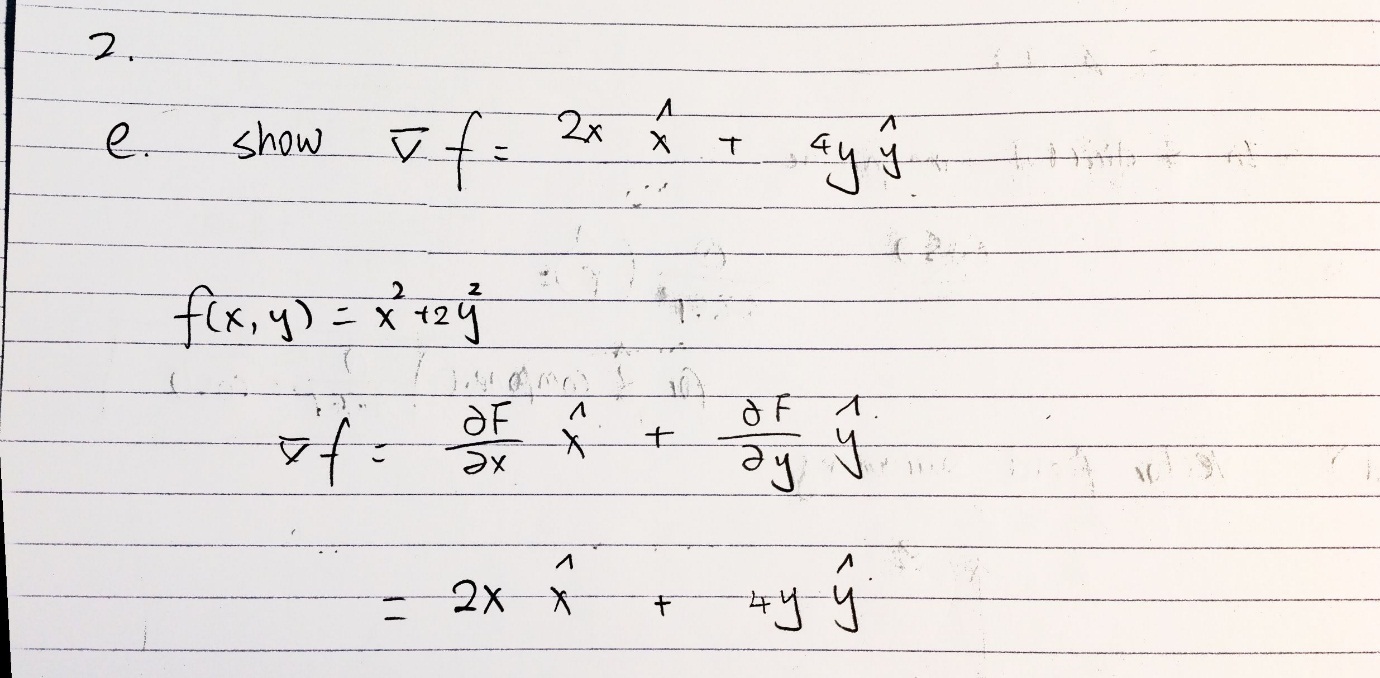
Graph plotted to be:



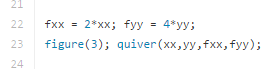
The purpose of the last argument ‘20’ in contour(xx,yy,zz,20) is to draw 20 contour lines in the plot. The levels of contour are chosen automatically.

(e)

