

Math 198 – DPGraph Micro-Project
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I started out by experimenting with various equations to get a general idea of how various modifications affected the resulting shape.

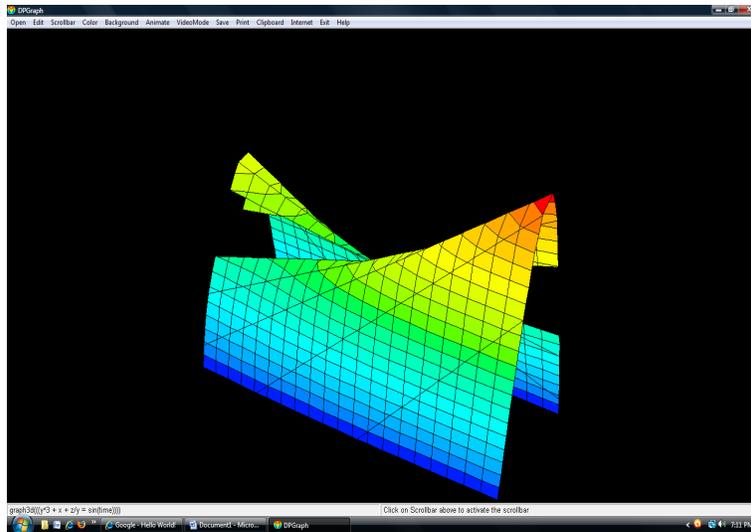


Fig. 1: $\text{graph3d}(y^3 + x + z/y = \sin(\text{time}))$

I thought that this figure looked rather interesting, so I tried putting 3 of these shapes together – one on each of the three axes: x, y, and z:

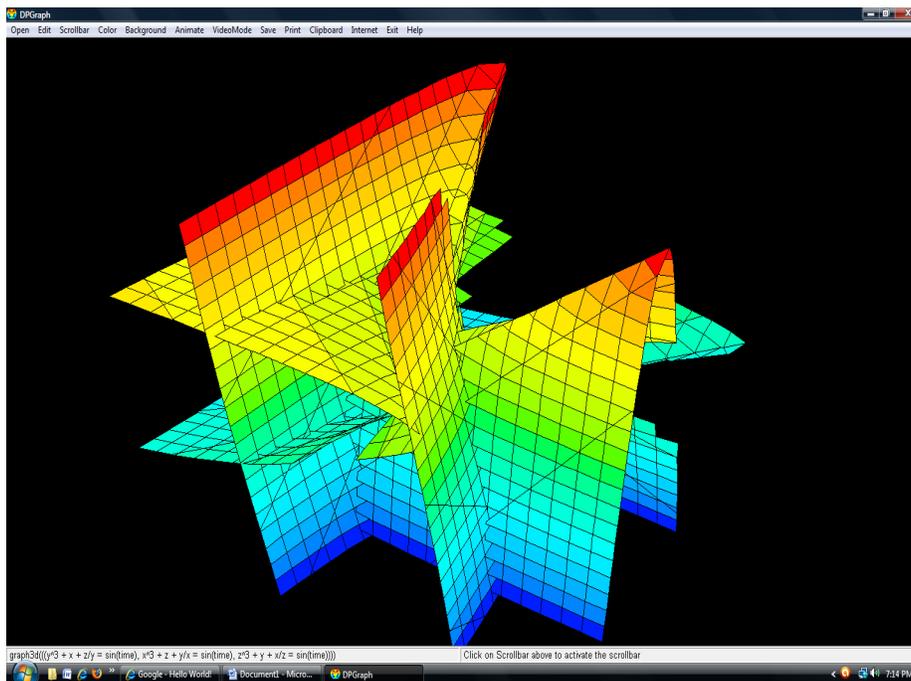


Fig. 2: $\text{graph3d}(((y^3 + x + z/y = \sin(\text{time}), x^3 + z + y/x = \sin(\text{time}), z^3 + y + x/z = \sin(\text{time}))))$

At this point, the graphical representation looked like too much was going on in one spot, so I decided to go in the other direction in order to gain a better understanding of the shape its self. Simplifying, we see:

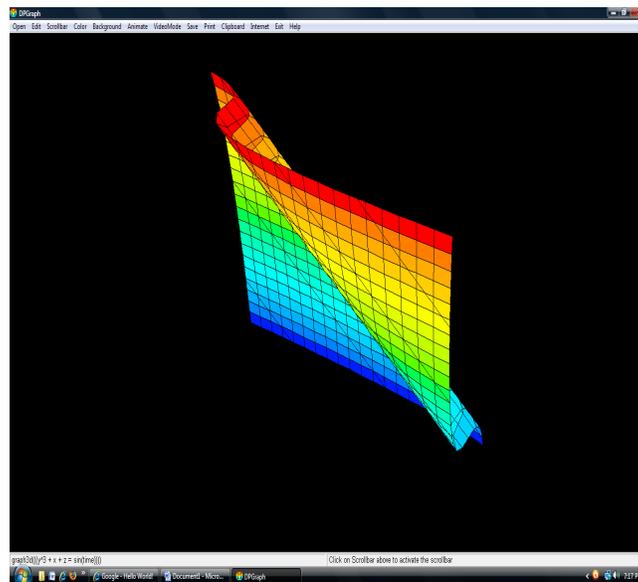


Fig 3: graph3d($y^2 + x + z = \sin(\text{time})$)

The biggest difference between this figure and Fig. 1 is that the asymptotes have disappeared, which makes sense since we are no longer dividing by any of the three variables. Hence, we never have to worry about dividing by zero, which produces the asymptotes in Figs. 1 and 2.

