Mathematica Project 3: due March, 13th (IN CLASS)
Multivariate Calculus, MTH 212, Spring 2019

Note: late projects will not be accepted.

Use the text input mode to start your Mathematica notebook with your name and project number. Your project should be well-organized and clear to read; make sure all the exercises are clearly labeled and all questions answered. (Failure to follow these directions will result in lost points.) Make sure that you get all your Mathematica input (functions, formulas, commands you use to answer questions) and the required output (evaluate all the necessary cells to produce/display your results, plots, etc.). Bring your project printout to class on 3/13/19. (Please staple it!)

1. Given the intersecting lines $L1$: $x = t$, $y = 3 - 3t$, $z = -2 - t$, $\infty < t < \infty$ and $L2$: $x = 1 + s$, $y = 4 + s$, $z = -1 + s$, $\infty < s < \infty$, use Mathematica to:
   (i) find the equation of the plane containing the lines (doing necessary vector computations);
   (ii) graph the two lines and the resulting plane.
2. Given the planes $3x - 6y - 2z = 3$ and $2x + y - 2z = 2$, use Mathematica to:
   (i) find the equation of the line in which the planes intersect (doing necessary vector computations);
   (ii) graph the two planes and the line of intersection.
3. Working with Exercise 62 on page 639, use Mathematica to:
   (i) find the answers to the exercise parts (b) through (d);
   (ii) find the normal vector for the plane determined by the points A, B, C;
   (iii) graph the plane determined by the points A, B, C.
4. Plot the surfaces listed below using *ContourPlot3D*. Pick a range that gives a good view of all the main features of the surface. Label the axes using *AxesLabel*. For each plot, identify the surface.

(a) $x^2 + z^2 = 9$

(b) $x^2 + z^2 = y^2$

(c) $4y^2 + z^2 - 4x^2 = 4$

(d) $36x^2 + 9y^2 + 4z^2 = 36$

5. Given the curve $\mathbf{r}(t) = \langle e^t \sin 2t, e^t \cos 2t, 2e^t \rangle$, use Mathematica to:

   (i) do the required computations to find the vectors **T**, **N**, **B**, and curvature κ at $t = 0$.

   (ii) graph the curve (using *ParametricPlot3D*) together with the **TNB**-frame on a slider (using *Manipulate*) for $-2 \leq t \leq 2$.