Conics in $\mathbb{R}^2$: $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$

for suitable constants $A, \ldots, F$.

In $\mathbf{R}^3$, the analytic analogue of the conic section is called a **quadric surface**. Quadric surfaces are those defined by equations that are polynomials of degree two in three variables:

$$Ax^2 + Bxy + Cxz + Dy^2 + Eyz + Fz^2 + Gx + Hy + Iz + J = 0.$$

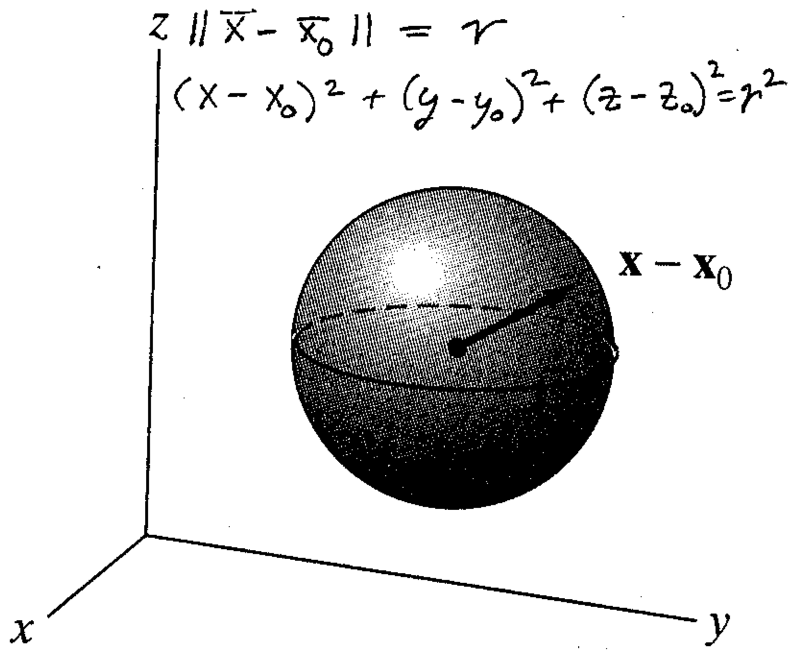

Figure 2.20 The sphere of radius a, centered at (x_0, y_0, z_0).

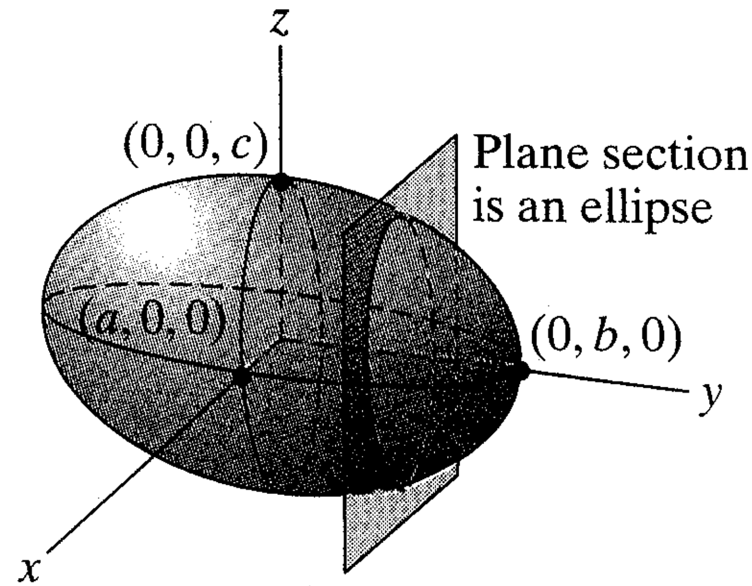

Figure 2.21 The ellipsoid $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1.$

