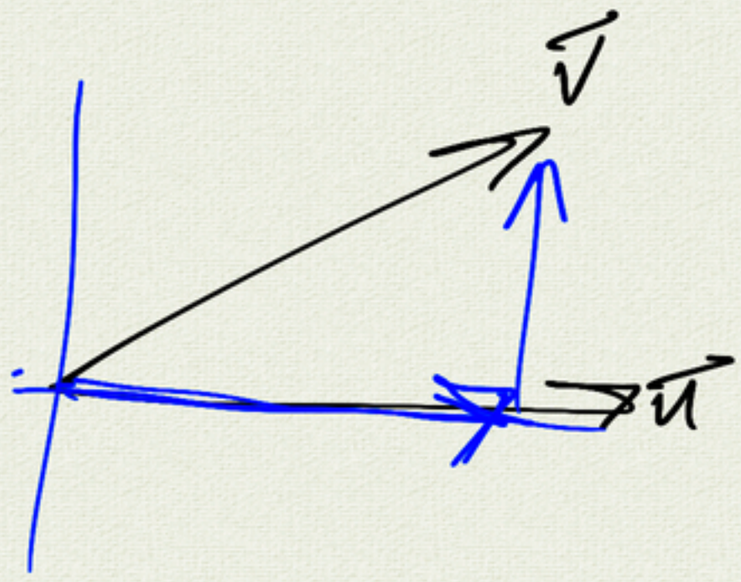
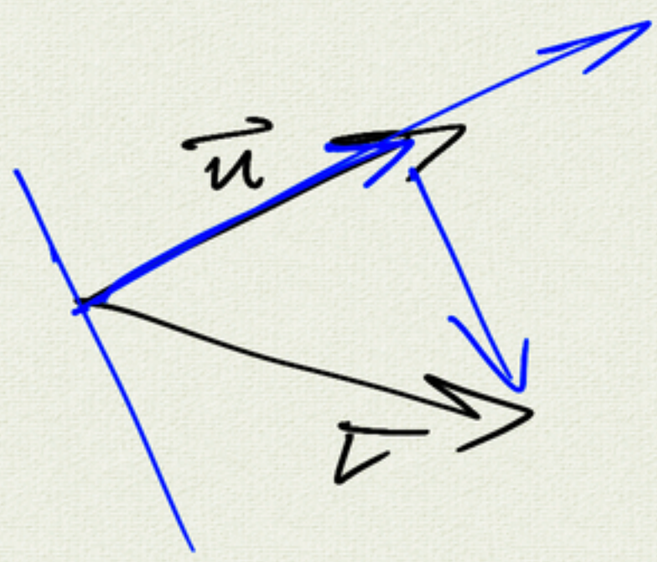


