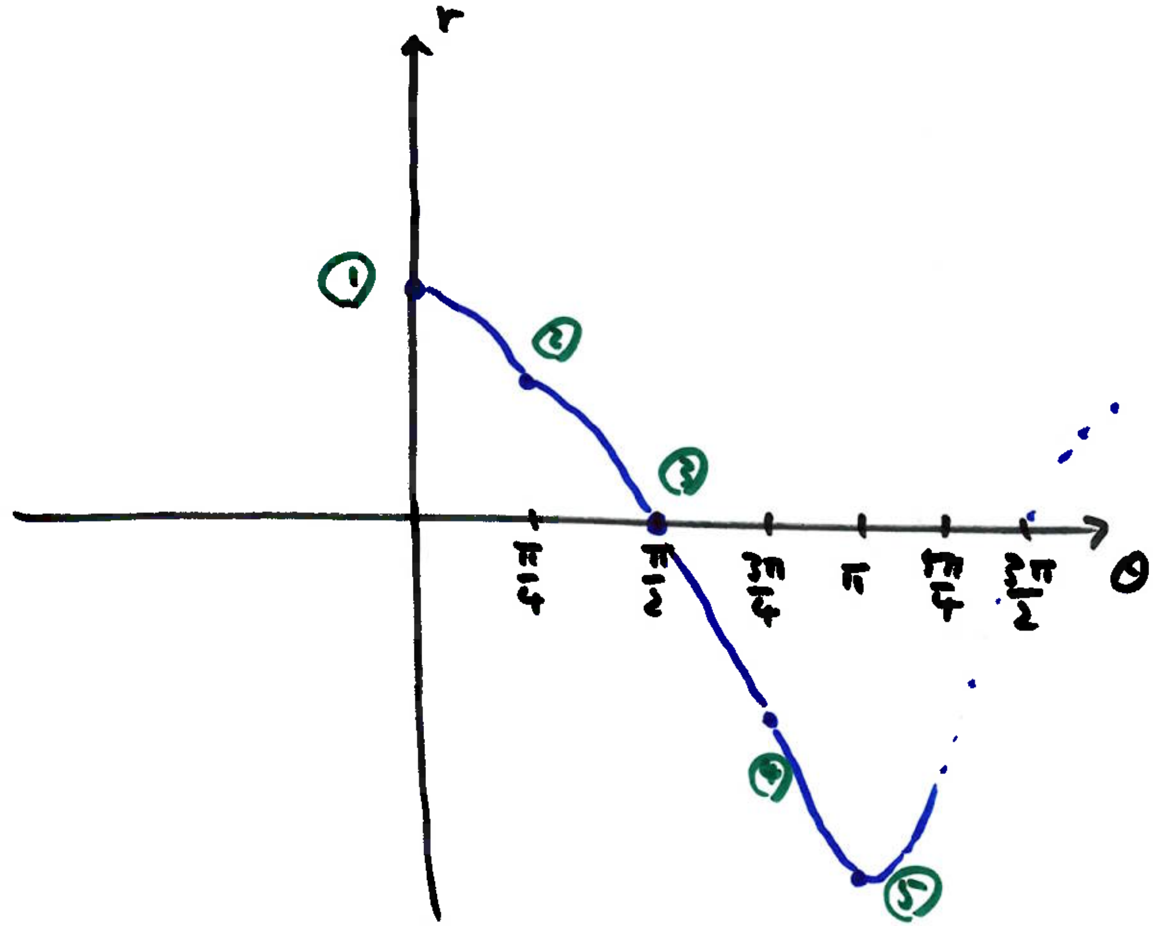
12.2 Polar Coordinates (continued)

