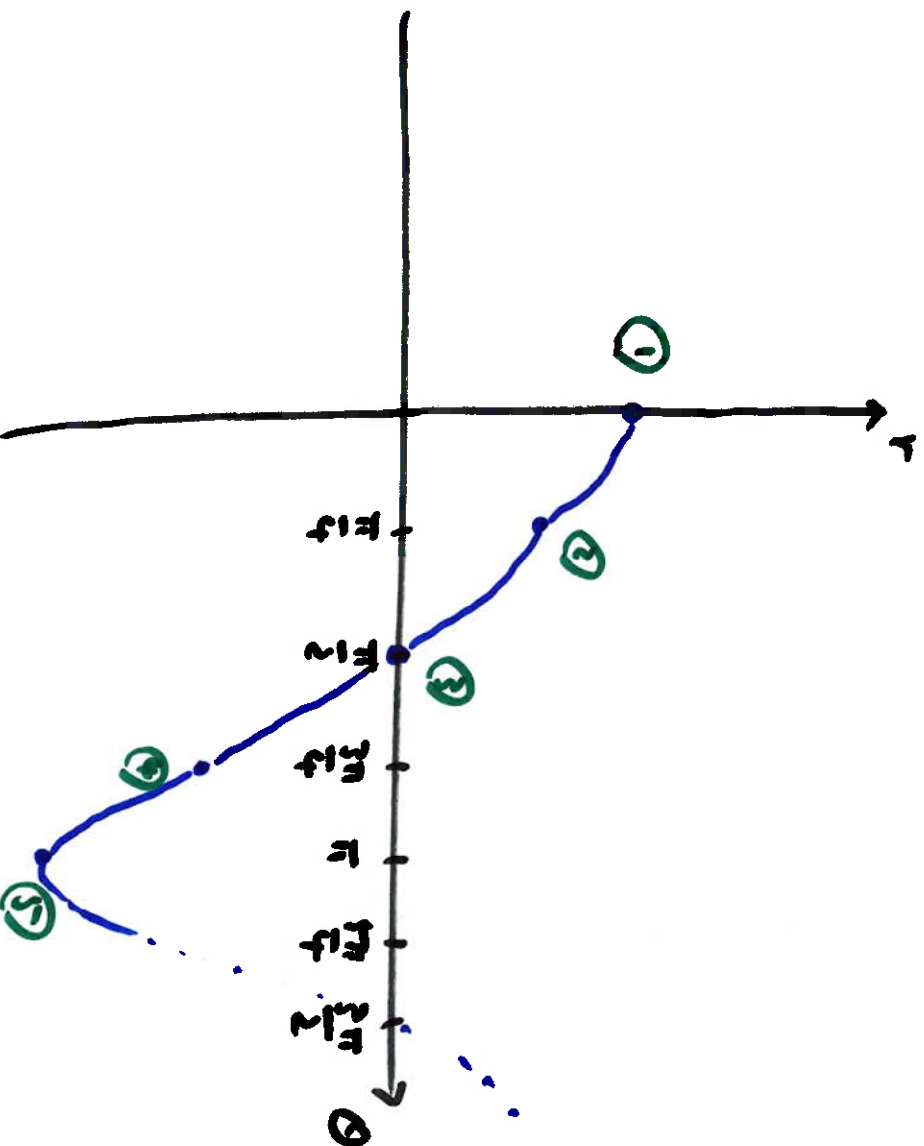


12.2 Polar Coordinates (continued)

Graphs of polar equations

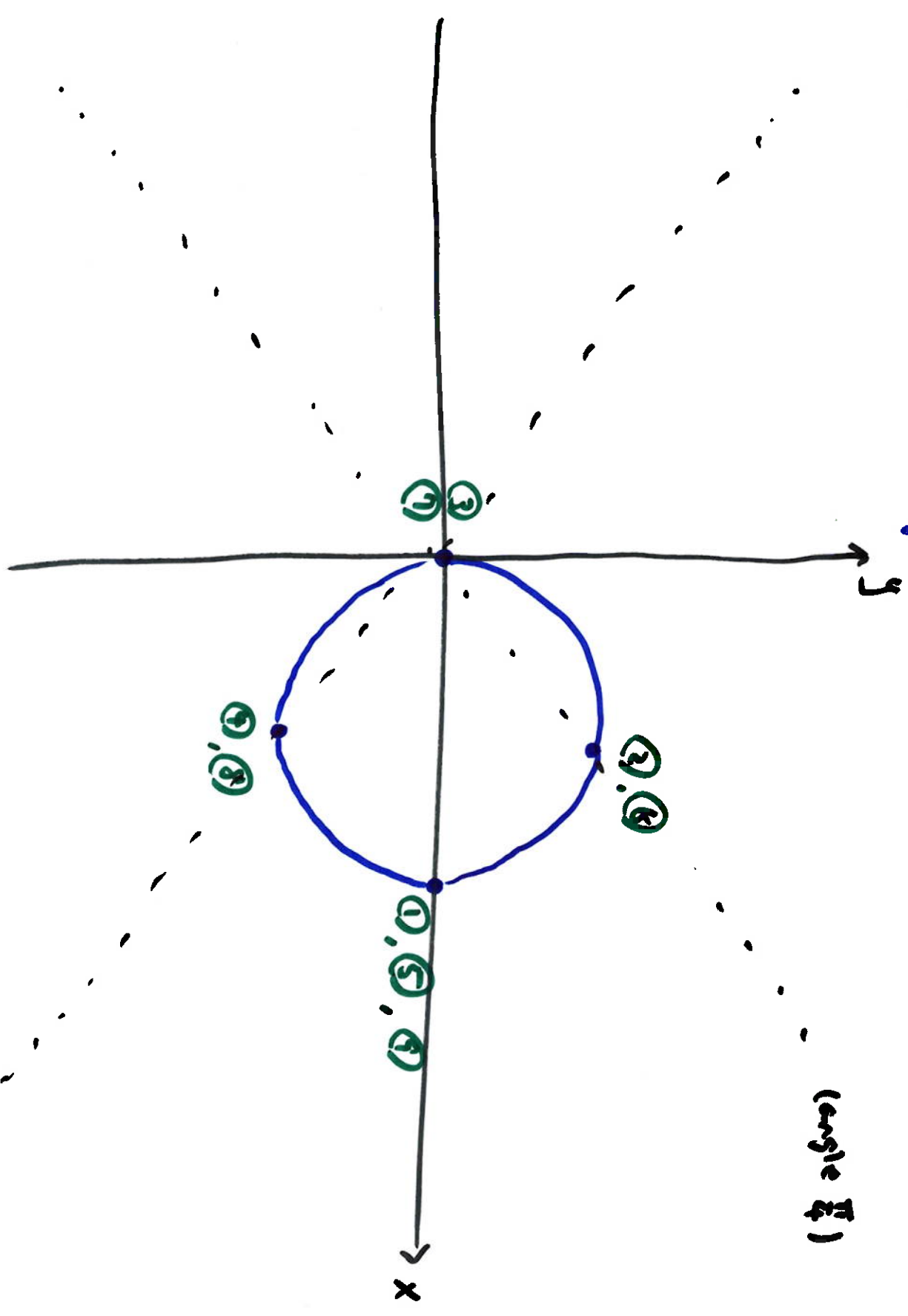
example $r = \cos(\theta)$

θ	r	(r, θ)
① 0	1	(1, 0)
② $\frac{\pi}{4}$	$\frac{1}{\sqrt{2}} \approx 0.7$	$(\frac{1}{\sqrt{2}}, \frac{\pi}{4})$
③ $\frac{\pi}{2}$	0	
④ $\frac{3\pi}{4}$	$-\frac{1}{\sqrt{2}} \approx -0.7$	
⑤ π	-1	
⑥ $\frac{5\pi}{4}$	-0.7	
⑦ $\frac{3\pi}{2}$	0	
⑧ $\frac{7\pi}{4}$	0.7	
⑨ 2π	1	