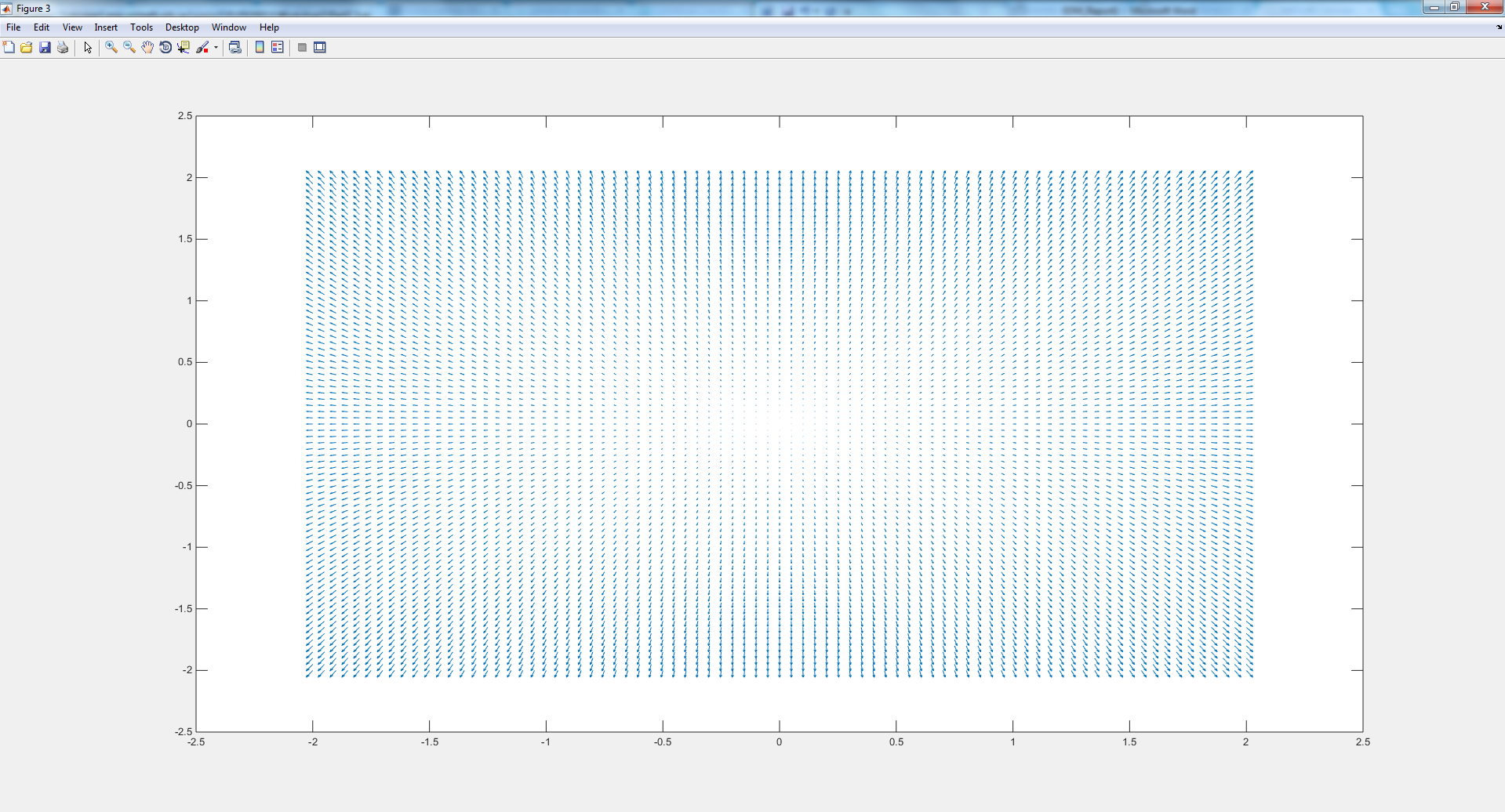
\*Show gradient of function is…



The code used to plot the gradient vector of F is



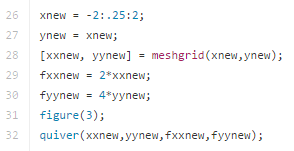
The plot is



Problem: cannot clearly see the magnitude and direction of the gradient vector field. This will be solved in (f)

(f)

