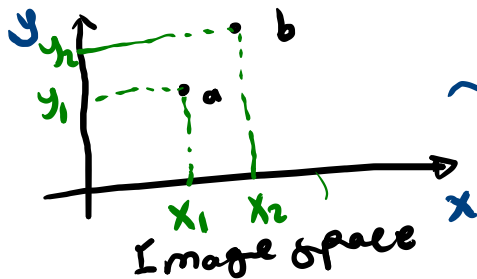
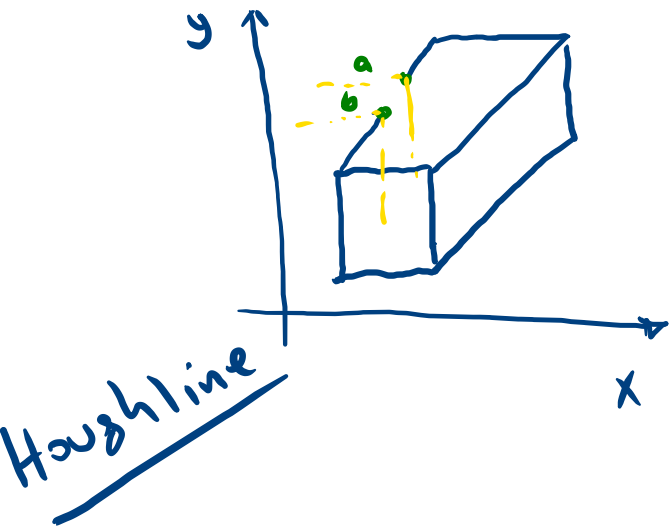