the usual cosine graph we
are used to seeing
this is the Cartesian graph

the Polar graph is more interesting

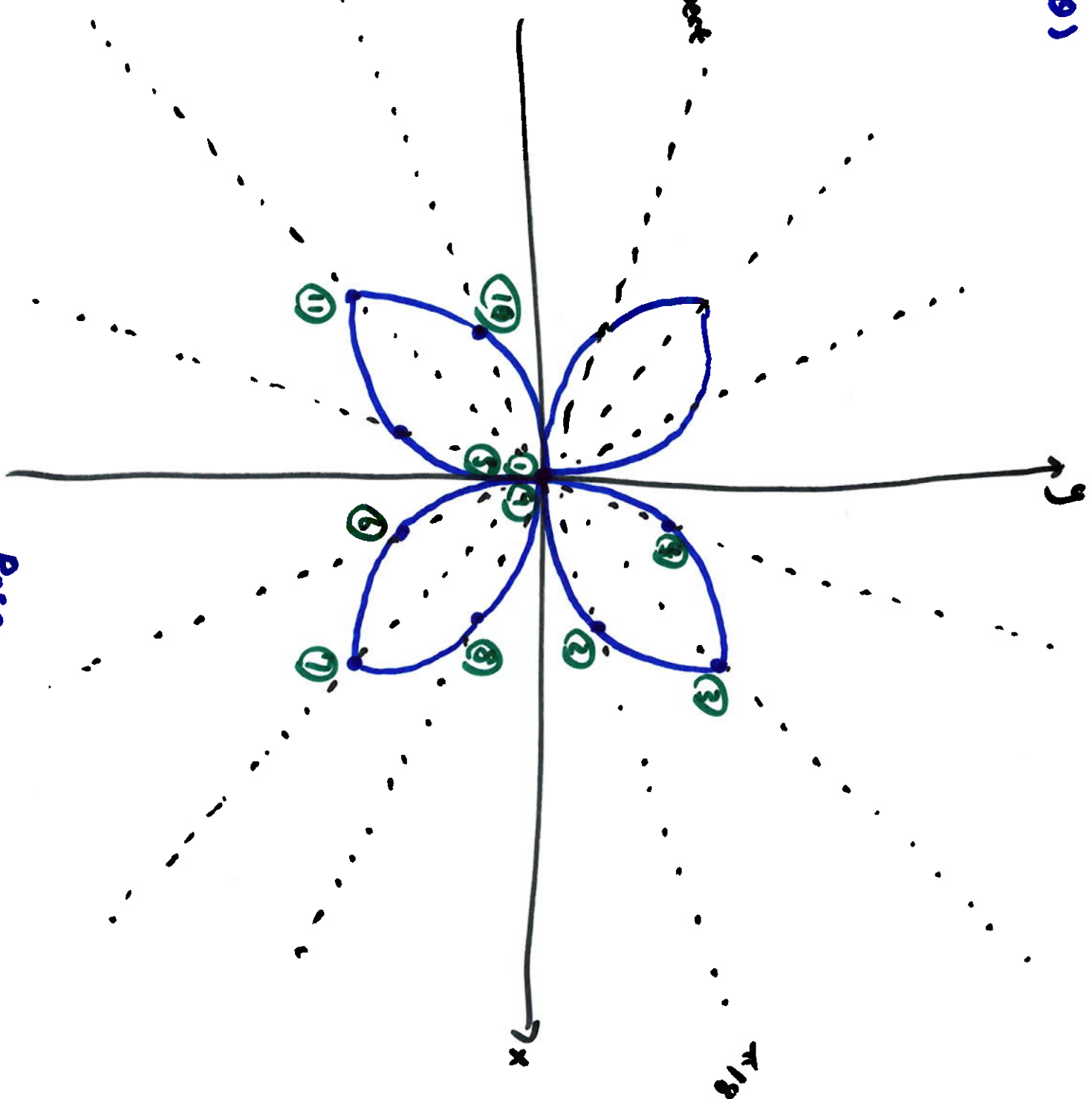


(angle $\frac{\pi}{4}$)

circle
(goes counterclockwise once)

Example $r = \sin(2\theta)$

θ	r
0	0
$\frac{\pi}{6}$	$\frac{1}{2} \approx 0.5$
$\frac{\pi}{4}$	1
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2} \approx 0.87$
$\frac{\pi}{2}$	1
$\frac{2\pi}{3}$	$\frac{\sqrt{3}}{2} \approx 0.87$
$\frac{3\pi}{4}$	1
$\frac{5\pi}{6}$	$\frac{1}{2} \approx 0.5$
π	0
$\frac{7\pi}{6}$	$-\frac{1}{2} \approx -0.5$
$\frac{5\pi}{4}$	-1
$\frac{3\pi}{2}$	$-\frac{\sqrt{3}}{2} \approx -0.87$
$\frac{7\pi}{4}$	-1
$\frac{11\pi}{6}$	$-\frac{1}{2} \approx -0.5$
2π	0