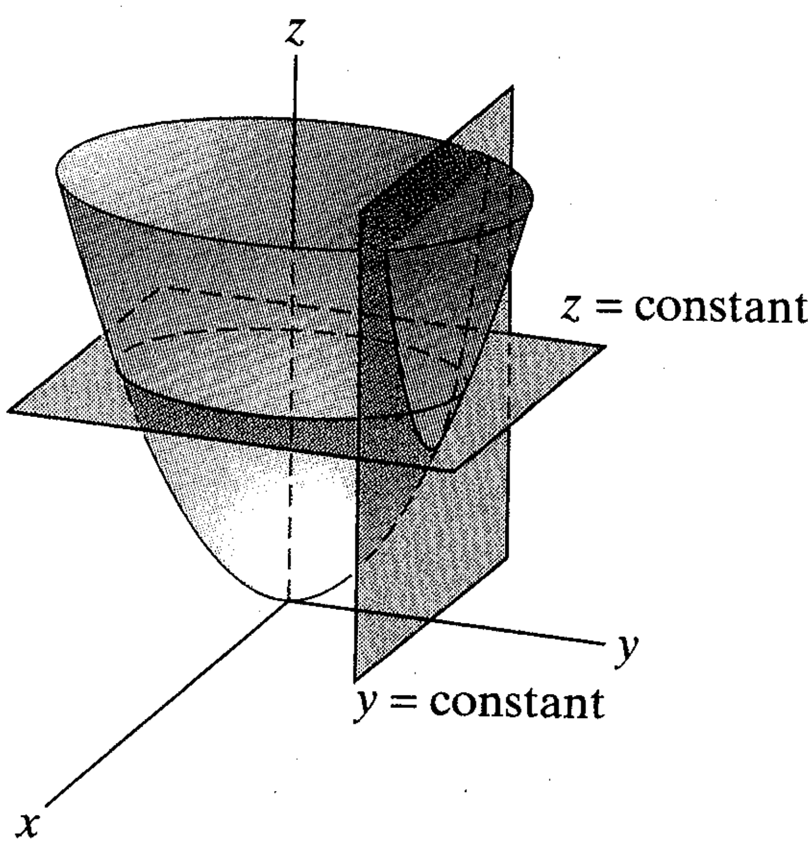

Figure 2.22 The elliptic paraboloid $\frac{z}{c} = \frac{x^2}{a^2} + \frac{y^2}{b^2}$.

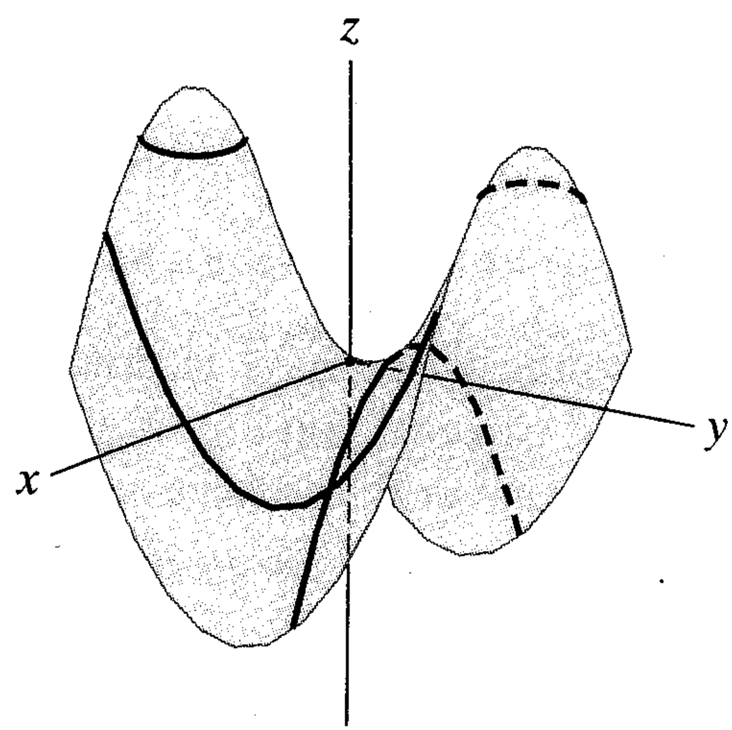

Figure 2.23 The hyperbolic paraboloid $\frac{z}{c} = \frac{y^2}{b^2} - \frac{x^2}{a^2}$.

