Chapter 12. Vectors and the Geometry of Space

12.6. Cylinders and Quadric Surfaces

Definition. A cylinder is a surface that is generated by moving a straight line along a given planar curve while holding the line parallel to a given fixed line. The curve is called a generating curve for the cylinder.

![Diagram of a cylinder and its generating curve](image)

Figure 12.43, page 714

Definition. A quadric surface is the graph in space of a second-degree equation in $x$, $y$, and $z$. We focus on the special equation $Ax^2 + By^2 + Cz^2 + Dz = E$ where $A$, $B$, $C$, $D$, and $E$ are constants. The basic quadric surfaces are ellipsoids, paraboloids, elliptical cones, and hyperboloids.
**Example.** Page 715, Example 2. Consider the ellipsoid \( \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 \).

![Figure 12.45, page 715](image)

**Example.** Page 716, Example 4. Consider the hyperbolic paraboloid \( \frac{y^2}{b^2} - \frac{x^2}{a^2} = \frac{z}{c}, \quad c > 0 \).

![Figure 12.46, page 715](image)
Note. Table 12.1 gives the graphs of several quadric surfaces.

Table 12.1, page 717

Examples. Page 718, numbers 6, 8, 20, and 28.