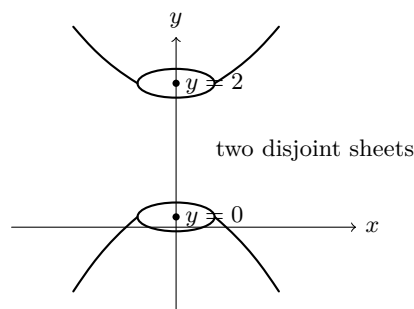


Question 3

For $9x^2 - 4y^2 + 9z^2 + 36x + 8y - 18z + 45 = 0$, find the standard form, classify the surface, and determine the vertices and which coordinate planes fail to intersect it.

Question 3 – Solution

Strategy Complete squares; a single negative term with right side -1 is more clearly read after multiplying by -1 .



Standard form Completing squares gives

$$9(x+2)^2 - 4(y-1)^2 + 9(z-1)^2 = -4,$$

hence

$$\frac{(y-1)^2}{1} - \frac{(x+2)^2}{4/9} - \frac{(z-1)^2}{4/9} = 1.$$

This is a hyperboloid of two sheets with axis parallel to y .

Vertices and coordinate traces The vertices are $(-2, 0, 1), (-2, 2, 1)$. All three coordinate planes intersect the surface: $y = 0$ contains the first vertex, while $x = 0$ and $z = 0$ give hyperbolas. The plane $y = 1$ does not intersect the surface, but it is not a coordinate plane.