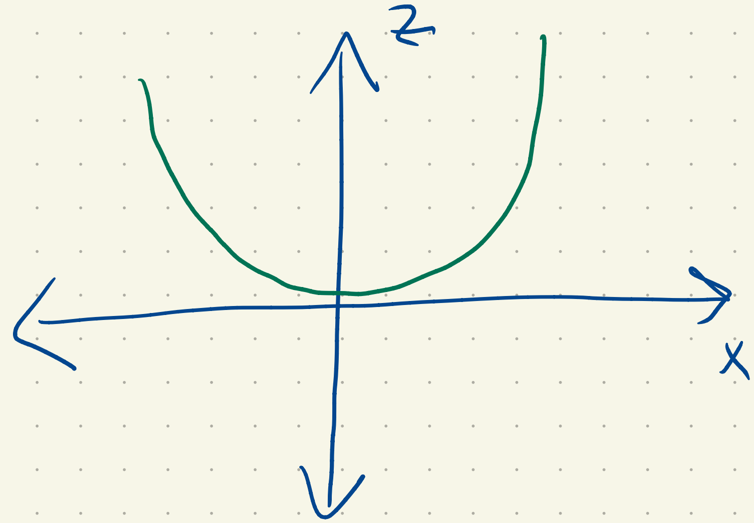
Last class: $z = x^2 - y^2$ $\qquad$ $y = \sin(x)$