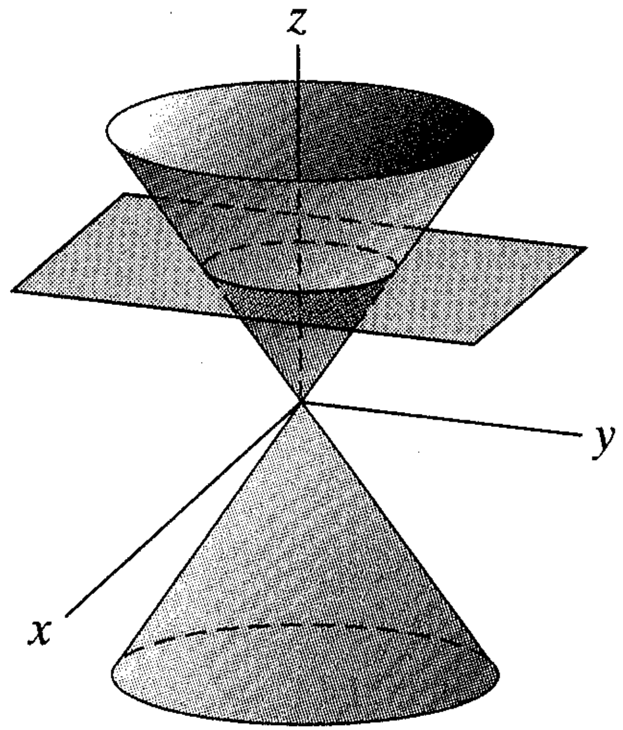

Figure 2.24 The elliptic cone $\frac{z^2}{c^2} = \frac{x^2}{a^2} + \frac{y^2}{b^2}$.

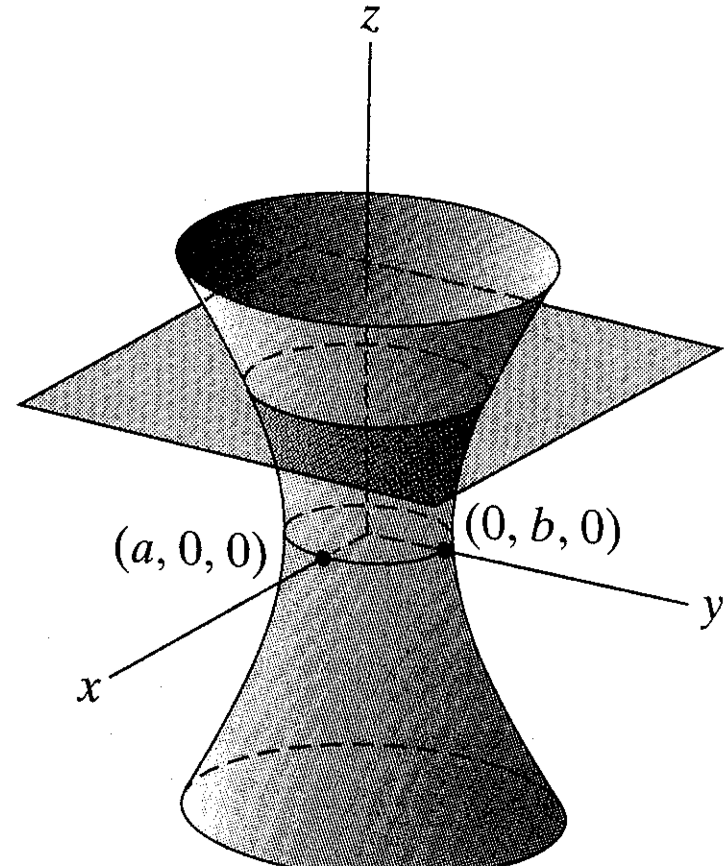

Figure 2.25 The graph of the equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$ is a hyperboloid of one sheet.

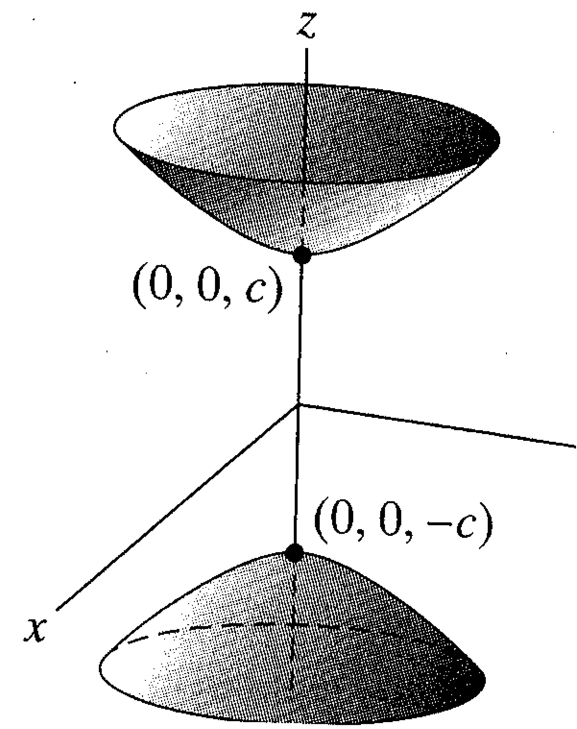

Figure 2.26 The graph of the equation $\frac{z^2}{c^2} - \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is a hyperboloid of two sheets.