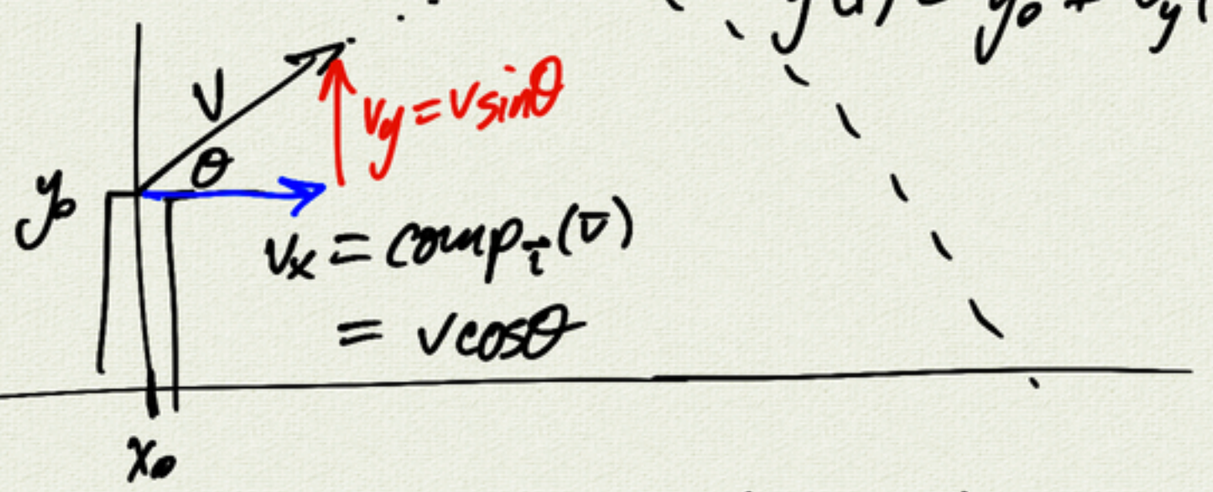


2.1 Vector valued functions (curves)

projectiles

$$x(t) = x_0 + v_x t$$
$$y(t) = y_0 + v_y t + \frac{1}{2} a t^2$$

$a = -32\ ft/s^2$

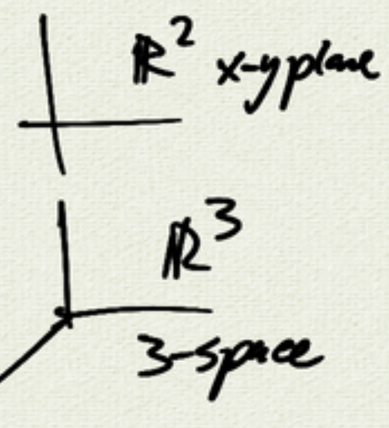


$\bar{r}(t) = \langle x(t), y(t) \rangle$

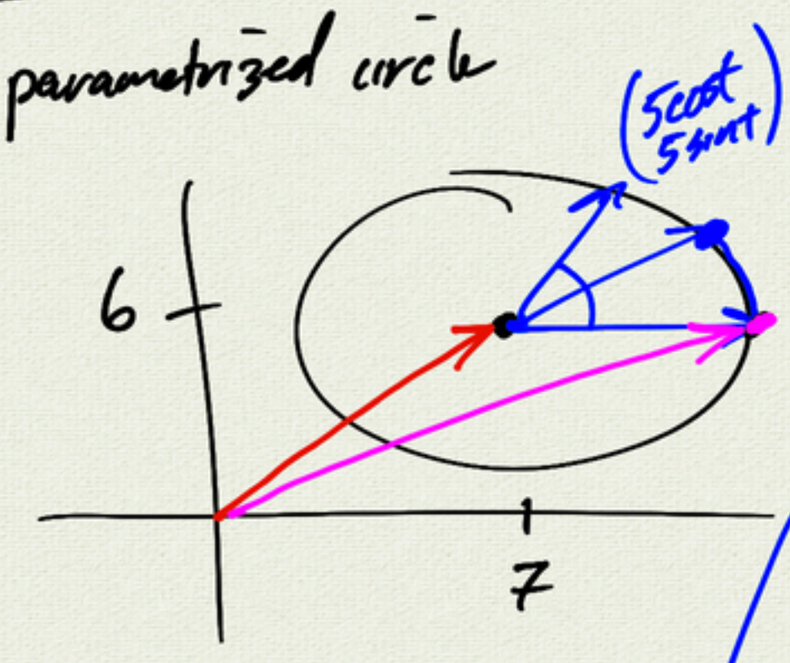
$\bar{r} : \mathbb{R} \longrightarrow \mathbb{R}^2$

$t \longmapsto \langle x(t), y(t) \rangle$

$\mathbb{R}$ real numbers



parametrized circle



center (7,6)
radius 5

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 7 \\ 6 \end{pmatrix} + \begin{pmatrix} 5\cos t \\ 5\sin t \end{pmatrix}$$

$x(t) = 7 + 5\cos t$
$y(t) = 6 + 5\sin t$

$$\bar{r}(t) = \begin{pmatrix} x(t) \\ y(t) \end{pmatrix}$$

---

parametrize line from $\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ to $\begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix}$

