Mathematica Project 1: due January, 29th (IN CLASS)
Multivariate Calculus, MTH 212, Spring 2020

Note: Late projects will not be accepted.

Failure to follow directions below may result in lost points.

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 (use comment or text mode) and all questions answered. 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.). While working on the project, you may want to use the help file posted on our web page.

Once the project is completed, review it, print it, and bring it to class on 1/29/20.

1. For each exercise in (a)-(c), use *ContourPlot3D* to plot the given pair of equations and give a geometric description of the sets of points satisfying these equations:

   (a) $x^2 + z^2 = 4$, $y = 0$

   (b) $x^2 + y^2 + (z + 3)^2 = 25$, $z = 0$

   (c) $z = y^2$, $x = 1$

   Make sure to find proper range for x, y, z in *ContourPlot3D* to display good graphs; explore the options of *ContourPlot3D*; use the text mode to give the descriptions.

2. Consider the vectors $\mathbf{u} = \langle 1, 1, 1\rangle$ and $\mathbf{v} = \langle 0, 5, -3\rangle$. Do the necessary computations in *Mathematica* to find:

   (a) the unit vector in the direction of $\mathbf{u}$

   (b) $\mathbf{u} \cdot \mathbf{v}$

   (c) the angle between $\mathbf{u}$ and $\mathbf{v}$

   (d) scalar component of $\mathbf{u}$ in the direction of $\mathbf{v}$

(e) the vector $\text{proj}_{\mathbf{v}}\mathbf{u}$

Lastly, using *Graphics3D*, plot $\mathbf{u}$, $\mathbf{v}$ and $\text{proj}_{\mathbf{v}}\mathbf{u}$ and label them.

3. Continue working with the vectors $\mathbf{u}$ and $\mathbf{v}$ from part 2. Do the necessary computations in *Mathematica* to find:

   (a) $\mathbf{u} \times \mathbf{v}$

   (b) area of the parallelogram determined by $\mathbf{u}$ and $\mathbf{v}$

   (c) area of the triangle determined by $\mathbf{u}$ and $\mathbf{v}$

   (d) volume of the parallelepiped determined by $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w} = \langle 1, 2, 3 \rangle$