Hough Transform



اگر دو نقطه a, b معلوم کنیم خط چقدر شیب دارد؟

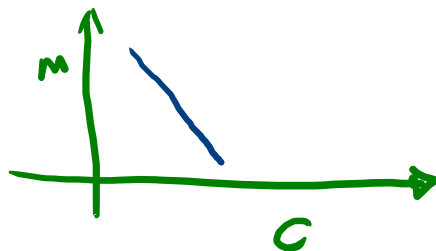


$y = mx + c$

intercept \uparrow

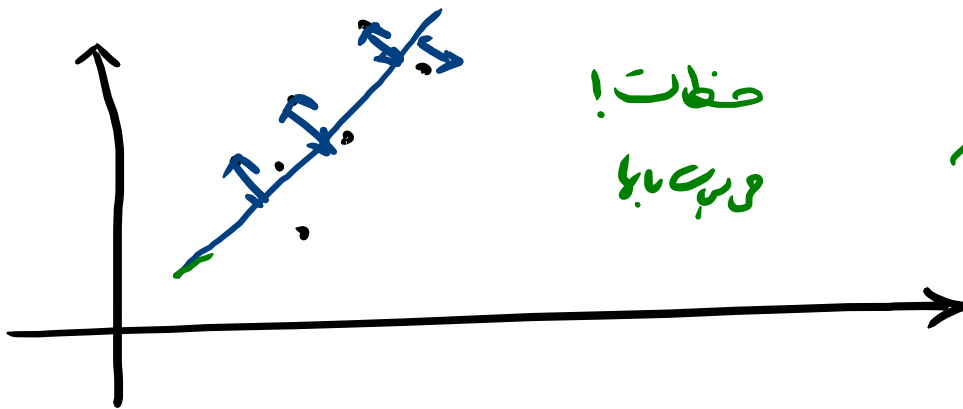
\downarrow slope

اگر شیب معلوم شود



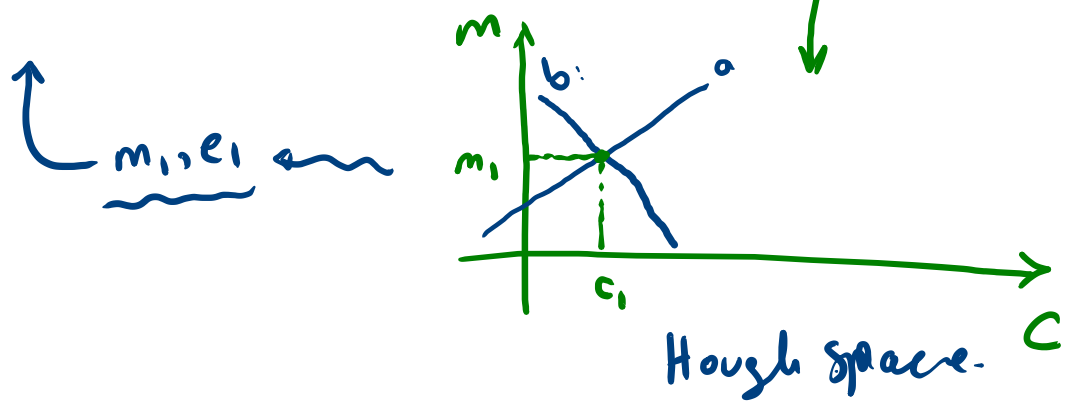
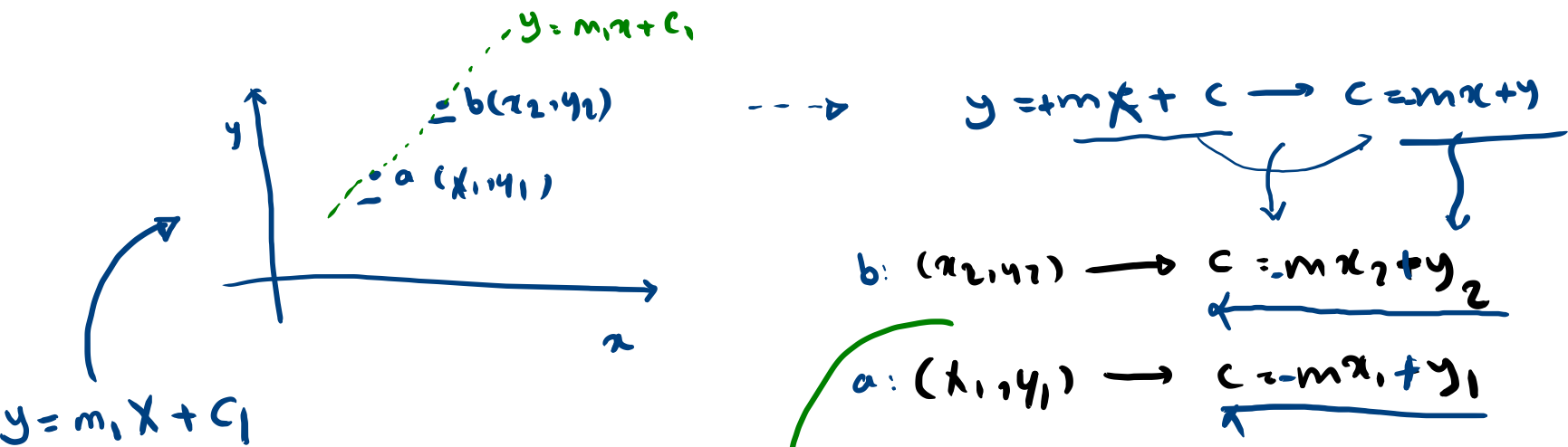
$(x, y) \rightarrow (m, c)$

$c = -mx + y$

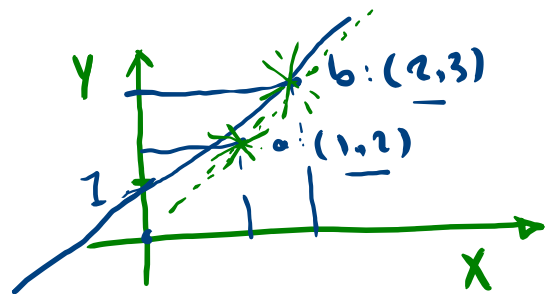


خطات!
درجه ها

Hough Transform



m_1, c_1



$$y = x + 1$$

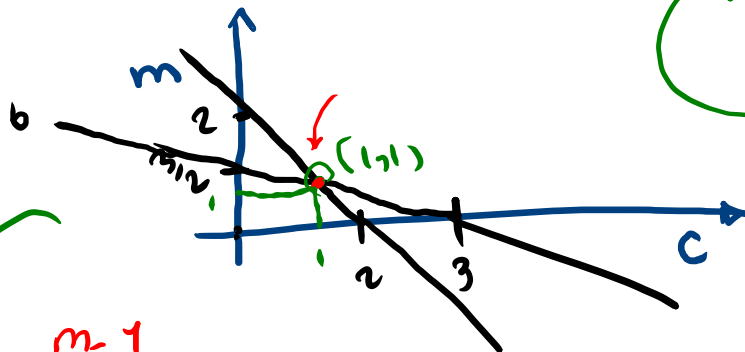
الخط المستقيم a, b مستقيم
 الخط المستقيم a, b مستقيم