$\bar{r}_0$ $\bar{r}_1$

$\bar{v} = \begin{pmatrix} 3 \\ 4 \\ 5 \end{pmatrix}$

$\bar{v} = \bar{r}_1 - \bar{r}_0$

$$\bar{r}(t) = \begin{pmatrix} x(t) \\ y(t) \end{pmatrix} = \bar{r}_0 + t\bar{v}$$

$\bar{r}(t) = \bar{r}_0 + t(\bar{r}_1 - \bar{r}_0)$

$t = 0 \Rightarrow \bar{r}(0) = \bar{r}_0$

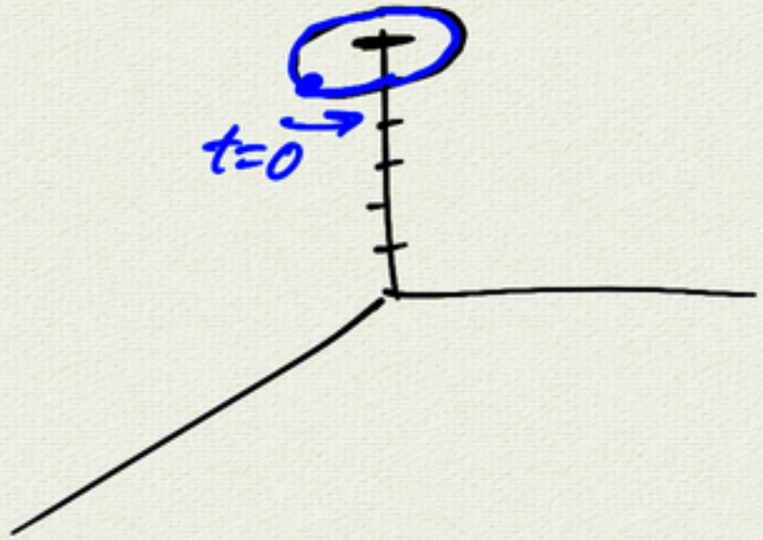
$t = 1 \rightarrow \bar{r}(1) = \bar{r}_1$

