Math 2263 Quiz 2 Solutions

1. (5 points) Use traces to sketch the surface $4x^2 + 9y^2 + z = 0$.

**Solution:** The traces in the planes $x = k$ (here $k$ is just some real number) are downward-pointing parabolas $z = -9y^2 - 4k^2$. The traces in the planes $y = k$ are also downward-pointing parabolas $z = -4x^2 - 9k^2$. Finally, the traces in the planes $z = k$ are ellipses $4x^2 + 9y^2 = -k$. Piecing this information together, we see that the surface $4x^2 + 9y^2 + z = 0$ is an elliptic paraboloid.

**Rubric:**

(+1) for each of the $x$, $y$, and $z$ traces

(+2) for the sketch

2. (5 points) Find an equation for the plane that passes through the point $(2, 0, 1)$ and is perpendicular to the line $x = 3t$, $y = 2 - t$, $z = 3 + 4t$.

**Solution:** To write the equation of this plane, we need a point on it and a vector perpendicular to it. We’re already given that the point $(2, 0, 1)$ is on the plane. The vector $(3, -1, 4)$ is parallel to the line $x = 3t$, $y = 2 - t$, $z = 3 + 4t$, and because this line is perpendicular to the plane we’re dealing with, the vector $(3, -1, 4)$ is perpendicular to this plane. An equation for this plane is therefore

$$(3, -1, 4) \cdot ((x, y, z) - (2, 0, 1)) = 0$$

**Rubric:**

(+3) for knowing that the vector $(3, -1, 4)$ is perpendicular to the plane

(+2) for a correct equation