Discussion Assignment Unit 5
Math 1201- College Algebra.

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PART 1

QUESTION
First, create 3 equations of the form $ax + by + cz = d$, where a, b, c, and d are constants (integers between -5 and 5). For example, $x + 2y - z = -1$. Perform on your system to obtain a row-echelon form and the solution.
Go to the 3D calculator website GeoGebra: www.geogebra.org/3d?lang=pt and enter each of the equations.

SOLUTION The equations i will be using are

$$x - y + z = 4$$

$$3x - 2y - z = -2$$

$$4x + 3y - 2z = 5$$

Writing the augmented matrix

$$\left[\begin{array}{ccc|c} 1 & -1 & 1 & 4 \\ 3 & 2 & -1 & -2 \\ 4 & -3 & -2 & 5 \end{array}\right]$$

Performing row operations to obtain row-echelon form.

$$-3R_1 + R_2 = R_2 \rightarrow \left[\begin{array}{ccc|c} 1 & -1 & 1 & 4 \\ 0 & 5 & -3 & -14 \\ 4 & -3 & -2 & 5 \end{array}\right]$$

$$-4R_1 + R_3 = R_3 \rightarrow \left[\begin{array}{ccc|c} 1 & -1 & 1 & 4 \\ 0 & 5 & -3 & -14 \\ 0 & 1 & -6 & -36 \end{array}\right]$$

$$\text{Interchange } R_2 \text{ and } R_3 \rightarrow \left[\begin{array}{ccc|c} 1 & -1 & 1 & 4 \\ 0 & 1 & -6 & -36 \\ 0 & 5 & -3 & -14 \end{array}\right]$$

Then,

$$-5R_2 + R_3 = R_3 \rightarrow \left[\begin{array}{ccc|c} 1 & -1 & 1 & 4 \\ 0 & 1 & -6 & -36 \\ 0 & 0 & 27 & 166 \end{array}\right]$$

$$\frac{1}{27}R_3 = R_3 \rightarrow \left[\begin{array}{ccc|c} 1 & -1 & 1 & 4 \\ 0 & 1 & -6 & -36 \\ 0 & 0 & 1 & \frac{166}{27} \end{array}\right]$$

$$x - y + z = 4$$

$$y - 6z = -36$$

$$z = \frac{166}{27}$$

Substituting z into $y - 6z = -36$

$$y = -36 + 6z$$

$$y = -36 + 6\left(\frac{166}{27}\right)$$

$$y = \frac{996}{27} - 36$$

$$y = \frac{24}{27}$$

Substituting z and y into $x - y + z = 4$

$$x - y + z = 4$$

$$x = 4 + y - z$$

$$x = 4 + \frac{24}{27} - \frac{166}{27}$$

$$x = \frac{108 + 24 - 166}{27}$$

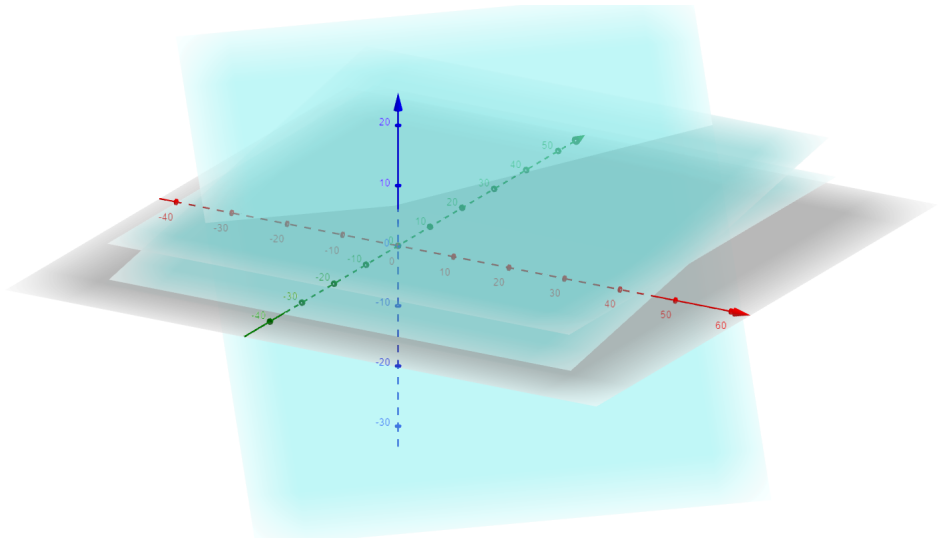
$$x = \frac{132 - 166}{27}$$

$$x = -\frac{34}{27}$$

So, the solution is

$$\left(-\frac{34}{27}, \frac{24}{27}, \frac{166}{27}\right)$$

These are the points of intersection between the three planes(Abramson, 2017). The 3D graph of the equation is given below.



