1. Find an equation for the plane that contains the line \( \frac{x-1}{2} = \frac{y+1}{3} = \frac{z}{2} \) and is parallel to the line \( \frac{x-3}{4} = \frac{y-3}{3} = \frac{z+1}{4} \).

2. The projection of a point \( P \) onto a plane \( S \) is defined to be the point \( Q \) of \( S \) such that \( PQ \) is perpendicular to \( S \). Find the projection of the point \( (1, 2, -1) \) onto the plane \( 2x + y - 3z = 5 \).

3. Find an equation for the plane that passes through the point \( (1, 2, -1) \) and contains the line of intersection of planes \( x+y+z = 4 \) and \( x-y-2z = 2 \).

4. A cooling tower for a nuclear reactor is to be constructed in the shape of a hyperboloid of one sheet. The diameter at the base is 150m and the minimum diameter, 200m above the base, is 100m. Find an equation for the tower (set-up the coordinate system with the origin in the center of the base and the \( z \)-axis pointing up).

5. Describe and sketch the surface
   (a) \( y^2 - z^2 = 1 \);
   (b) \( y^2 - z^2 = x \).

6. Describe and sketch the surface
   (a) \( 4y^2 - z^2 = x^2 \);
   (b) \( 4y^2 - z^2 = 1 + x^2 \).

7. Reduce the equation \( x^2 - y^2 + z^2 - 2x + 2y + 4z + 2 = 0 \) to one of the standard forms, classify it, and sketch it.

8. Find an equation for the surface obtained by rotating
   (a) the parabola \( x = z^2 \);
   (b) the line \( x = 3z \)
around the \( x \)-axis.

9. Find parametric equations of two lines contained in the surface \( x^2 + y^2 = 1 + 4z^2 \) and passing through the point \( (1, 2, 1) \).

10. Sketch the region given by inequalities \( z \leq x^2 + y^2 \) and \( 2z \leq x^2 + y^2 + 1 \).

11. Find an equation for the surface consisting of all points \( P \) for which the distance from \( P \) to the \( x \)-axis is twice the distance from \( P \) to the \( yz \)-plane. Identify and sketch the surface.

12. Find an equation for the surface consisting of all points \( P \) for which the sum of the distance from \( P \) to the point \( (-1, 0, 0) \) and the distance from \( P \) to the point \( (1, 0, 0) \) is equal to 5. Identify and sketch the surface.