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.
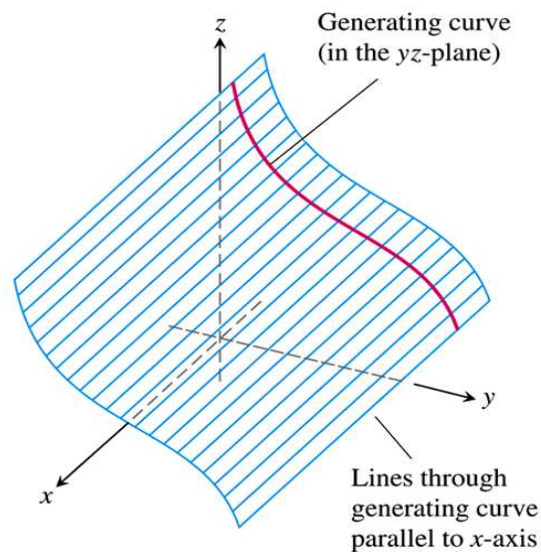

Figure 12.43, page 714

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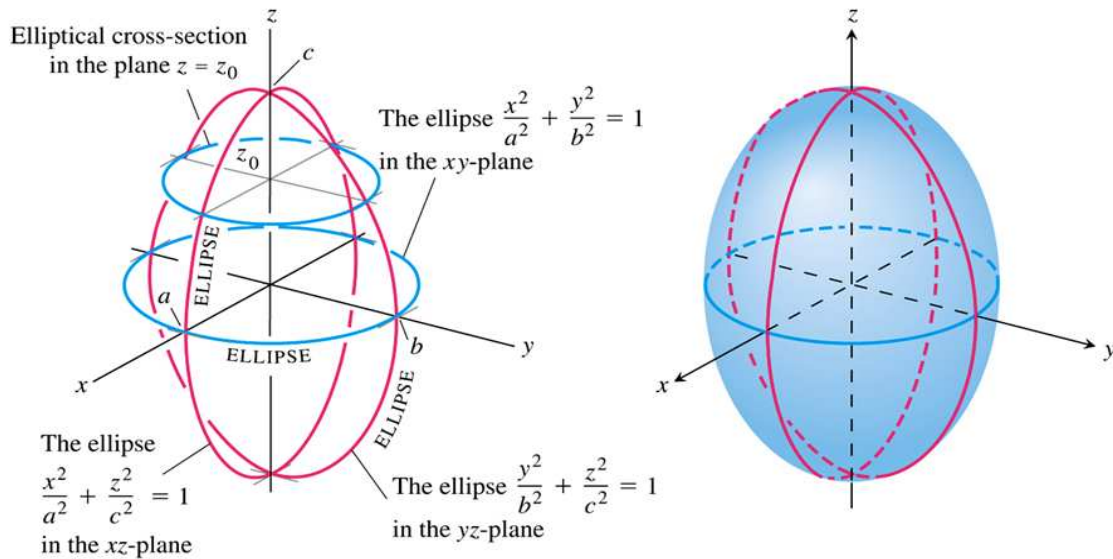

Figure 12.45, page 715

Example. Page 716, Example 4. Consider the hyperbolic paraboloid $\dfrac{y^2}{b^2}-\dfrac{x^2}{a^2}=\dfrac{z}{c}$, $c>0$.
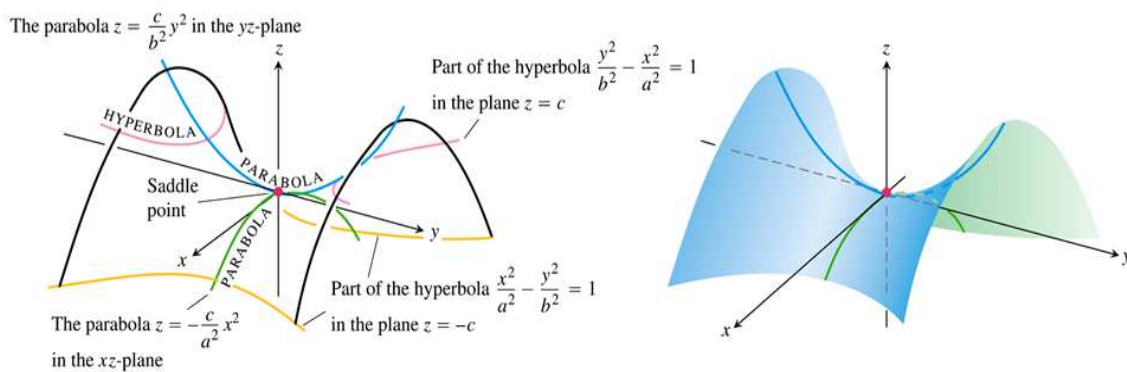