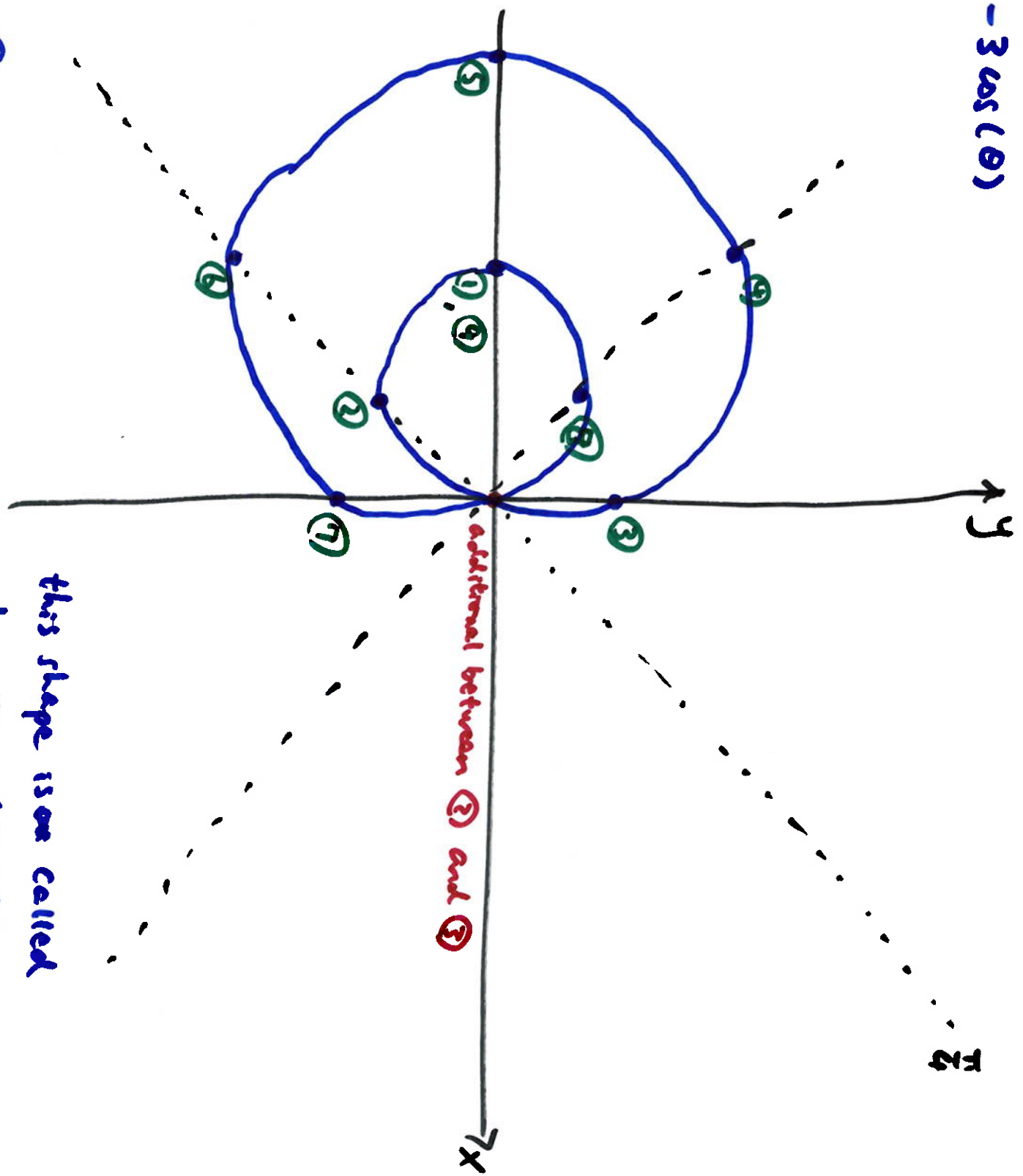
$r = \cos(n\theta)$ and $r = \sin(n\theta)$ are roses (circle is a p one-petal rose)

if n is even $\rightarrow 2n$ petals

if n is odd $\rightarrow n$ petals

Example $r = 1 - 3 \cos(\theta)$

θ	r
① 0	-2
② $\frac{\pi}{4}$	-1.12
③ $\frac{\pi}{2}$	1
④ $\frac{3\pi}{4}$	3.12
⑤ π	4
⑥ $\frac{5\pi}{4}$	3.12
⑦ $\frac{3\pi}{2}$	1
⑧ $\frac{7\pi}{4}$	-1.12
⑨ 2π	-2



