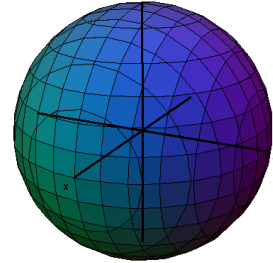


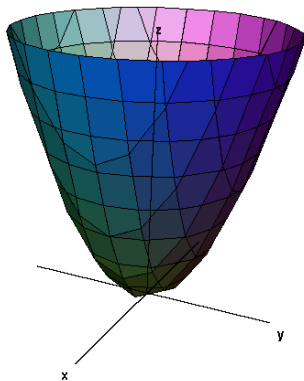
**Ellipsoid:**  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$

- All traces are ellipses.
- If  $a = b = c$ , the ellipsoid is a sphere.



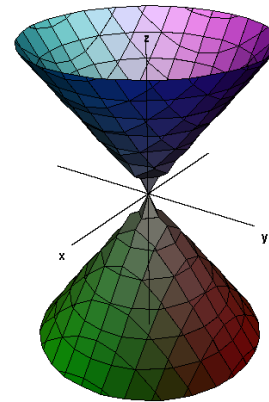
**Sphere:**  $x^2 + y^2 + z^2 = 1$

- All Traces are circles.



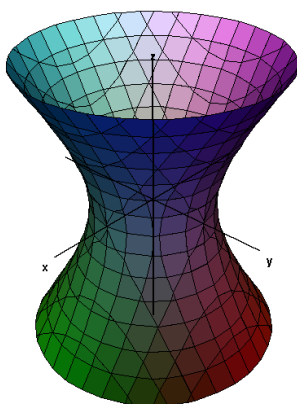
**Elliptic Paraboloid:**  $z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$

- Horizontal traces are ellipses.
- Vertical traces are parabolas.
- The variable raised to the first power indicates the axis of the paraboloid.



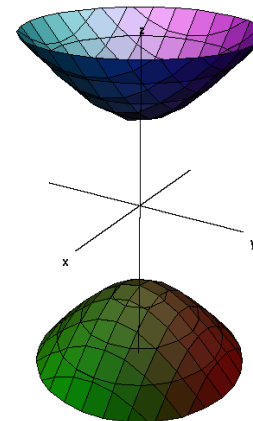
**Cone:**  $\frac{z^2}{c^2} = \frac{x^2}{a^2} + \frac{y^2}{b^2}$

- Horizontal traces are ellipses.
- Vertical traces in the planes  $x = k$  and  $y = k$  are hyperbolas if  $k \neq 0$  but are pairs of lines if  $k = 0$



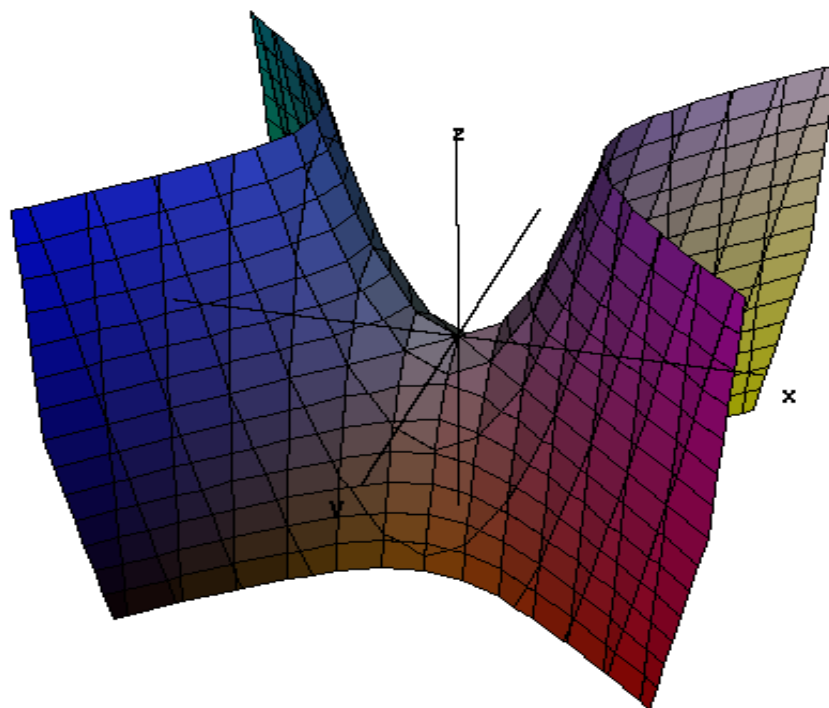
**Hyperboloid of One Sheet:**  $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$

- Horizontal traces are ellipses.
- Vertical traces are hyperbolas.
- The axis of symmetry corresponds to the variable whose coefficient is negative.



**Hyperboloid of Two Sheets:**  $-\frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$

- Horizontal traces in  $z = k$  are ellipses if  $k > c$  or  $k < -c$ .
- Vertical traces are hyperbolas.
- The two minus signs indicates two sheets.



**Hyperbolic Paraboloid:** 
$$\frac{z}{c} = \frac{x^2}{a^2} - \frac{y^2}{b^2}$$

- Horizontal traces are hyperbolas.
- Vertical traces are parabolas.
- The case where  $c > 0$  is illustrated.