graphs of polar equations

<u>example</u> $r = \cos(\theta)$

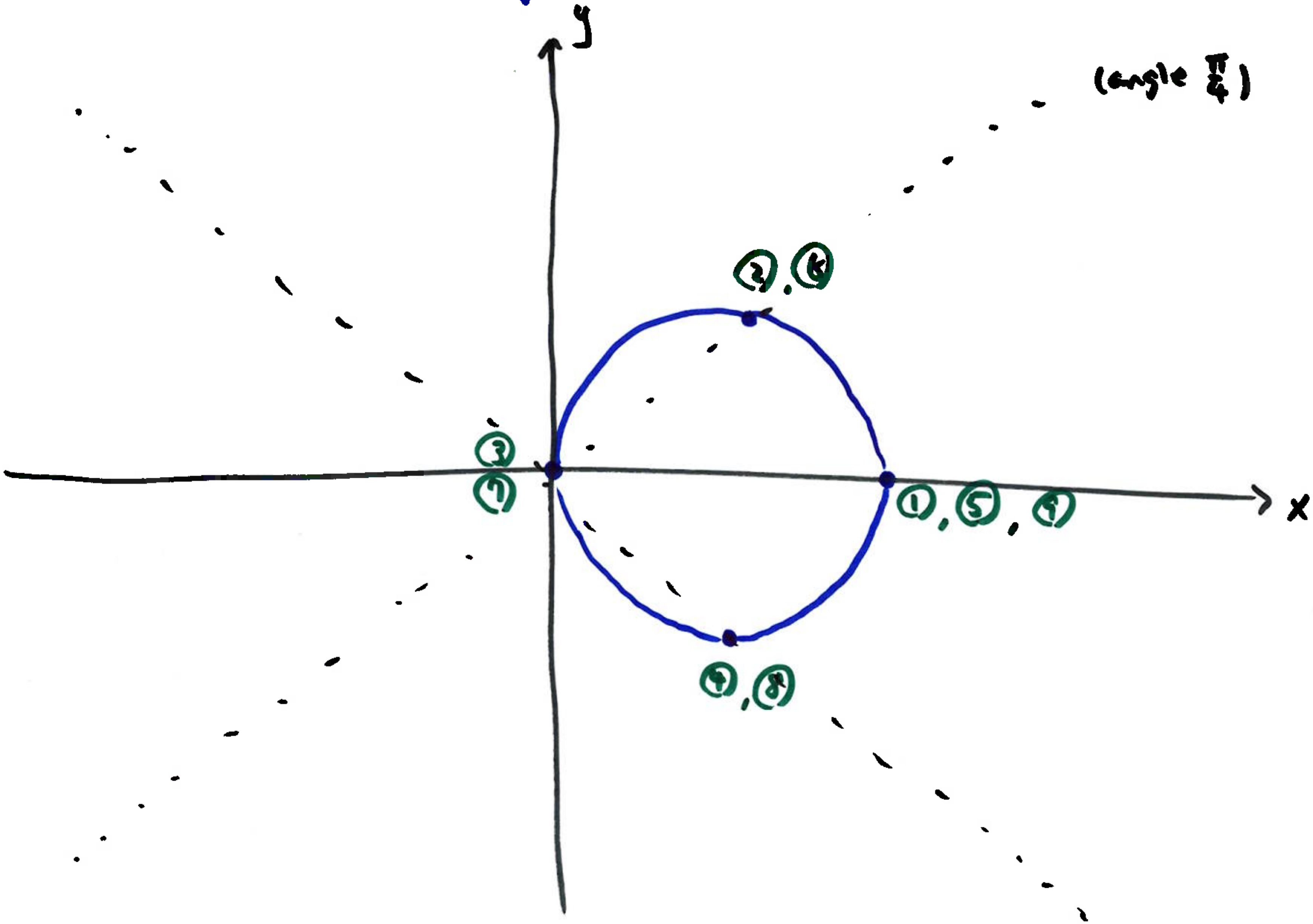
	θ	r	(r, θ)
1	0	1	$(1, 0)$
2	$\frac{\pi}{4}$	$\frac{1}{\sqrt{2}} \approx 0.7$	$(\frac{1}{\sqrt{2}}, \frac{\pi}{4})$
3	$\frac{\pi}{2}$	0	
4	$\frac{3\pi}{4}$	$-\frac{1}{\sqrt{2}} \approx -0.7$	
5	π	-1	
6	$\frac{5\pi}{4}$	-0.7	
7	$\frac{3\pi}{2}$	0	
8	$\frac{7\pi}{4}$	0.7	
9	2π	1	