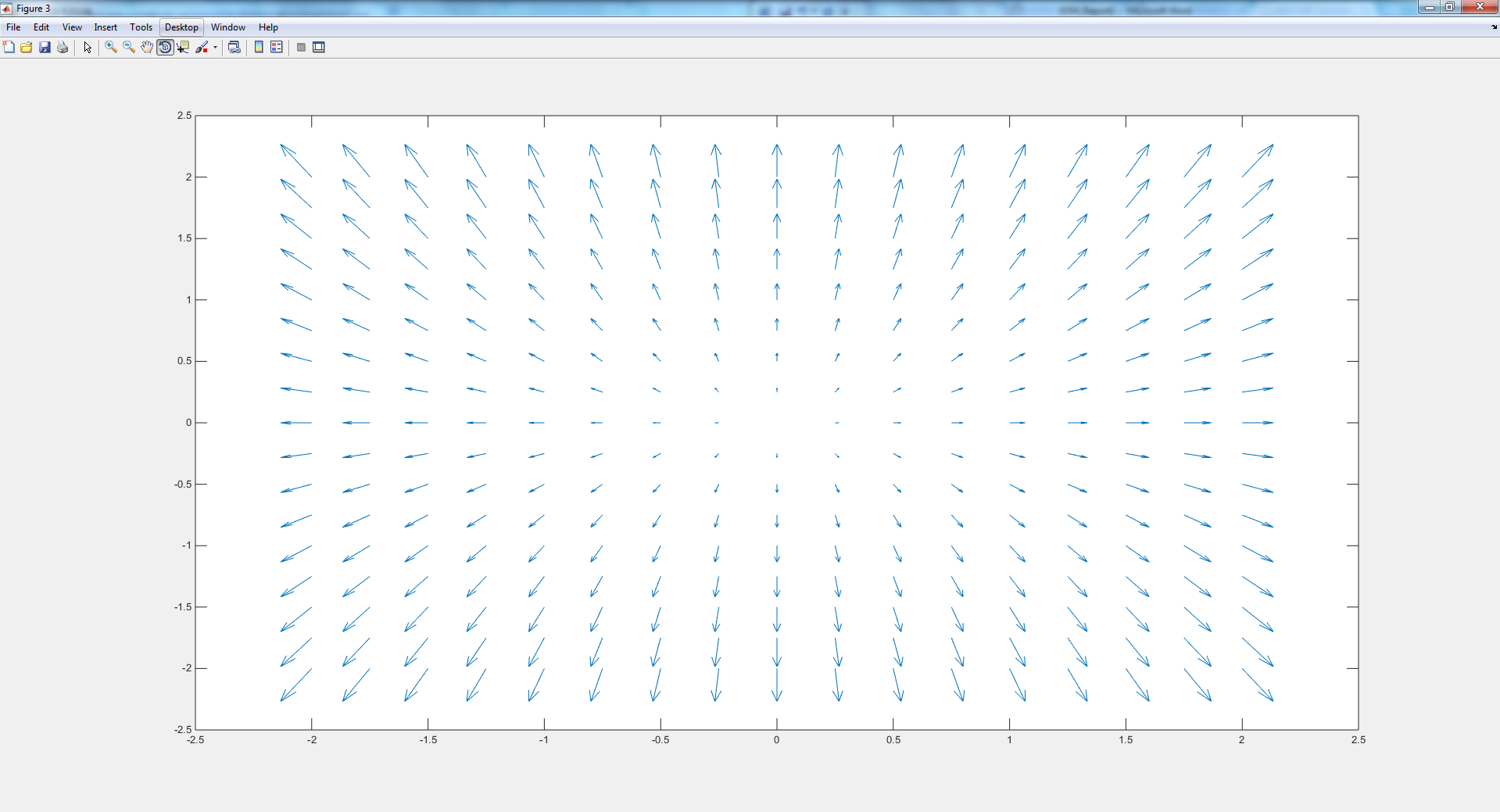
Code:



By increasing the step of the x and y vector, the number of arrows that used to represent the gradient vector is reduced and now it is easier to see We can now easily see the direction and magnitude of the vector field.

.

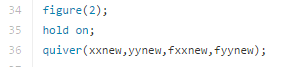
Plot

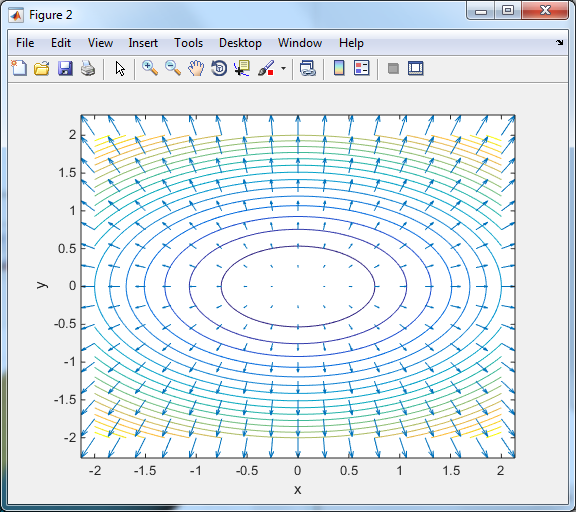


The problem from before is now resolved.