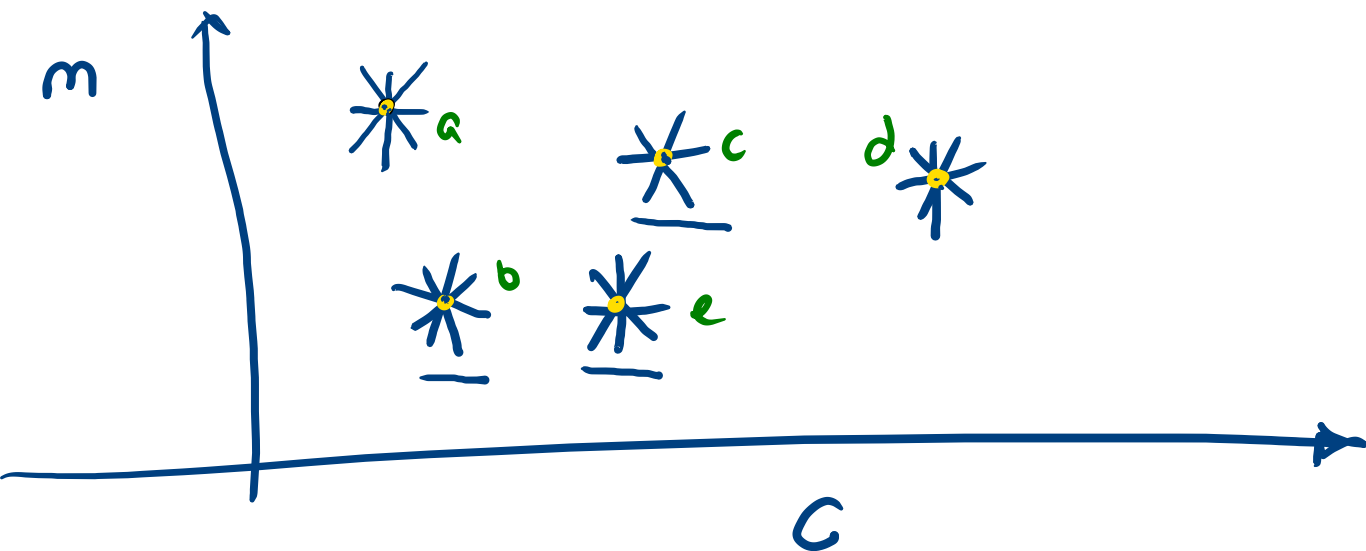
$$b(2,3) \rightarrow c = -2m + 3$$

$$a(1,2) \rightarrow c = -m + 2$$

$m=1$
 $c=1$ من هنا



$m=1$
 $c=1$
 $\rightarrow y = x + 1$



Threshold: 100

...

