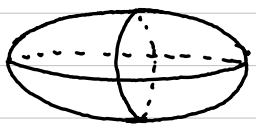
Basic Quadratic Surfaces

Ellipsoid

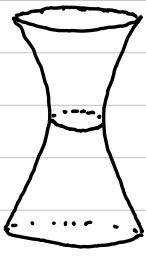
Special case is the Sphere, when $a=b=c=1$



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

- all squared
- all positive
- equal to 1

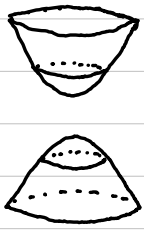
Hyperboloid of one sheet



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

- all squared
- one negative
- equal to 1

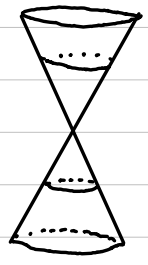
Hyperboloid of 2 sheets



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

- all squared
- two negative
- equal to 1

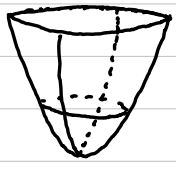
Elliptic Cone



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

- all squared
- one negative
- equal to zero

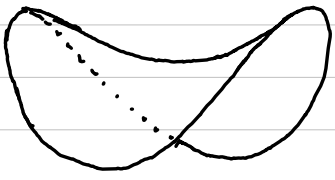
Elliptic Paraboloid



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

- two squared
- both positive
- equal to the unsquared variable

Hyperbolic paraboloid



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

- two squared
- one positive, one negative
- equal to the unsquared variable