(g)

Overlaying the gradient vector field to the contour plot by adding the code below:

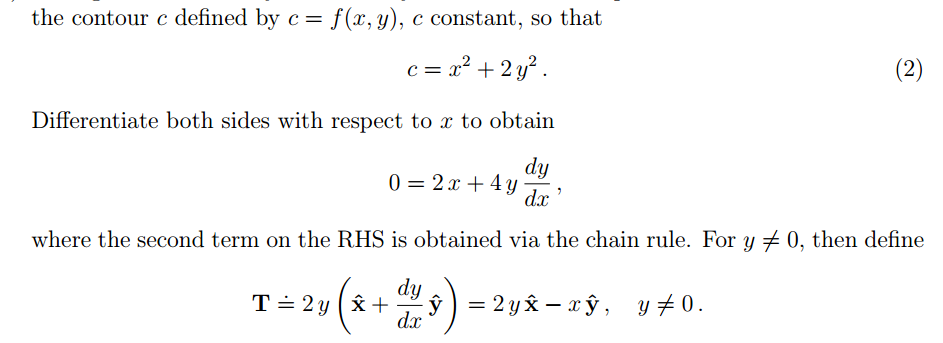




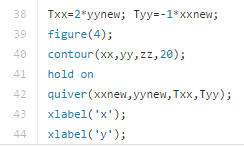
As the diagram show, the gradient vector field is perpendicular to the contours.

(h)

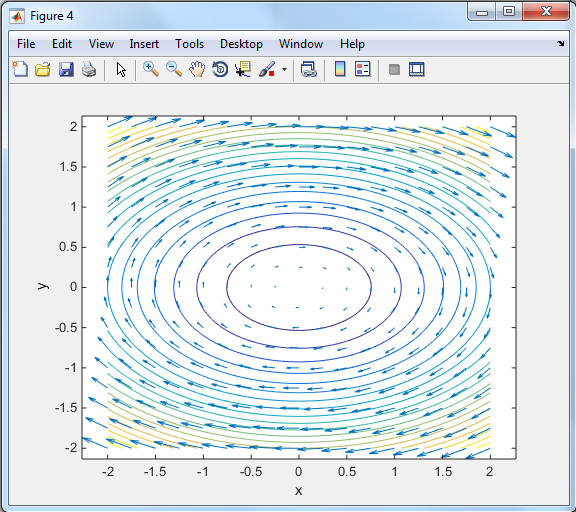
The tangent vetor field T obtain by implicite differecitation as shows below



By plotting the tangential vector field T on the same figure as the contour using the code below:



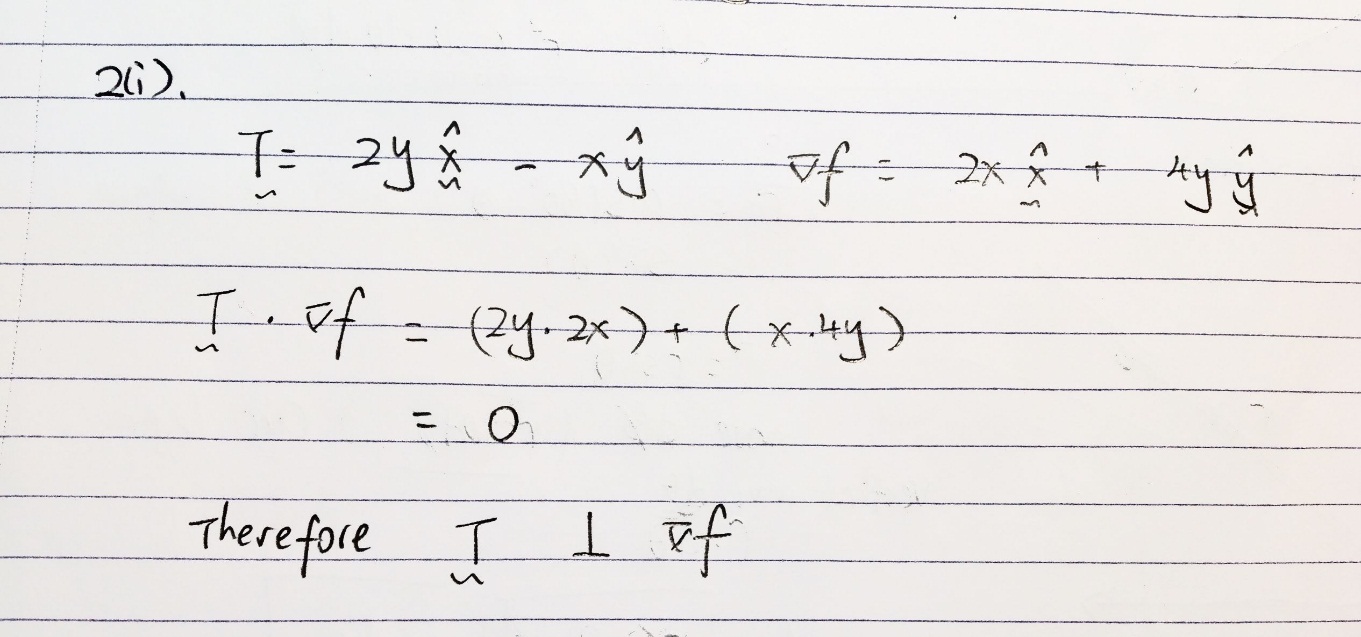
We obtained this graph:



As the figure shows, the vector field T contains vectors that are tangential to the contours of function f.

(i)

\*show explicitly that the tangent vector is perpendicular to grad F

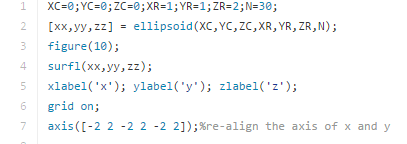


Q2. (a)

# \*YUXIN show equation PLEASE

(b)

The code that used to plot the ellipsoid is show below



In the ellipsoid functiuon that use to generate the surface of a ellipsoid in matlab:

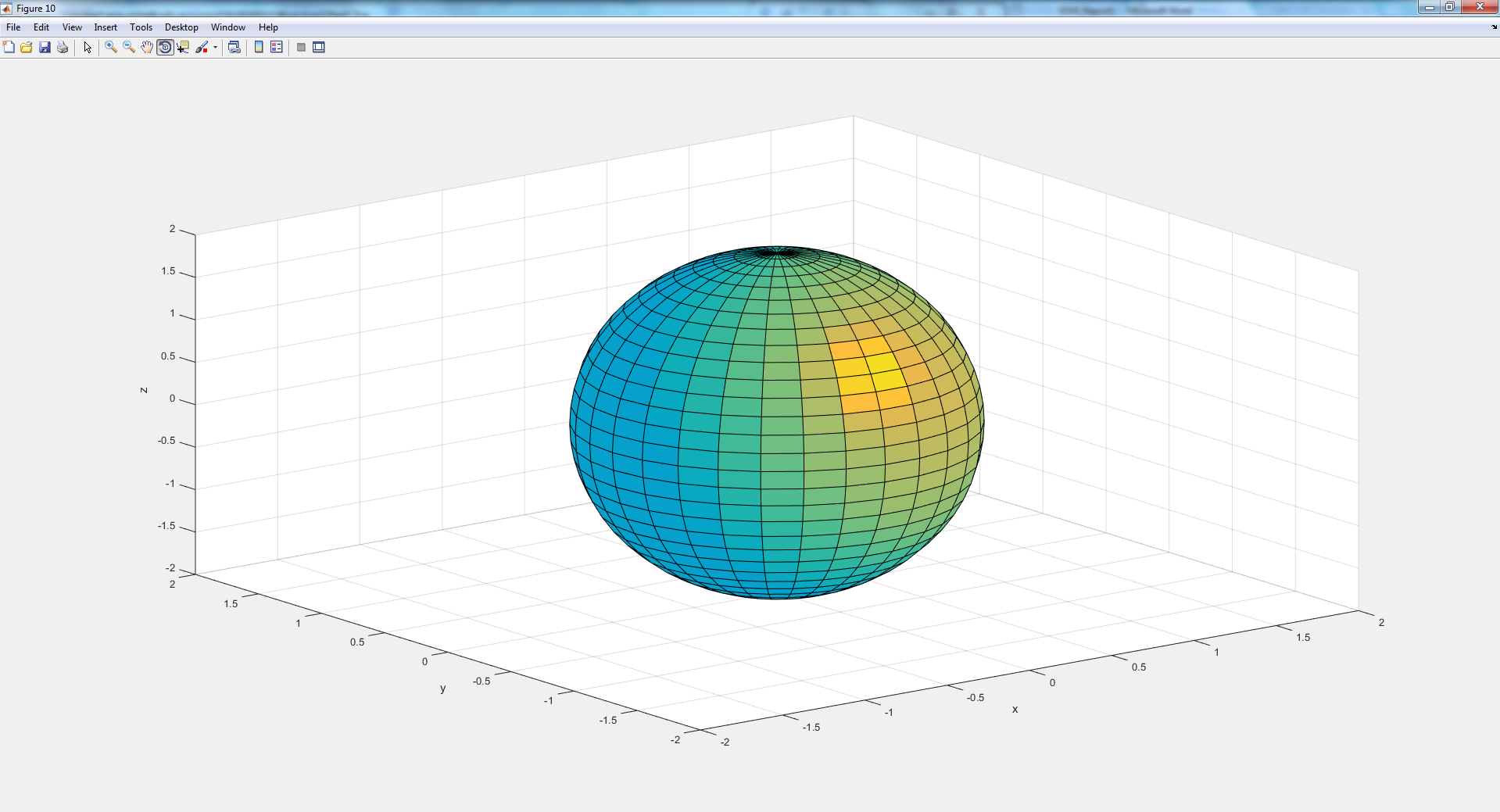
The arguments, XC, YC, ZC is the coordinate of the centre of the ellipsoid;