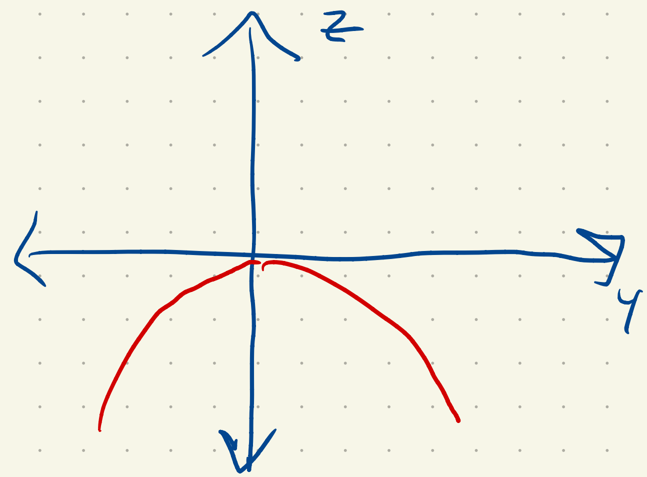
z-x plane $(y=0)$

$z = x^2 - 0^2$



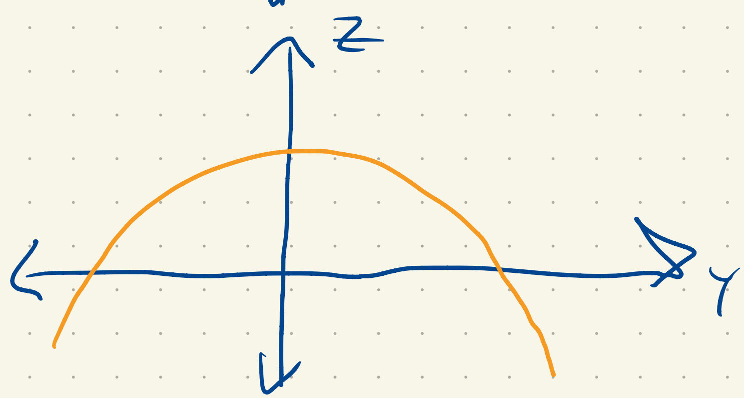
z-y plane $(x=0)$

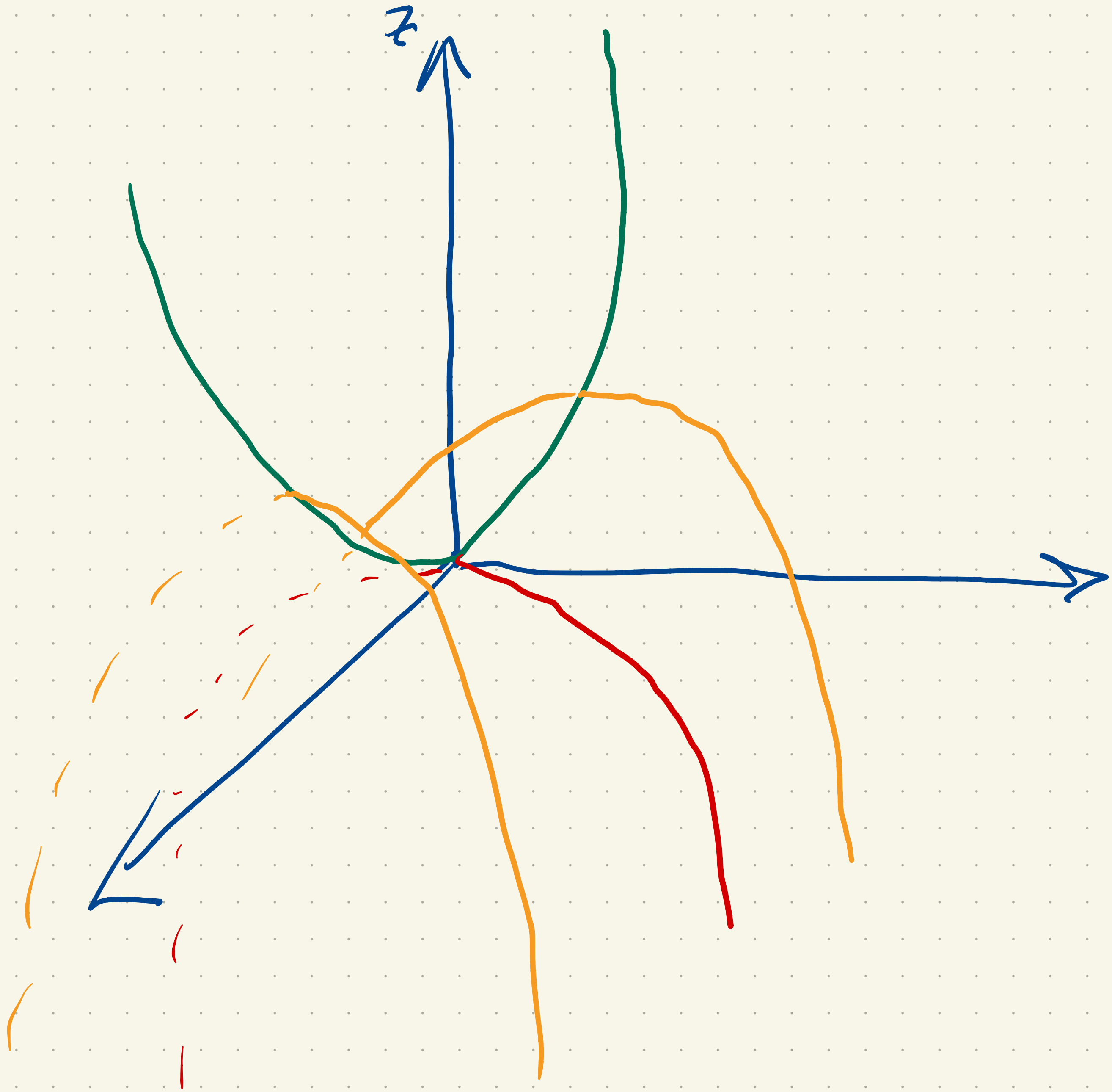
$z = -y^2 + 0^2$



plane $x=1$: $z = 1-y^2$

$x=-1$ $\quad$ $z = 1-y^2$



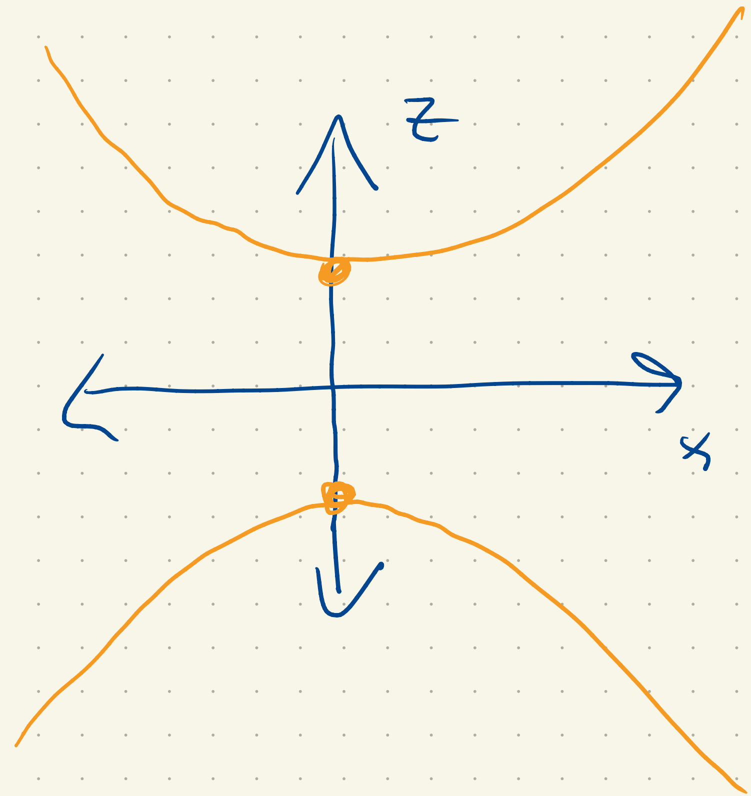