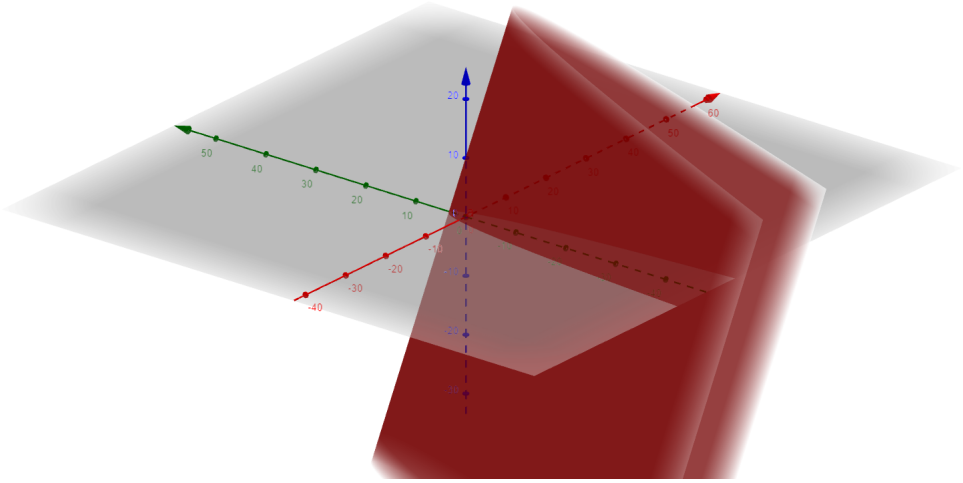
PART 2

QUESTION
After you have completed the first task, choose **ONE** of the following to complete your discussion post.
4. Give an example with 2 equations as simple as possible with 3 variables (at least 1 being non-linear, keeping z to the one power on both equations) and describe the potential of GeoGebra to study nonlinear systems.

SOLUTION The First example of a non-linear system with a quadratic equation

$$3x^2 + 3y + z = 10$$

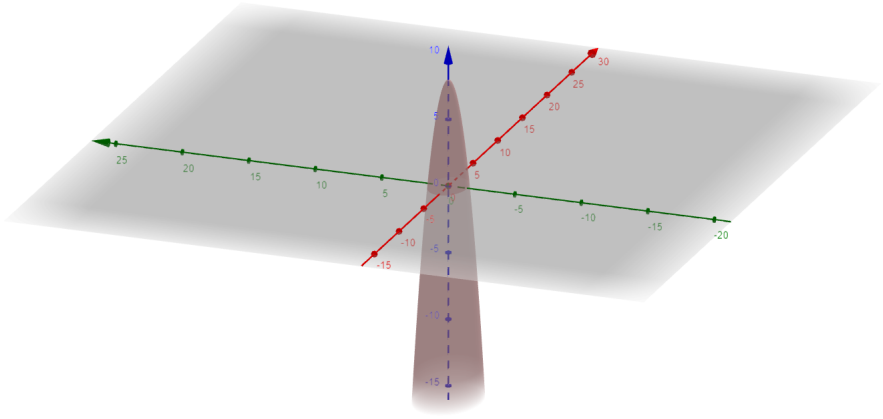
The 3D graph of the equation is given below.



The Second example of a non-linear system with a cubic equation

$$2x^2 + 4y^2 + z = 8$$

The 3D graph of the equation is given below.



Geogebra is a very useful tool plotting the graph of these equations for better visualisation of the points of intersection as it renders it in 3D.

References

Abramson, J. (2017). *Algebra and trigonometry.* OpenStax, TX: Rice University. Retrieved from https://openstax.org/details/books/algebra-and-trigonometry