

Writing assignment:

Consider the equation $x^2 - 2x + 2 + y^2 - z = 1$. Let S be the surface in 3-space that is the solution set for this equation. Determine what the surface S looks like, and discuss how S can be viewed as a graph of a suitable function of two variables or as a level surface of suitable functions of three variables.

Guide for your work:

A fully complete writing assignment will include the steps outlined below as well as additional discussion of the key ideas and how they are connected.

- (a) Find a function $f(x, y)$ whose **graph** is S . (Hint: Remember that the graph of a function $f(x, y)$ is the solution set for the equation $z = f(x, y)$.)
- (b) Use the methods of 12.2 (cross-sections) or 12.3 (level curves), to determine what the graph of $f(x, y)$ looks like. Use your judgement to select appropriate cross-sections or level curves, which will enable you to give a complete description of the graph. Include illustrations and use appropriate terminology.
- (c) Find a function $F(x, y, z)$ for which S is the **level surface** corresponding to $F = 0$. What do other level surfaces for F look like?
- (d) Can you find another function $G(x, y, z) \neq F(x, y, z)$ for which S is the level surface corresponding to $G = 0$? Or is F the only such function?