z

$z^2 - x^2 - y^2 = 1$

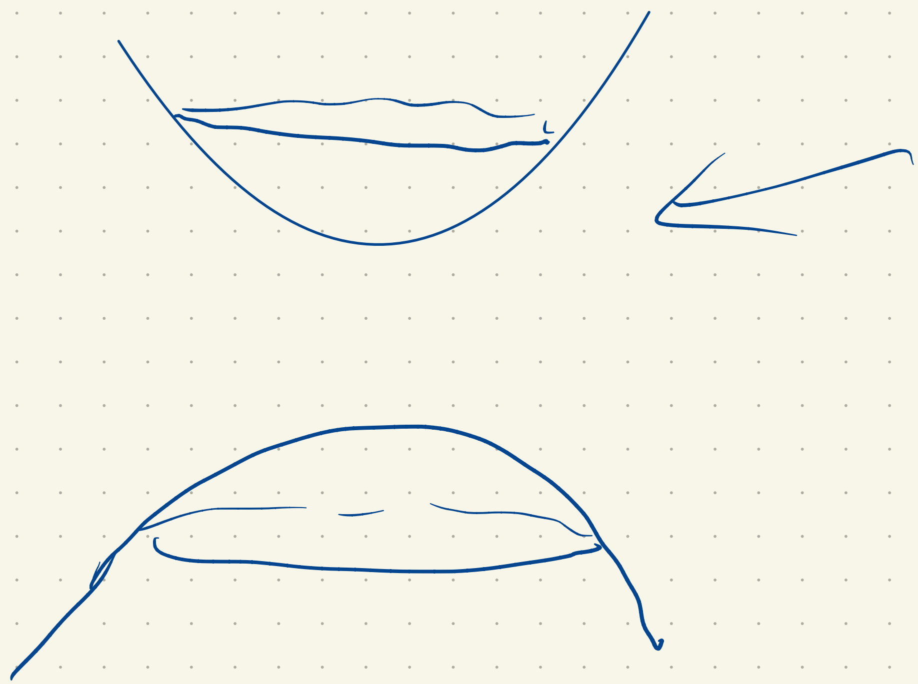
z-x plane $(y=0)$

$z^2 - x^2 = 1$

z-y plane $(x=0)$



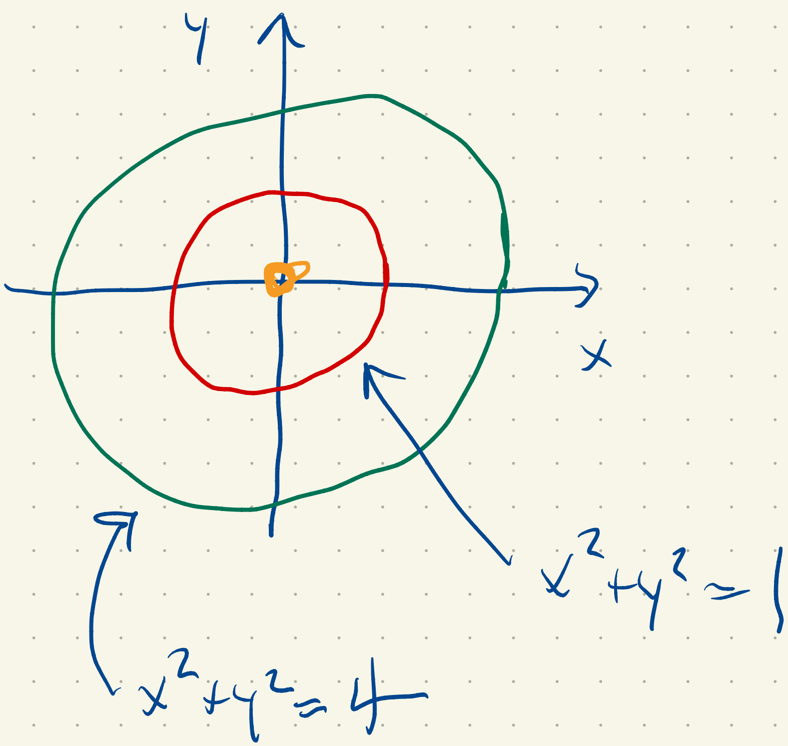
Two sheeted hyperboloid

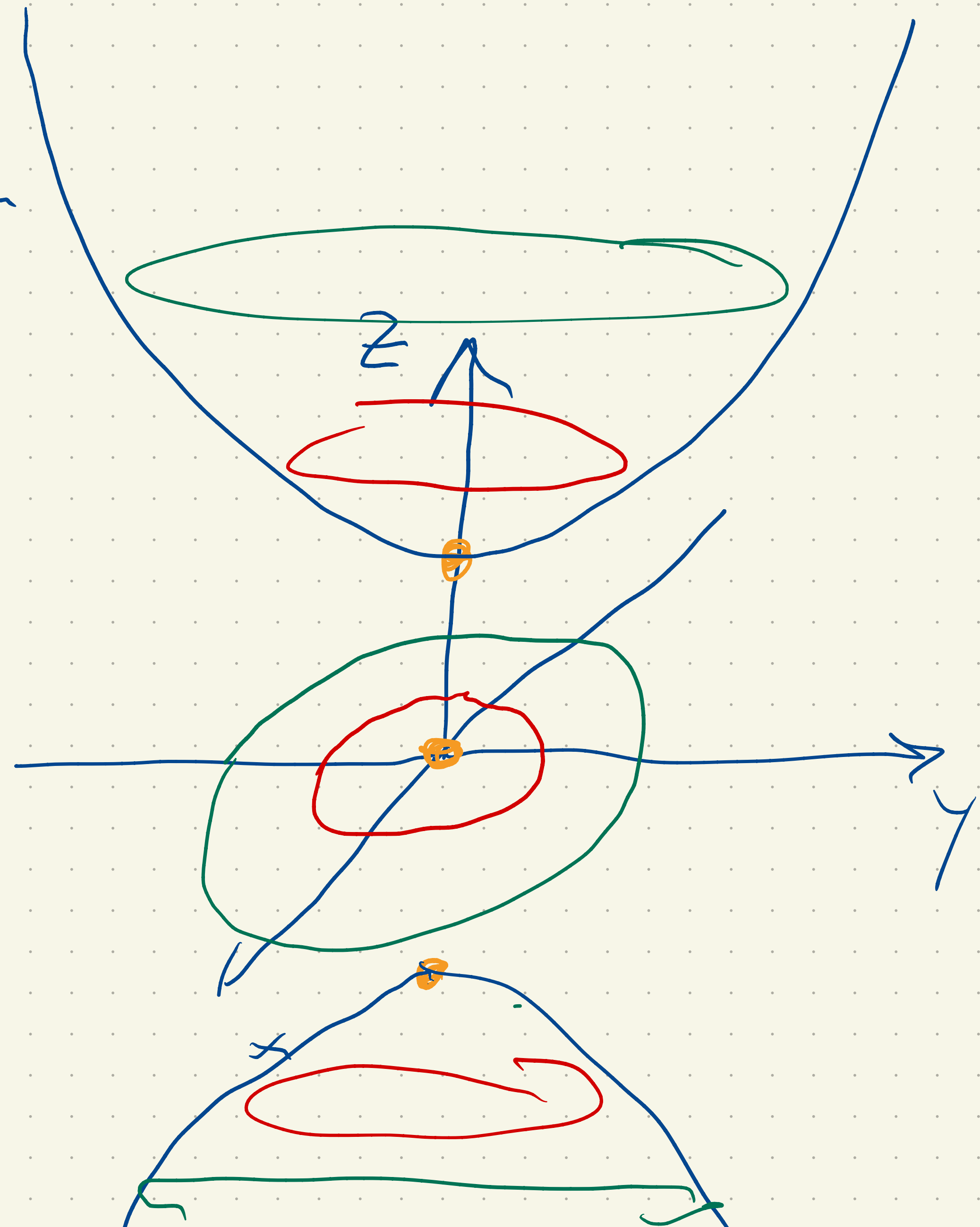


$$z^2 - x^2 - y^2 = 1$$

$$z^2 = 1 + x^2 + y^2$$

