12.6 - Cylinders & Quadric Spaces

A **Cylinder** is a surface made by moving a line parallel to a line along a **curve**
this curve is called the **generating curve**

Quadric Surfaces

A **Quadric Surface** is the graph of a second degree equation in x,y,z
Basic Quadric Surfaces:

- ellipsoids
- paraboloids
- elliptical cones
- hyperboloids

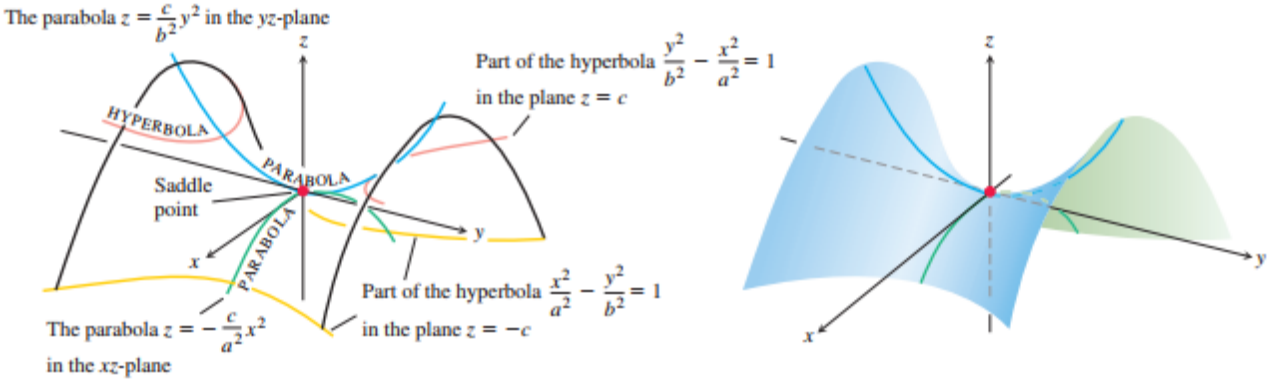
Ellipsoid

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

If 2 of the semiaxes are equal: the surface is an **ellipsoid of revolution**
If all 3 are equal: the surface is a **sphere**

Hyperbolic Paraboloid

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



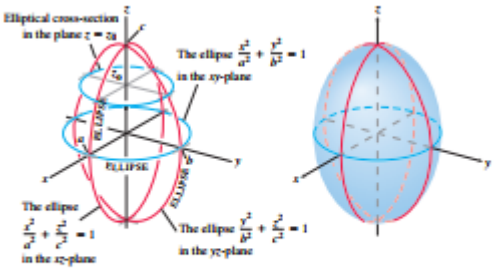
General Quadric Surfaces

General Equation:

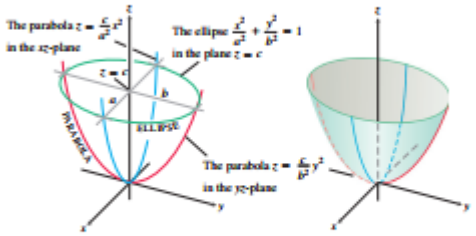
$Ax^2 + By^2 + Cz^2 + Dxy + Exy + Fxy + Gz + Hy + Iz + J = 0$

Terms G,H, and I are translations, and are found by completing the square

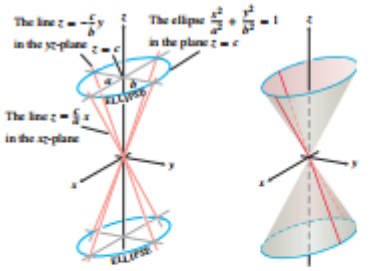
TABLE 12.1 Graphs of Quadric Surfaces



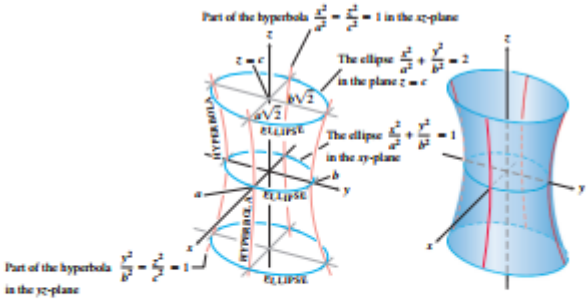
ELLIPSOID $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$



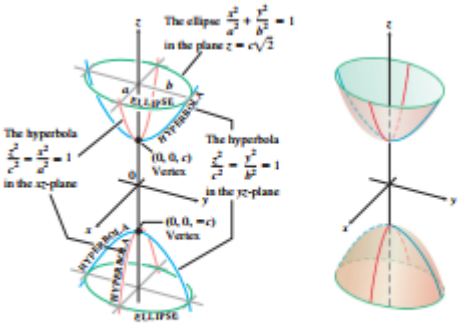
ELLIPTICAL PARABOLOID $\frac{x^2}{a^2} + \frac{y^2}{b^2} = \frac{z}{c}$



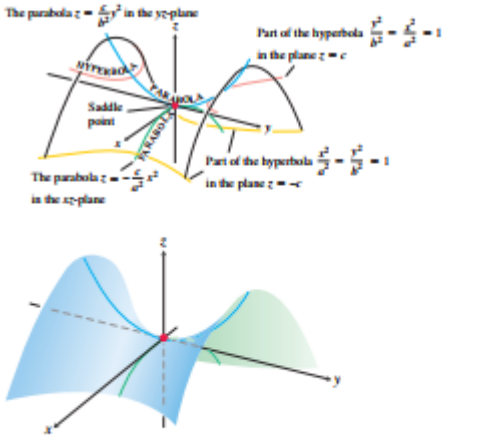
ELLIPTICAL CONE $\frac{x^2}{a^2} + \frac{y^2}{b^2} = \frac{z^2}{c^2}$



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



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



HYPERBOLIC PARABOLOID $\frac{y^2}{b^2} - \frac{x^2}{a^2} = \frac{z}{c}, c > 0$