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 traces (i.e., slices) of the surface

\[-x^2 + 4y^2 - z = 0\]

in the planes \( x = 0, y = 0, z = k \), for \( k = 0, \pm 1, \pm 2 \). Then sketch the surface.

3. 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.

4. 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.

5. Describe and sketch the surface \( z = xy \). How is it related to the surface \( z = x^2y^2 \)?

6. Sketch the surfaces whose equations in spherical coordinates are

(a) \( \phi = \frac{\pi}{2} \),
(b) \( \phi = \frac{3\pi}{4} \),
(c) \( \theta = 0 \).

7. Sketch the surfaces whose equations in cylindrical coordinates are

(a) \( z^2 - 2r^2 = 1 \),
(b) \( z = 4r \).

8. (From Fall 2010, Exam 1)

   (a) Find a parametrization of the plane that contains both the point \((2, 4, 6)\) and the line \( x = 7 - 3t, y = 3 + 4t, z = 5 + 2t \).

   (b) Find a level set equation (i.e., an equation of the form \( ax + by + cz = d \)) for the plane in (a).

9. (From Fall 2009, Exam 1) Which of the following statements are always true and which are not always true. Give reasons for your answers.

   (a) \( \mathbf{u} \times \mathbf{v} = \mathbf{v} \times \mathbf{u} \)

   (b) \( (\mathbf{u} \times \mathbf{v}) \cdot \mathbf{u} = 0 \)

   (c) \( \mathbf{u} \times \mathbf{u} = |\mathbf{u}|^2 \)

10. Look at solutions to Fall 2015 Exam I Problem 5 to see what we expect on questions that ask you to sketch a quadric surface.