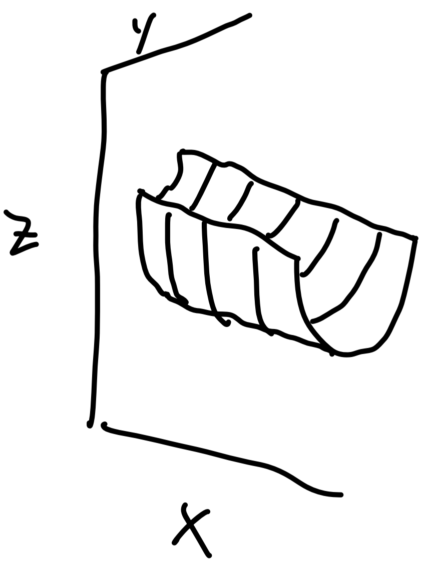
1. Elliptic Paraboloid

Tai Wong

$z = Ax^2 + By^2$, a and b have the same sign

a. $x = c$, $z = Ac^2 + By^2$, in yz plane they are parallel parabolas opening in $+z$, they have the same curve but are just shifted up Ac^2.

b. you get a parabolic cylinder as its basically a quadratic going infinitely in direction of x or y



c. negative sliders will just flip the shape downward

2. Hyberbolic Paraboloid

$z = Ax^2 + By^2$ but B and A have different signs

a. The horizontal cross section is just 2 intersecting lines. It is not a hyperbola

b.
Its the same curve but the directions are swapped (up/down)

3. Ellipsoid

$$1 = \frac{x^2}{A^2} + \frac{y^2}{B^2} + \frac{z^2}{C^2}$$

a. Its a sphere when $A = B = C = R$

b. division by 0 prevents the slider from going to 0 as it makes the equation undef.

4. Double Cone

$z^2 = Ax^2 + By^2$

a. horizontal section is an ellipse
($z = c$)

vertical section are pairs of lines

↳ Not a parabola

b. the equation reduces to $z^2 = By^2$ or $z^2 = Ax^2$ which are 2 intersecting planes

c. setting y or x to 0 makes $z^2 = By^2$ or $z^2 = Ax^2$ which are just lines and not hyperbolas

5. Hyperboloid of one sheet

$$\frac{x^2}{A^2} + \frac{y^2}{B^2} - \frac{z^2}{c^2} = 1$$

a. sliders cant hit 0 due to the equation being undefined if A, B, or C is 0. The pictures look like double cones

b.

$$\frac{y^2}{B^2} - \frac{z^2}{c^2} = 0$$, which are 2 straight lines

c.

when $z = 0$, $\frac{x^2}{A^2} + \frac{y^2}{B^2} = 1$

is an ellipse

for no hole A and B must equal to 0 which is impossible

6. Hyperboloid of 2 sheets

$$-\frac{x^2}{A^2} - \frac{y^2}{B^2} + \frac{z^2}{C^2} = 1$$

a. larger A and B make $-\frac{x^2}{A^2} - \frac{y^2}{B^2}$ less negative for the same x, y thus flattening the hyperboloid

b.

at $z = 0$ $-\frac{x^2}{A^2} - \frac{y^2}{B^2}$ is always smaller than 1 since x^2 and y^2 are always positive, so there is always a gap.

C.

$$\frac{z^2}{A^2} - \frac{x^2+y^2}{A^2} = 1$$

$$\Leftrightarrow z^2 - x^2 + y^2 = A^2$$

as A becomes closer to 0

this becomes $x^2+y^2 = z^2$

which is the double cone.