$a: 150$

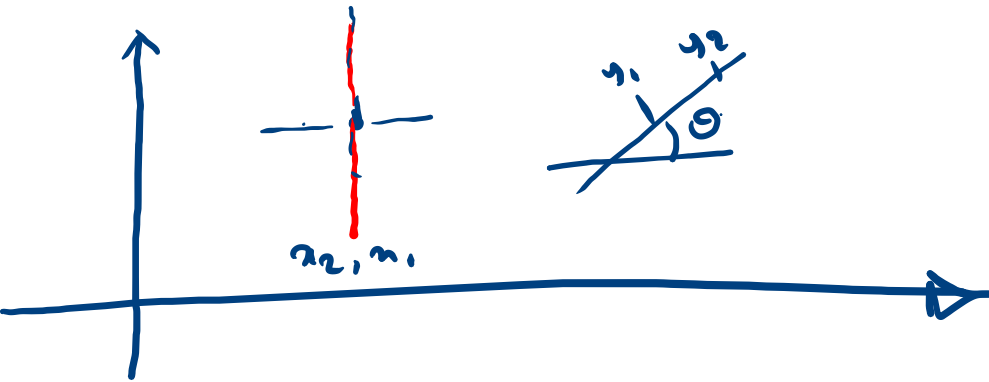
$b: 300$

$c: 8$

✓ 100

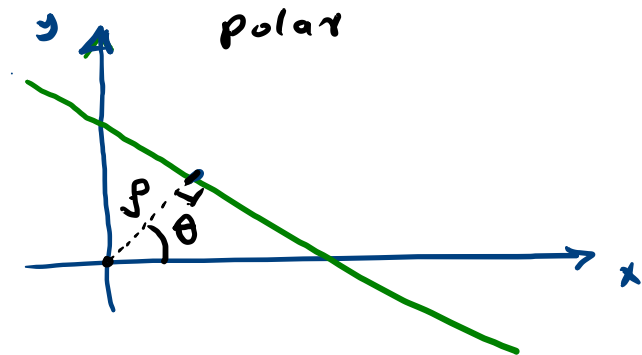
100 ✓

$$x_1 = x_2 \rightarrow m = \frac{y_2 - y_1}{0} = \infty$$



$$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow \frac{dy}{dx}$$

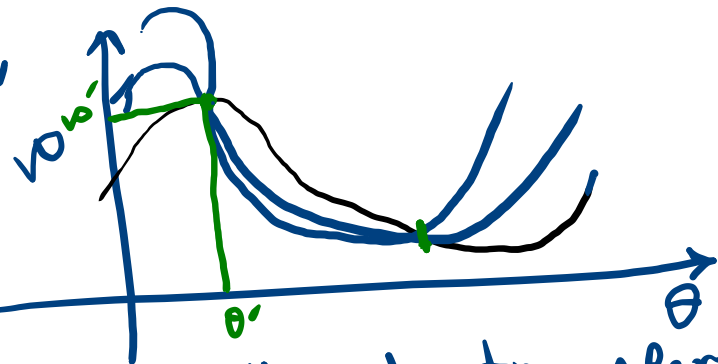
Cartesian \rightarrow polar



$$x', y' \rightarrow \rho = x' \cos \theta + y' \sin \theta$$

$$\begin{matrix} x' = 2 \\ y' = 3 \end{matrix} \quad \rho = 2 \cos \theta + 3 \sin \theta$$

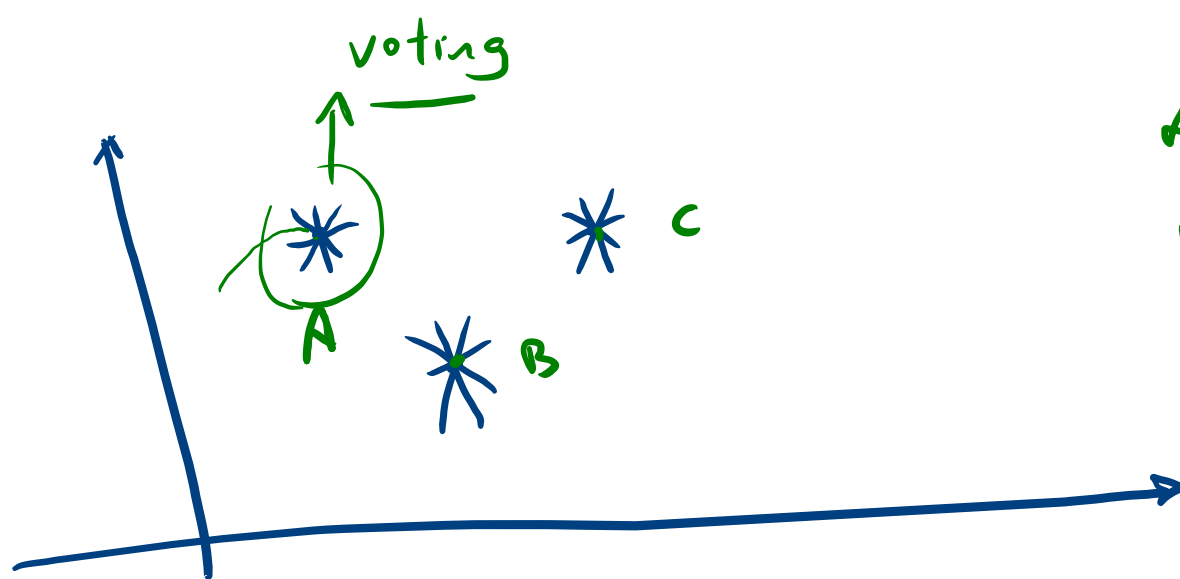
$$\rho = \frac{x}{\cos \theta} + \frac{y}{\sin \theta}$$