$$z = \pm\sqrt{1 + x^2 + y^2}$$



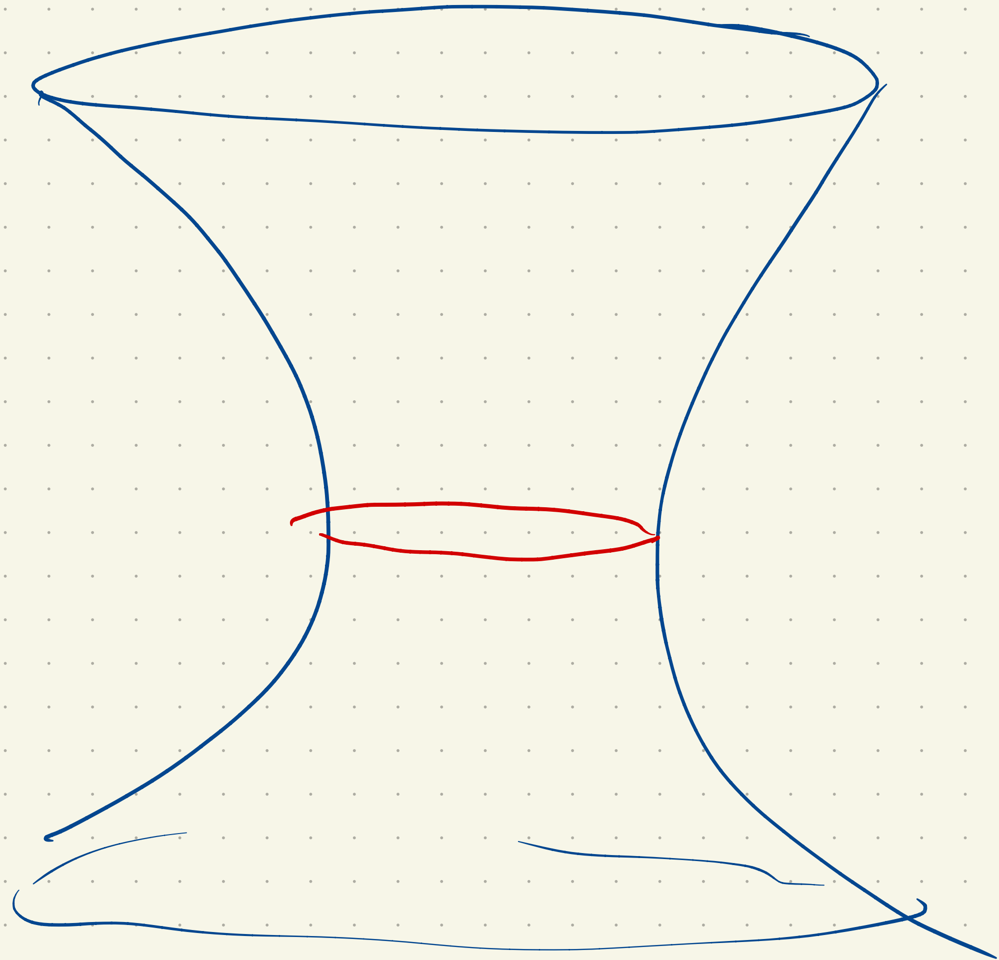


$$z^2 - x^2 - y^2 = -1$$

$$z^2 = x^2 + y^2 - 1$$

one sheeted

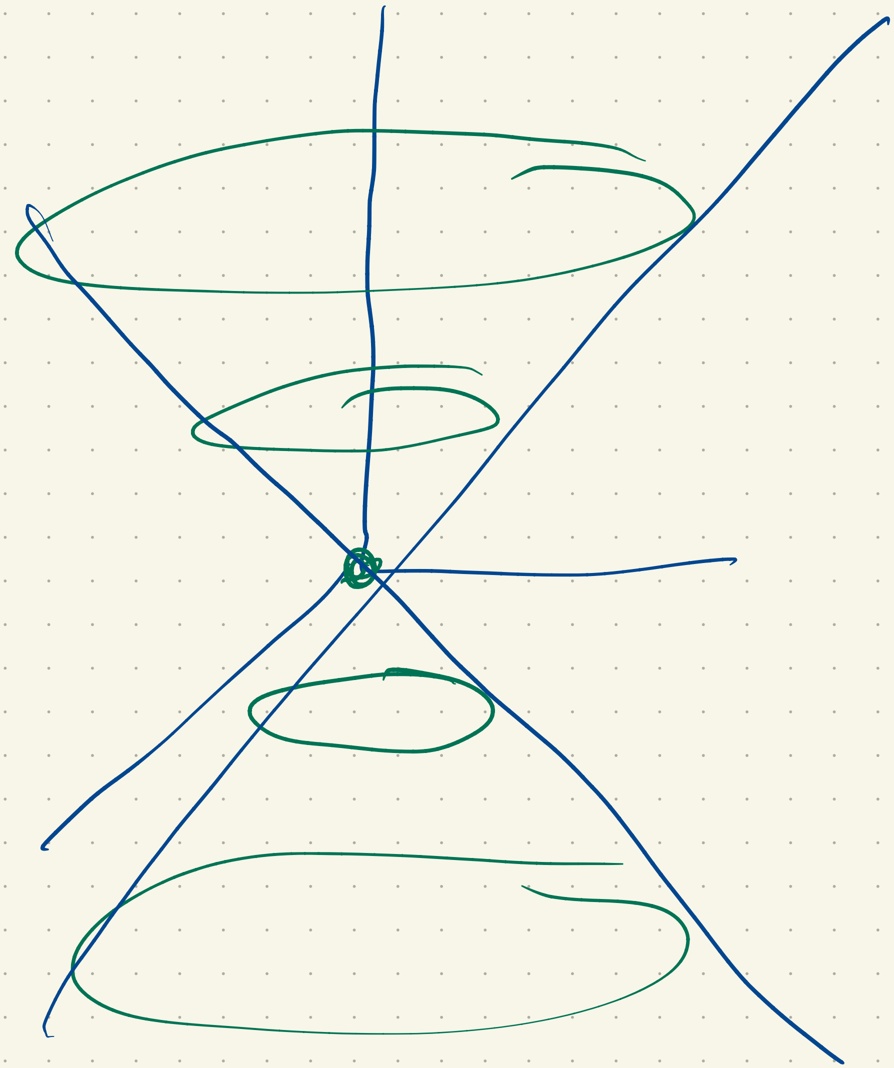
hyperboloid



$$z^2 - x^2 - y^2 = 0$$

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