$\bar{r}(t) = \bar{r}_0 + t\bar{r}_1 - t\bar{r}_0$

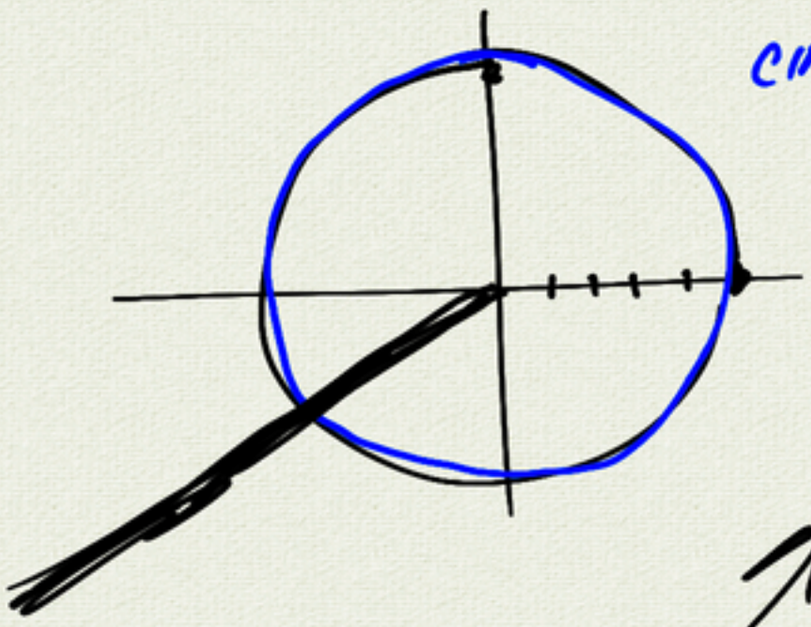
$= \bar{r}_0(1-t) + t\bar{r}_1$

$= (1-t)\bar{r}_0 + t\bar{r}_1$

$$\vec{r}(t) = \begin{pmatrix} \cos t \\ \sin t \\ 5 \end{pmatrix}$$

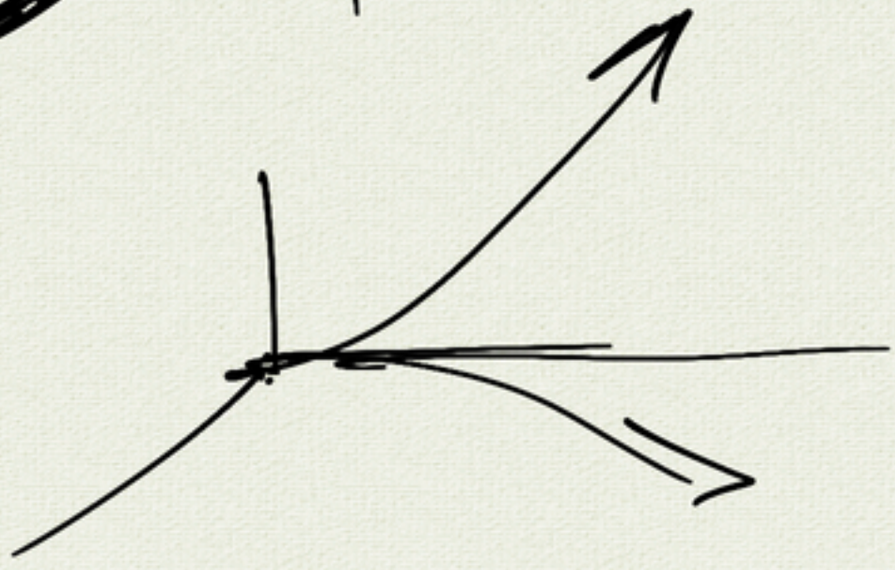


$$\vec{r}(t) = \begin{pmatrix} 0 \\ 5\cos t \\ 5\sin t \end{pmatrix}$$



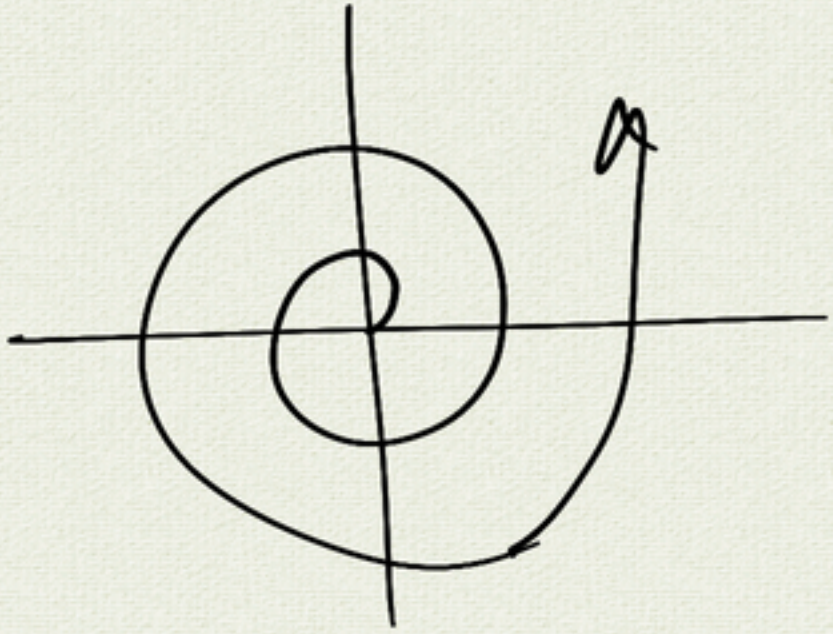
circle in yz plane, radius 5

$$\vec{r}(t) = \begin{pmatrix} t \\ t^2 \\ t^3 \end{pmatrix}$$



$$\vec{r}(t) = \begin{pmatrix} t\cos t \\ t\sin t \end{pmatrix}$$

$r=0$



$$\vec{r}(t) = \begin{pmatrix} \cos t \\ \sin t \\ t \end{pmatrix}$$

helix