Simplifying further, we get:

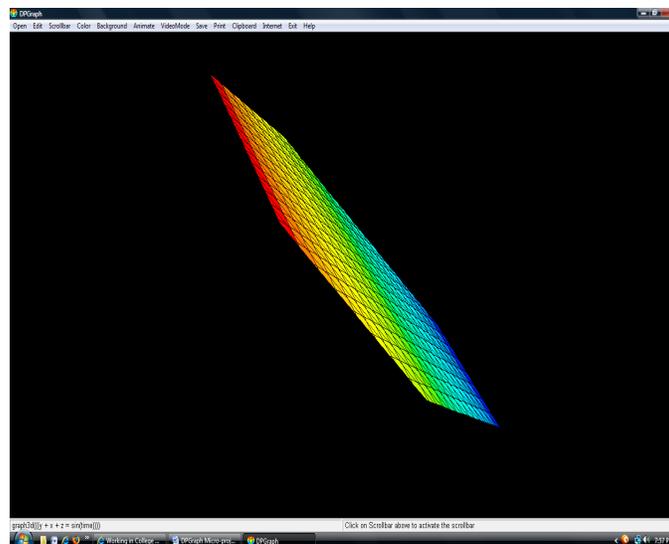


Fig. 4: graph3d($y + x + z = \sin(\text{time})$)

We now have a very basic three-dimensional figure: a plane. The equation for the flat plane is very similar to the equation of a two-dimensional line: $X + y = \text{constant}$. Looking at the figure, we see that, in actuality, the figure can be seen as a set of lines mapped over all z values in the specified range.

Applying this way of thinking, we see that Fig. 3 consists of a set of graphs of $y^3 + x = \text{constant}$ mapped over all z values in the given range. When we look at Fig. 3 in this way, we notice that the graph of $y^3 + x = \text{constant}$ would consist of a graph with two points where the graph would change its direction and, furthermore, that this is also true for the surface that has been created by the equation $y^3 + x + z = \sin(\text{time})$. Setting the constant equal to $\sin(\text{time})$ creates an animation that lets us see the graph for a set of values put in for the constant, rather than just one.

Seeing how each of the graphs has been created, allowed me to make a fifth figure, this time one that didn't look like everything was (unsuccessfully) trying to crowd into one spot on the computer screen:

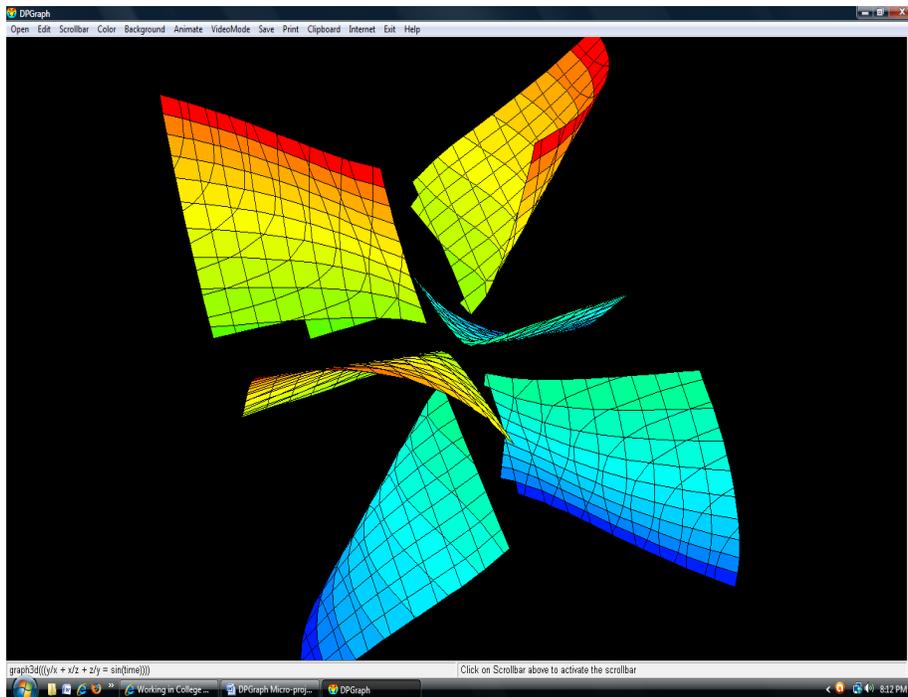


Fig. 5: $\text{graph3d}(y/x + x/z + z/y = \sin(\text{time}))$

Since dividing one of the variables by another created an asymptote, I decided to try dividing all of the variables by another variable in a way, so that each variable would appear exactly once in one of the numerators and in one of the denominators (without having a fraction equal to one on all points, of course). The results came up as expected, and I was very pleased with the aesthetic appeal of the final figure.