

Quadratic Surfaces

David Robinson

Cylinders

A set of lines parallel to a given line passing through a given curve is known as a cylindrical surface, or **cylinder**. The parallel lines are called **rulings**. The **traces** of a surface are the cross-sections created when the surface intersects a plane parallel to one of the coordinate planes.

Quadratic Surfaces

Quadratic surfaces are the graphs of expressions that can be expressed in the form

$$Ax^2 + By^2 + Cz^2 + Dxy + Exz + Fyz + Gx + Hy + Jz + K = 0$$

Common Quadratic Surfaces

1. **Ellipsoid**

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

2. **Hyperboloid of One Sheet**

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$$

3. **Hyperboloid of Two Sheets**

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$$

4. **Elliptic Cone**

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 0$$

5. **Elliptic Paraboloid**

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = z$$

6. **Hyperbolic Paraboloid**

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = z$$