

### Ellipsoid

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

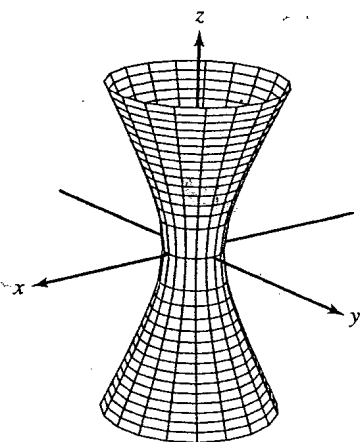
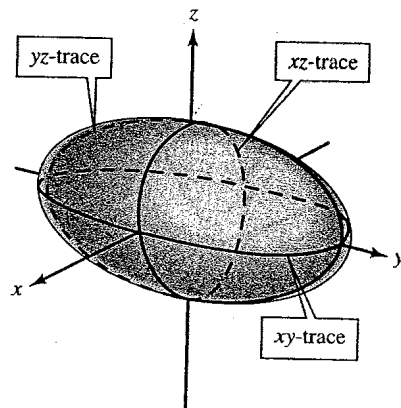
Trace

Ellipse  
Ellipse  
Ellipse

Plane

Parallel to  $xy$ -plane  
Parallel to  $xz$ -plane  
Parallel to  $yz$ -plane

The surface is a sphere if  $a = b = c \neq 0$ .



### Hyperboloid of One Sheet

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

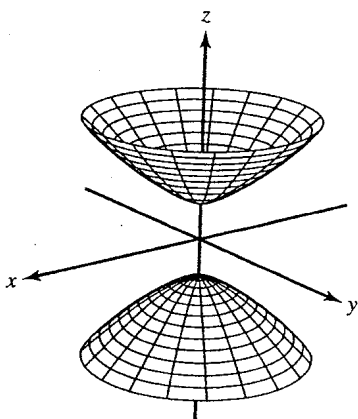
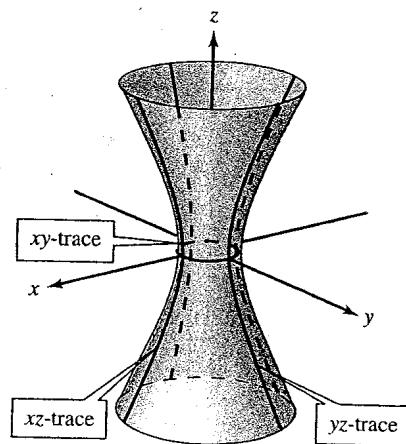
Trace

Ellipse  
Hyperbola  
Hyperbola

Plane

Parallel to  $xy$ -plane  
Parallel to  $xz$ -plane  
Parallel to  $yz$ -plane

The axis of the hyperboloid corresponds to the variable whose coefficient is negative.



### Hyperboloid of Two Sheets

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

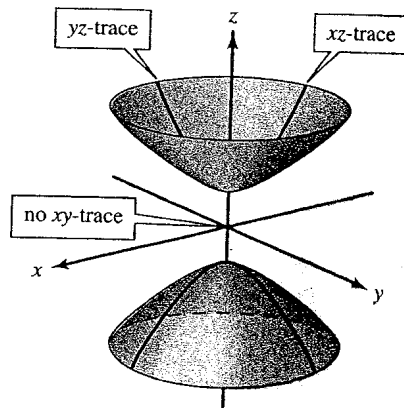
Trace

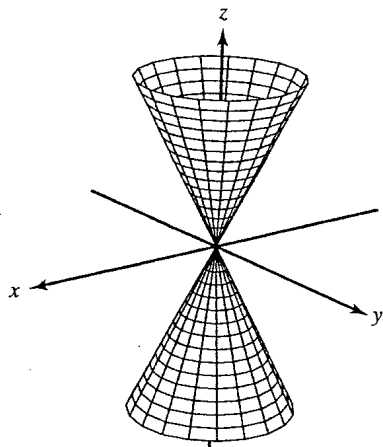
Ellipse  
Hyperbola  
Hyperbola

Plane

Parallel to  $xy$ -plane  
Parallel to  $xz$ -plane  
Parallel to  $yz$ -plane

The axis of the hyperboloid corresponds to the variable whose coefficient is positive. There is no trace in the coordinate plane perpendicular to this axis.





### Elliptic Cone

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

Trace

Plane

Ellipse

Parallel to  $xy$ -plane

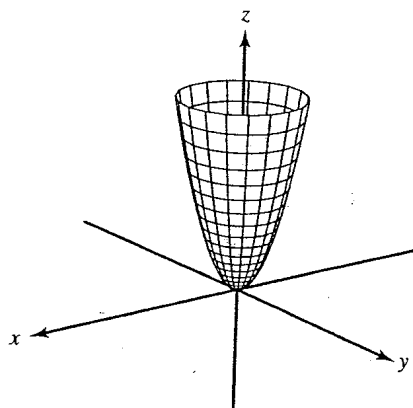
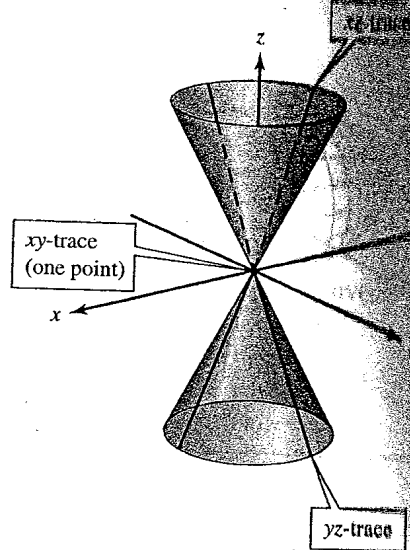
Hyperbola

Parallel to  $xz$ -plane

Hyperbola

Parallel to  $yz$ -plane

The axis of the cone corresponds to the variable whose coefficient is negative. The traces in the coordinate planes parallel to this axis are intersecting lines.



### Elliptic Paraboloid

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

Trace

Plane

Ellipse

Parallel to  $xy$ -plane

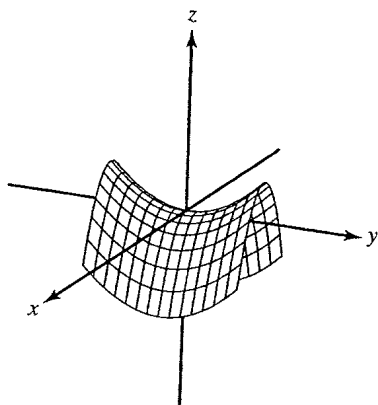
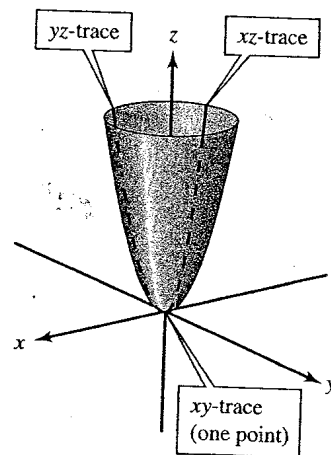
Parabola

Parallel to  $xz$ -plane

Parabola

Parallel to  $yz$ -plane

The axis of the paraboloid corresponds to the variable raised to the first power.



### Hyperbolic Paraboloid

$$z = \frac{y^2}{b^2} - \frac{x^2}{a^2}$$

Trace

Plane

Hyperbola

Parallel to  $xy$ -plane

Parabola

Parallel to  $xz$ -plane

Parabola

Parallel to  $yz$ -plane

The axis of the paraboloid corresponds to the variable raised to the first power.