Hough transform

$$-\frac{\pi}{2} \leq \theta \leq +\frac{\pi}{2}$$

$$0 \leq \rho \leq 11$$



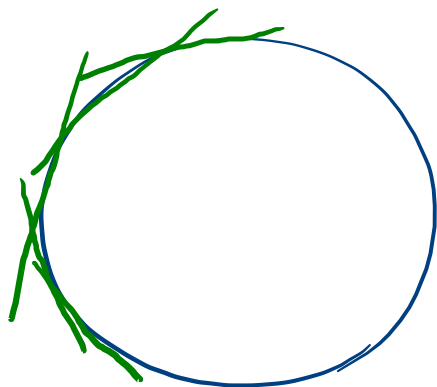
$$A = 200$$

$$B = 100$$

$$C = 150$$

accept line \leftarrow $A \cap C$

$$\leftarrow Th = 120$$



• (x', y')

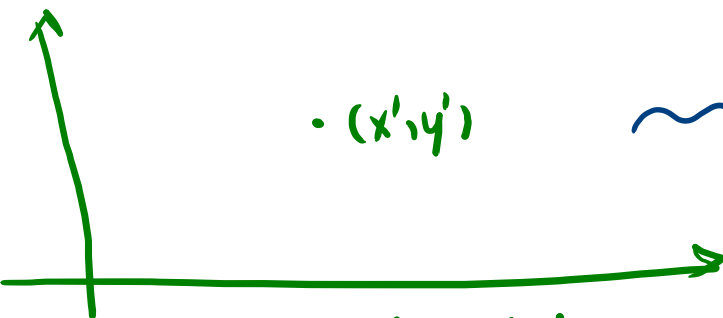
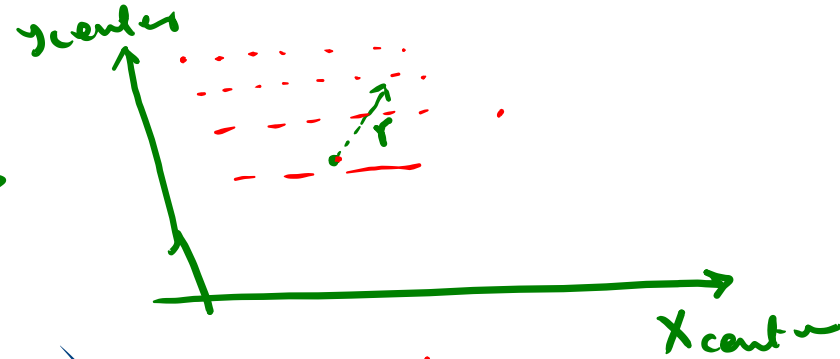
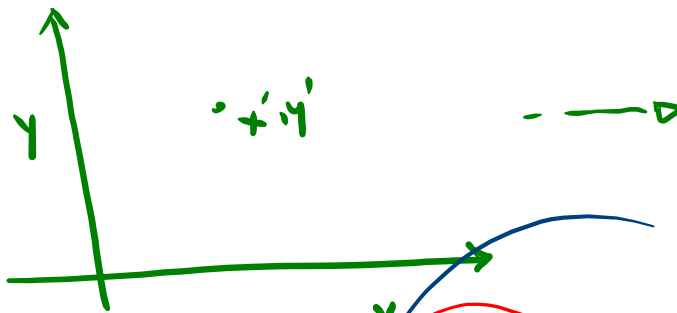


