1. Sketch the curves in the $xy$-plane given by $4x^2 - y^2 = k$ for $k = -2, -1, 0, 1, 2$. Be sure to label each curve and show the coordinates of special points on the curves.

2. Find the (evel set) equation of the plane that contains both the point $(1, 2, 3)$ and the line $x = 5 + t, y = -1 + 5t, z = 2 + 5t$.

3. (From Exam 1, F11) Find a vector parametrization of the line obtained by intersecting the planes $x + 2y + 3z = 1$ and $x - y + z = 2$.

4. (Adapted from Exam 1, F11) Let $L_1$ and $L_2$ be lines in space with parametrizations

\[ x = 1 + 2t \quad y = 2 + t \quad z = -4 + t \]

and

\[ x = 1 + 5t \quad y = 2 + 2t \quad z = -4. \]

(a) Using a schematic diagram and an English sentence, explain why $L_1$ and $L_2$ lie in a plane, $P$.

(b) Find a vector parametrization of the plane $P$.

(c) Find the (level set) equation of the plane $P$.

(d) Find the points of intersection of $P$ with each of the three coordinate axes. Use this information to sketch $P$.

5. Find the traces (i.e., slices) of the surface $-x^2 + 4y^2 - z = 0$ in the planes $x = 0, y = 0,$ and $z = k$, for $k = 0, \pm 1, \pm 2$. Then sketch the surface.

6. Find the point in which the line through the points $(1, 0, 1)$ and $(0, 2, 5)$ intersects the plane through the points $(1, 2, 3), (5, 0, 1)$ and $(0, 1, 2)$.

7. Describe and sketch the surface $z = xy$. How is it related to the surface $z = x^2+y^2$?

8. 12.6.29

9. Sketch traces (slices) of the surface $z^2 + 4x^2 = 1 + y^2$ in the planes $y = k$ for $k = 0, \pm 1, \pm 2$ and $x = 0, z = 0$. Sketch the surface.

10. Sketch traces (slices) of the surface $z^2 + 4x^2 = -1 + y^2$ in the planes $y = k$ for $k = 0, \pm 1, \pm 2$ and $x = 0, z = 0$. Sketch the surface.