Group Project: Get to know a surface

In a group of 3 (determined in class) you will work to understand the details of a particular function and the corresponding surface in 3-space. This project has three parts:

1. A physical model of your surface
2. A computer-based investigation
3. **A written discussion of the properties of the surface.**

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 level curves (z fixed).

   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 for me to grade it.**

2. **The computer investigation**

   Investigate your surface via computer. I recommend WolframAlpha and GeoGebra for this; however, you may use other programs 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

   - a picture 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 be printed out and submitted. You can also use the computer to find out other important features about your surface, and discuss them in your written report.

3. **The written discussion**

   Produce a written mathematical discussion about the properties of your surface. What do its level curves look like? Its cross-sections? Why? Knowing those properties, how can you explain the shape of your surface? What are its interesting features? Did you discover anything unexpected? Does your surface appear somehow in the natural world? There is a lot of freedom here. At minimum, you should include a discussion of the level curves, cross-sections, and contour plots, but I expect you to give more details than those. This should be typed, but you may write in equations and draw graphs/pictures by hand.

The projects will be presented by the groups in class on Monday, October 22.