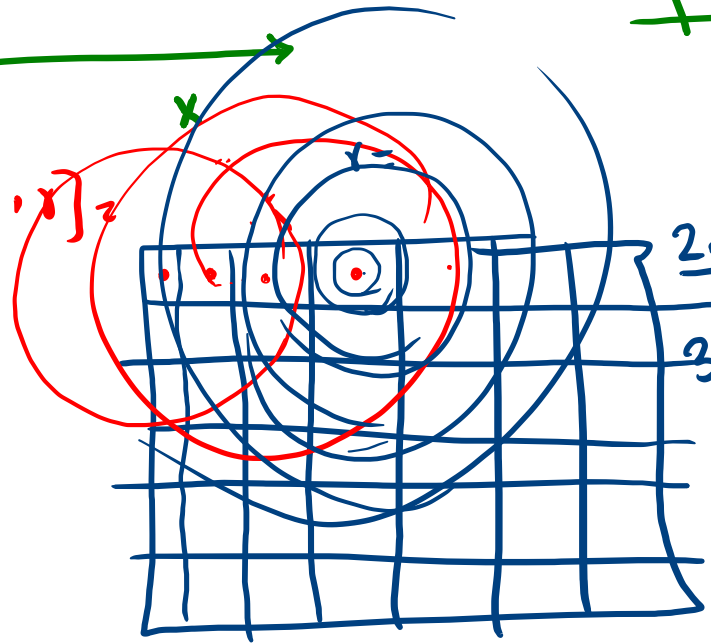
Image space

$$\leadsto (x' - \underline{x_{center}})^2 + (y' - \underline{y_{center}})^2 = \underline{r^2}$$

$$\overset{or}{(x - \underline{x_{center}})^2 + (y - \underline{y_{center}})^2 = r^2}$$



$[x_{center}, y_{center}, r]$

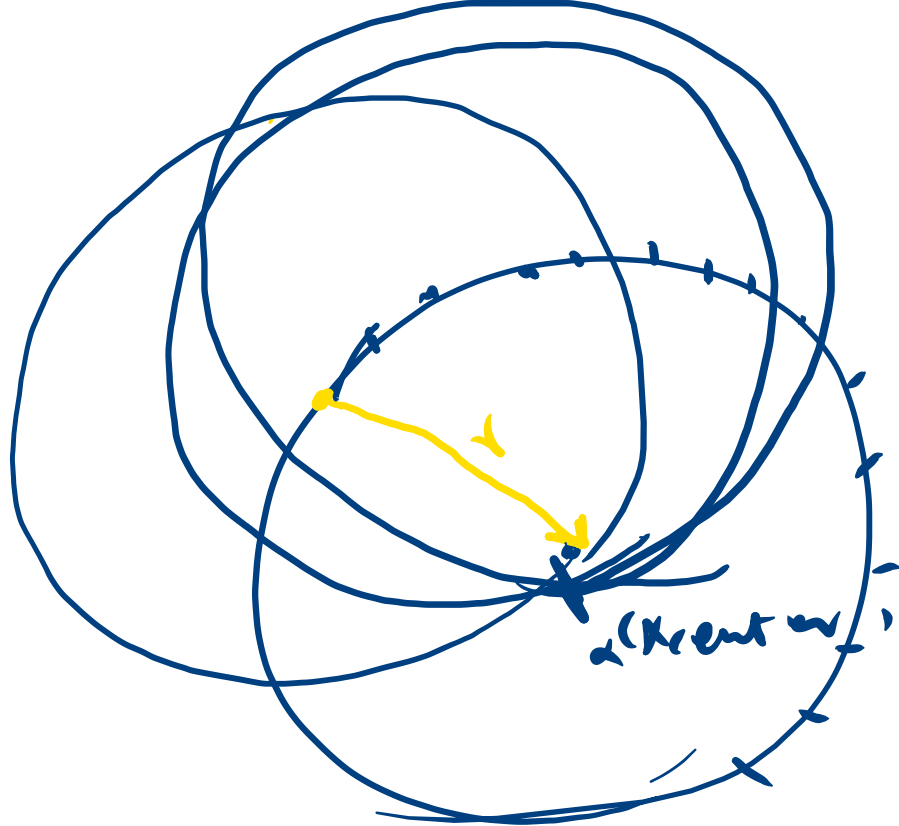


100

$200 = [x_{center}, y_{center}, r]$

$300 = [$

400



$\alpha(\text{center } v_i) \rightarrow \text{center } v_{i+1}$