You are encouraged to discuss this assignment with other students and with the instructors, but the work
you hand in should be your own. The web page
http://www.math.rutgers.edu/courses/251/Maple/Lab3/Quadrics.html
can help you with this assignment; to find it, follow the “Maple in Math 251” link on the the Math 251
course webpage.

A web page will be posted listing individual data for each student. For this lab the data will be two functions
and three constants.

• The first function, \( F(x, y) \), will be a second degree polynomial of two variables \((x \text{ and } y)\). There will
also be a specific value given for \( x \), let’s say \( x = A \).

• The second function, \( G(x, y, z) \), will be a second degree polynomial of two variables \((x, y, \text{ and } z)\).
There will also be a value given for \( x \) and a value given for \( y \), let’s say \( x = B \) and \( y = C \).

Use Maple to help you answer the following questions.

What kind of curve is \( F(x, y) = 0 \)? Is it a hyperbola, a parabola, or an ellipse? For which values of \( y \) is
\((A, y)\) on the curve \( F(x, y) = 0 \)? (Usually there will be two values of \( y \), but you may be lucky, and there may
be only one.) For each of these values of \( y \), use Maple to compute a vector normal to the curve \( F(x, y) = 0 \)
at the point \((A, y)\). Then use Maple to draw this vector or vectors, together with the curve \( F(x, y) = 0 \).

What kind of surface is \( G(x, y, z) = 0 \)? Is it a cylinder (what type of cylinder?), a cone, a paraboloid (what
type of paraboloid?), an ellipsoid, or a hyperboloid (what type of hyperboloid?). For which values of \( z \) is
\((B, C, z)\) on the curve \( G(x, y, z) = 0 \)? (Usually there will be two values of \( z \), but you may be lucky, and there
may be only one.) For each of these values of \( z \), use Maple to compute a vector normal to \( G(x, y, z) = 0 \) at
\((B, C, z)\). Then use Maple to draw this vector or vectors, together with the surface \( G(x, y, z) = 0 \).

This assignment is due Thursday July 9, 2015 in class. Late submissions will not be accepted.

Please hand in a printout of all Maple instructions that you use. You must print out the
assignment and hand it in to me.

- All pages should be labeled with your name and section number. Also, please staple together all the
pages you hand in.

- You should clean up your submission by removing the instructions that had errors.

The work that you hand in should include:

1. A clear picture of \( F(x, y) = 0 \), including your identification of the type of the curve. Show
evidence for your assertion. The identification can be done “by hand” on your printout.

2. The coordinates of the point or points \((A, y)\) in your computations.

3. A second picture of the curve \( F(x, y) = 0 \), which shows also the normal vectors at point(s) \((A, y)\).
Select the picture carefully. It should show the vectors as perpendicular to the curve.

4. A clear picture of the surface \( G(x, y, z) = 0 \), including your identification of the type of the
surface. You may give several pictures; select your views carefully to show evidence for your assertion.
The identification can be done “by hand” on your printout.
5. The coordinates of the point or points \((B, C, z)\) in your computations.

6. A further picture or pictures of the curve \(G(x, y, z) = 0\), which show also the normal vectors at point(s) \((B, C, z)\). You may need to give several views of this picture; select your views carefully so that the vectors are shown as perpendicular to the surface.

**Remark:** The background information for these labs suggests drawing vectors using the `spacecurve` command, which is fine. There is also an `arrow` command, which gives plots that look more like vectors but is rather tricky to use. Experiment with it if you like.