

Mathematica Project 1: due October 17th

Multivariate Calculus, MTH 212, Fall 2023

Note: Late projects will not be graded.

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 and all questions answered (use comments or text mode). 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 see 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 and submit it to the appropriate folder at <http://LIVE.wilkes.edu> anytime before 11:59 pm on 10/17/23. *The name of your .nb file should identify you clearly.* (A good example of a name could be Jane_Smith_Project1.nb.) For an easier upload of your file, you may **delete all output from your notebook** - you can find the corresponding command under "Cell" in your notebook top panel.

1. Lines and Planes

Given the intersecting lines $L_1: x = t, y = 3 - 3t, z = -2 - t$ and

$L_2: x = 1 + s, y = 4 + s, z = -1 + s$, use Mathematica to:

- find the equation of the plane containing the lines (doing necessary vector computations in Mathematica);
- graph the two lines and the resulting plane together, *in one figure* (use command *Show*).

Given the planes $x + y + z = 1$ and $x + y = 2$, use Mathematica to:

- find parametric equations of the line in which the planes intersect (doing necessary vector computations in Mathematica);

- (b) graph the two planes and the line of intersection together, *in one figure* (use command *Show*).

2. Plotting Quadrics

Plot the quadrics 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 (that is, name it)**.

- (a) $z = y^2$
(b) $y^2 + z^2 - x^2 = 1$
(c) $x^2 - y^2 = z$
(d) $x - y^2 - z^2 = 0$

3. Space Curve, Arclength, and TNB-Frame

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

- (a) find the arclength of the curve as t increases from 0 to 10 (use the command *NIntegrate* and a proper formula for the arclength);
(b) define the vectors \mathbf{T} , \mathbf{N} , and \mathbf{B} at time t and graph the curve (using *ParametricPlot3D*) together with the **TNB**-frame on a slider (using *Manipulate*) for $-10 \leq t \leq 10$.