$$z = \pm\sqrt{x^2+y^2}$$



3.1 Vector valued functions

Space curves

$$y = f(x)$$

one input $\rightarrow$ t, time

one output $\rightarrow$ multiple outputs

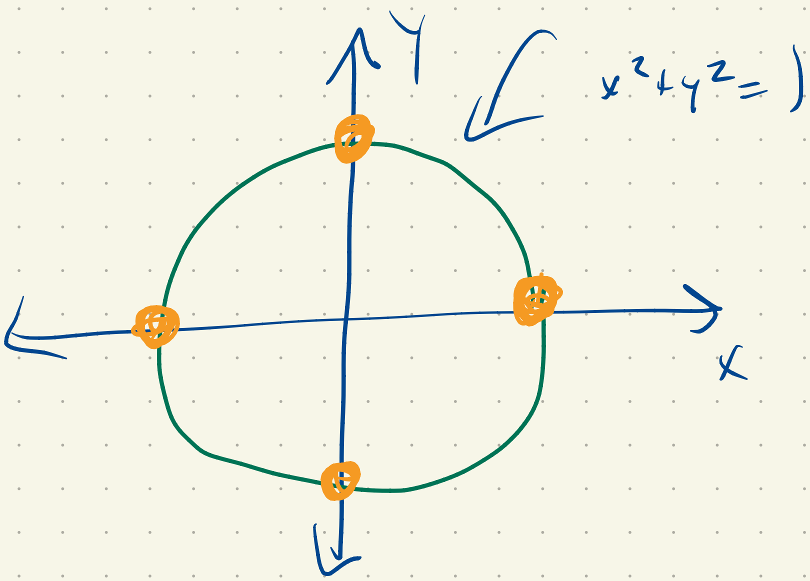
Position as a function of time

$$x(t),\ y(t),\ z(t)$$

$$\vec{r}(t) = \langle x(t), y(t), z(t) \rangle$$

$$\vec{r}(t) = \langle \underset{x}{\cos(t)},\ \underset{y}{\sin(t)},\ \overset{z=0}{0} \rangle$$

$$x^2+y^2=1$$



$t=0, 2\pi \quad \vec{r} = \langle 1, 0, 0 \rangle$

$t=\pi/2 \quad \vec{r} = \langle 0, 1, 0 \rangle$

$t=\pi \quad \vec{r} = \langle -1, 0, 0 \rangle$

$t=\frac{3\pi}{2} \quad \vec{r} = \langle 0, -1, 0 \rangle$

$$\vec{r}(t) = \langle \cos(2t), \sin(2t), 0 \rangle$$

$x \quad y \quad z$

$$x^2 + y^2 = 1$$

$$\vec{r}(0) = \langle 1, 0, 0 \rangle$$

$$\vec{r}(\pi) = \langle \cos(2\pi), \sin(2\pi), 0 \rangle$$

$$= \langle 1, 0, 0 \rangle$$