Additional between ③ and ③

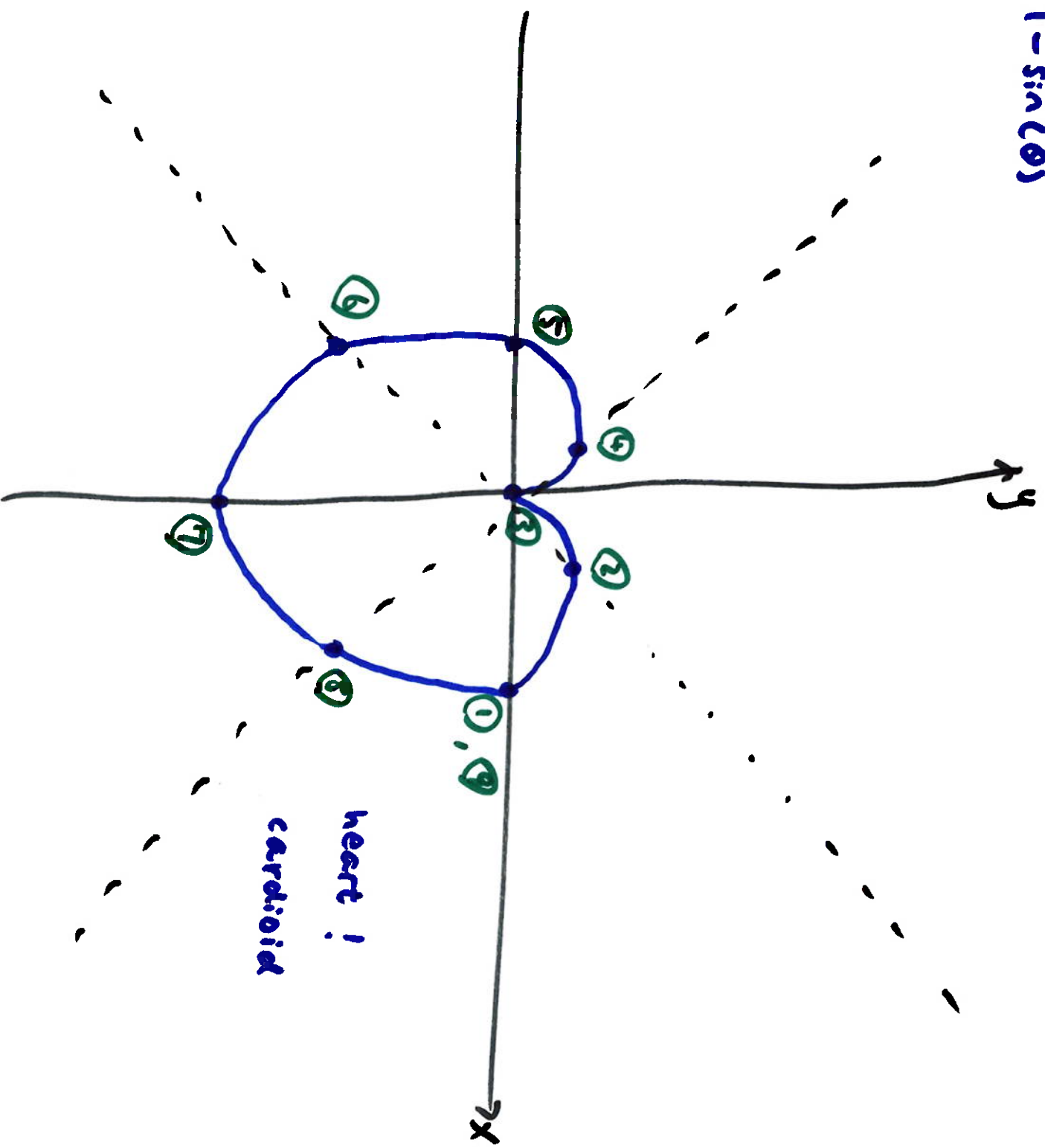
this shape is called
limaçon (snail)

② → ③ how?
insert additional point

Example

$$r = 1 - \sin(\theta)$$

θ	r
① 0	1
② $\frac{\pi}{4}$	0.3
③ $\frac{\pi}{2}$	0
④ $\frac{3\pi}{4}$	0.3
⑤ π	1
⑥ $\frac{5\pi}{4}$	1.7
⑦ $\frac{3\pi}{2}$	2
⑧ $\frac{7\pi}{4}$	1.7
⑨ 2π	1



heart i
cardioid