Figure 12.46, page 715

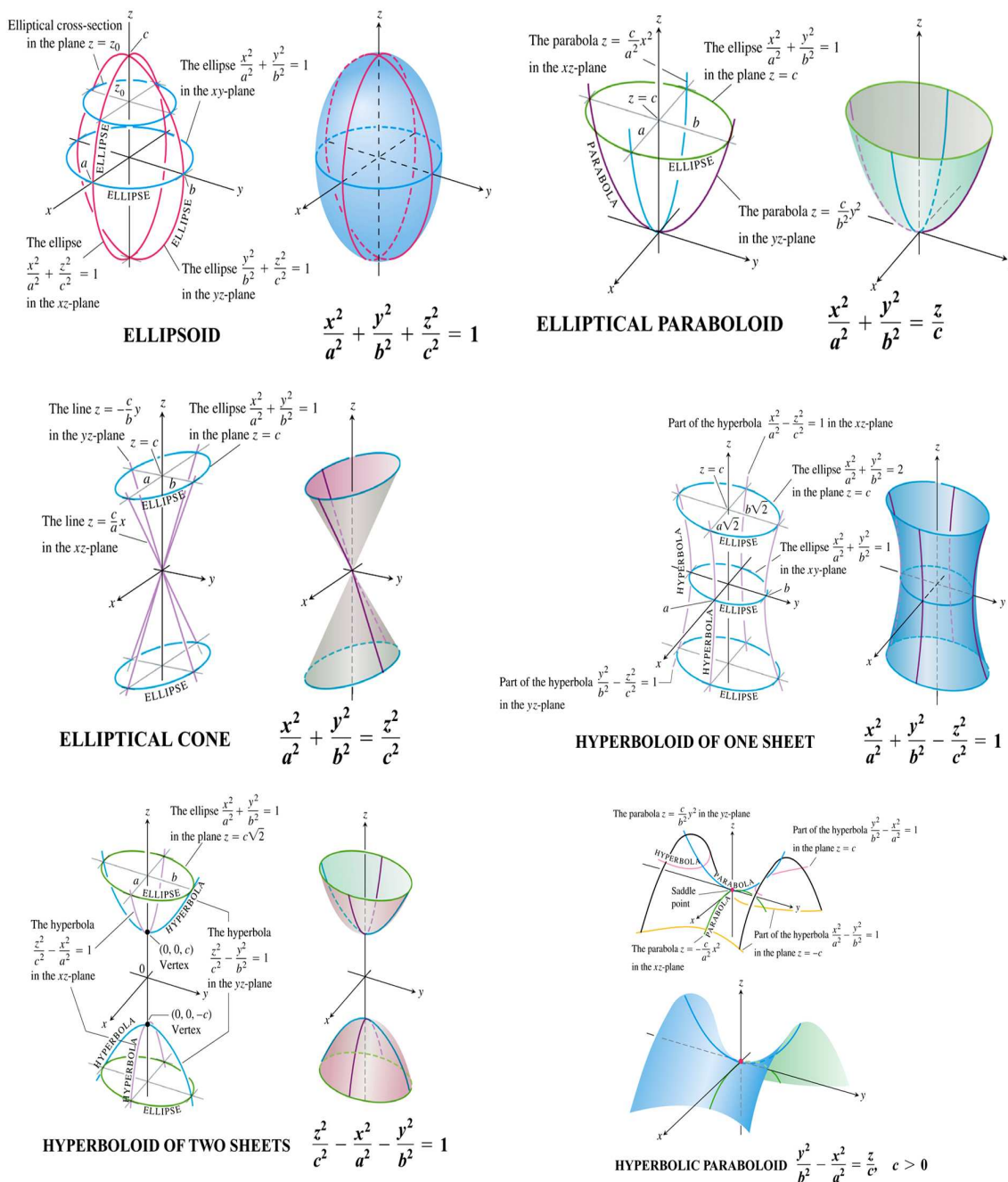**Note.** Table 12.1 gives the graphs of several quadric surfaces.

Table 12.1, page 717

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