Group Project: Get to know a surface

In a group of three, you will work to understand the details of a surface in 3-space. This project has three parts:

1. A physical model of your surface
2. A computer-based investigation
3. A video presentation about your surface and its features.

The only part that needs to be turned in is the video presentation, as it will include the previous two parts. The project will be graded according to the following rubric.

Category	Max points
Physical model	3
Computer investigation	3
Video presentation	4
Creativity	2
Total	12

Details about each piece follow. It is important to note that the specifics given below are considered the *bare minimum requirements*, and completing only the minimum requirements perfectly will get you a grade equivalent to a B. Be creative!

1. **The physical model**

   Make a 3-dimensional model of your surface. On it, draw and label the following:

   - at least two cross-sections with x fixed
   - at least two cross-sections with y fixed
   - at least two sections with z fixed (if your surface is a graph $z = f(x, y)$, these are level curves)

   Your surface should stand up on its own, and you should indicate the locations of the coordinate axes in some way. Your model's dimensions should not exceed 1ft×1ft×1ft. Use whatever material you have on hand; please don't go out and buy any expensive craft supplies. If you encounter any difficulty obtaining supplies, please ask for assistance. **Use perishable items with caution! The project needs to last long enough to be presented.**

2. **The computer investigation**

   Investigate your surface via computer. Here are some tools you may want to use for your computer investigation:

- WolframAlpha
- GeoGebra
- Desmos 3D
- Mathematica (available on some Colby computers)
- 3D modeling software like TinkerCAD (ambitious)

You can of course use other tools if you prefer. It is **not** acceptable to simply Google your surface and print out an image - part of the goal of this project is to familiarize you with tools that will be helpful for future homework. Use the computer to generate at least the following:

- an image of your surface, or multiple pictures if it is helpful to provide various perspectives.
- a contour diagram for your surface
- graphs of multiple different level curves and cross-sections.

These must shown in some way in your video. You can also use the computer to find out other important features about your surface, and discuss them in your video.

3. **The video presentation**

   Most important, make a video presentation about your surface. The maximum time permitted is 10 minutes. Display your surface. Show a few cross sections and explain why they look the way they do; similarly, display a few level curves. All group members must appear in some way in the video.

Choosing a surface

Your surface should either be:

- the graph of a two-variable function $z = f(x, y)$ (e.g. $z = x^2 + y^2$), or
- a level surface of a three-variable function $f(x, y, z) = c$ (e.g. $x^2 + y^2 + z^2 = 1$).

If your surface has multiple pieces or faces, each piece should be described by one of the above formulas. Here are some places to look for inspiration when picking a fun surface[1] to talk about:

- SingSurf
- Category:Surfaces on Wikipedia
- Desmos 3D Gallery

[1] Don't pick something boring like a plane, unless you really like planes in which case I am looking forward to hearing all of your plane facts.

Deadlines

- One member of your group must send me an email with the names of your group members and choice of surface by **November 17, 2025**.
- The final video presentation is due **December 5, 2025**.