XR, YR, ZR are the radius of the ellipsoid on x, y, z axis

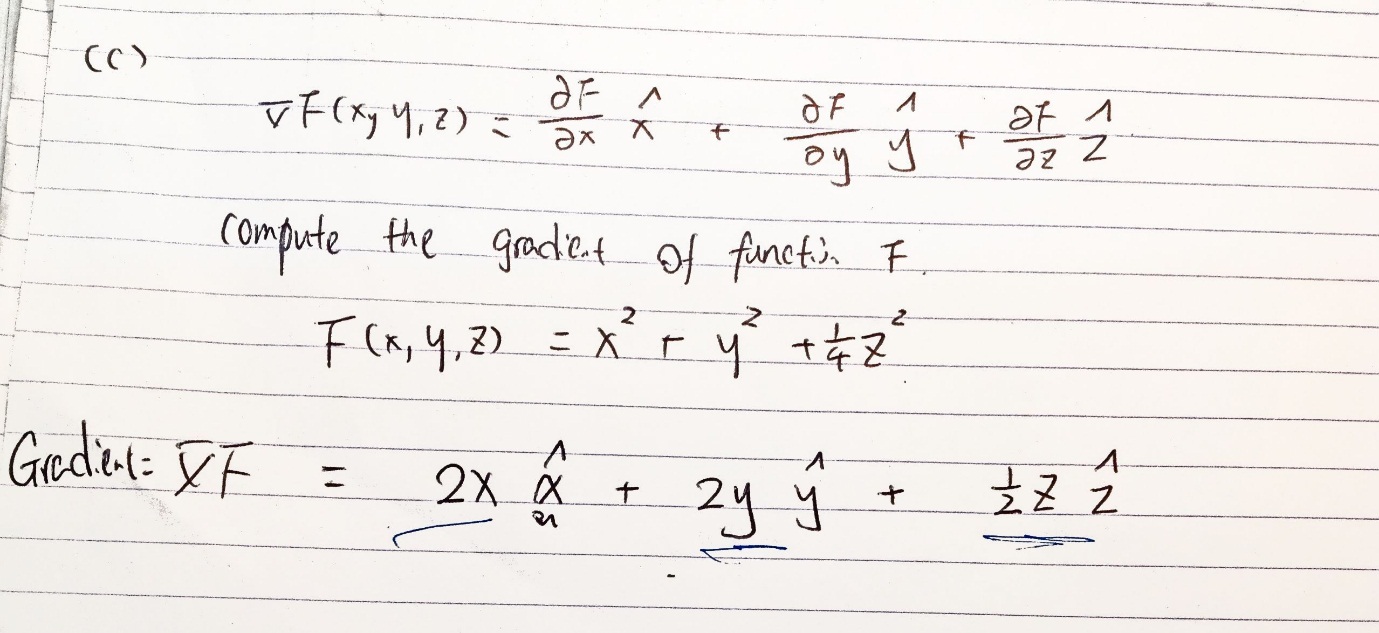
N is the graphing resolution.

