Student name:

You have 10 minutes to complete the quiz. Calculators are not permitted, and remember to show your calculations and explain your reasoning in order to receive full credit.

1. Find an equation for the surface consisting of all points that are twice as far from the plane $x = 0$ as from the point $(1, 0, 0)$. Identify the surface and sketch it.

   The distance of a point (x, y, z) from the plane $x = 0$ is $|x|$, and its distance from the point $(1, 0, 0)$ is $\sqrt{(x-1)^2 + y^2 + z^2}$. Squaring both distances and using the fact that the point is twice as far from the plane $x = 0$ as from $(1, 0, 0)$ gives

$$x^2 = 4((x-1)^2 + y^2 + z^2)$$
$$x^2/4 = x^2 - 2x + 1 + y^2 + z^2$$
$$0 = (3/4)x^2 - 2x + 1 + y^2 + z^2$$
$$0 = (3/4)(x - 4/3)^2 - 1/3 + y^2 + z^2$$
$$1/3 = (3/4)(x - 4/3)^2 + y^2 + z^2$$

   The shape is an ellipsoid centered at $(4/3, 0, 0)$ with semiaxes of length $2/3, 1/\sqrt{3}$, and $1/\sqrt{3}$. When x is a constant the trace is a circle, and when y or z are constants the trace is an ellipse.