Line 7 of the code above is for re-aligning the x and y axis of the graph from 0 to 2.

The graph is show below

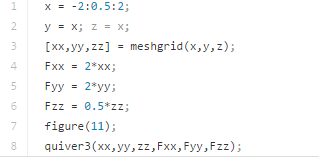


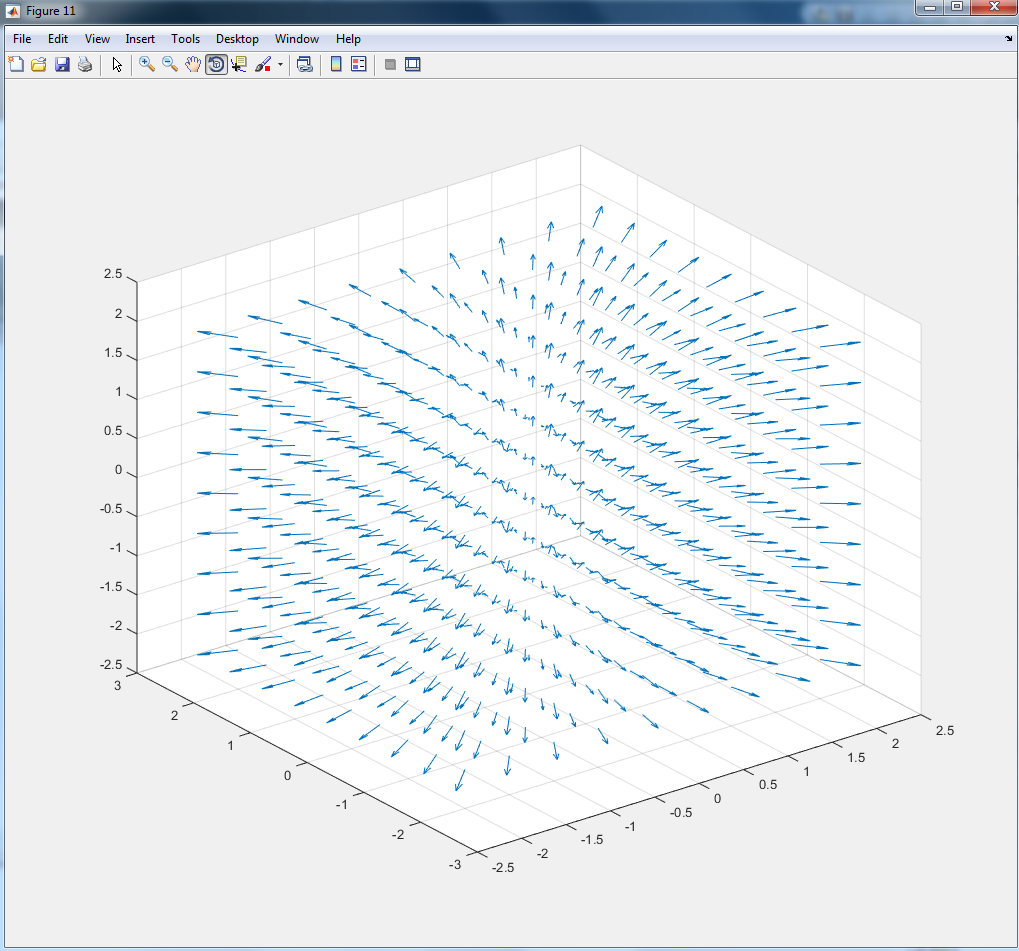
(c)



(d)

Using the gradient vector from the previous vector, the code used to plot the gradient vector field is show below.



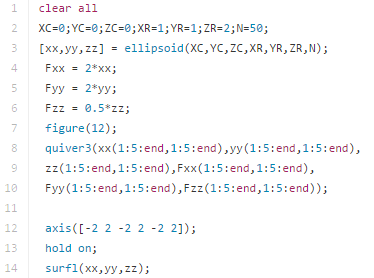


This figure is identical to Figure 6 from the Lab specification by inspection.

f)

Figure 5 from the lab specification is essentially a vector field which is perpendicular to the ellipsoid surface, and the ellipsoid surface itself.

In order to obtain this graph, we used the code below:



**YUXIN, add explanation to the code’s (1:5:end,1:5:end) etc here please.**

And this is the graph that plotted by the script above, which is identical to Figure 5 in the labotary specification.