the usual cosine graph we are used to seeing

this is the Cartesian graph

the Polar graph is more interesting

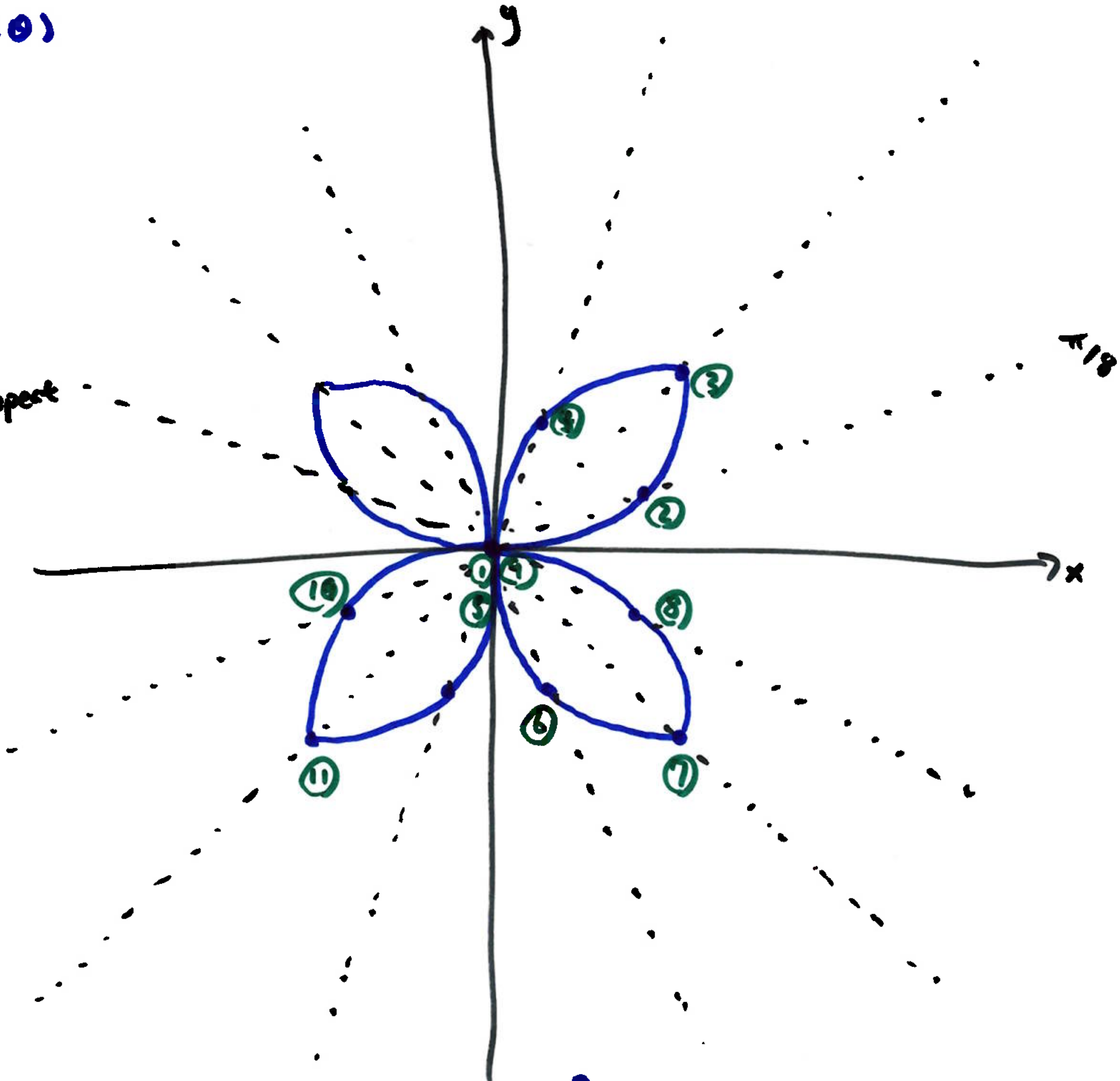


circle
(goes counterclockwise once)

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

	θ	r
1	0	0
2	$\frac{\pi}{8}$	$\frac{1}{\sqrt{2}} \approx 0.7$
3	$\frac{\pi}{4}$	1
4	$\frac{3\pi}{8}$	$\frac{1}{\sqrt{2}} \approx 0.7$
5	$\frac{\pi}{2}$	0
6	$\frac{5\pi}{8}$	$-\frac{1}{\sqrt{2}} \approx -0.7$
7	$\frac{3\pi}{4}$	-1
8	$\frac{7\pi}{8}$	$-\frac{1}{\sqrt{2}} \approx -0.7$
9	π	0
10	$\frac{9\pi}{8}$	$\frac{1}{\sqrt{2}} \approx 0.7$
11	$\frac{10\pi}{8}$	
	$\vdots$	
	2π	0

repeat



Rose

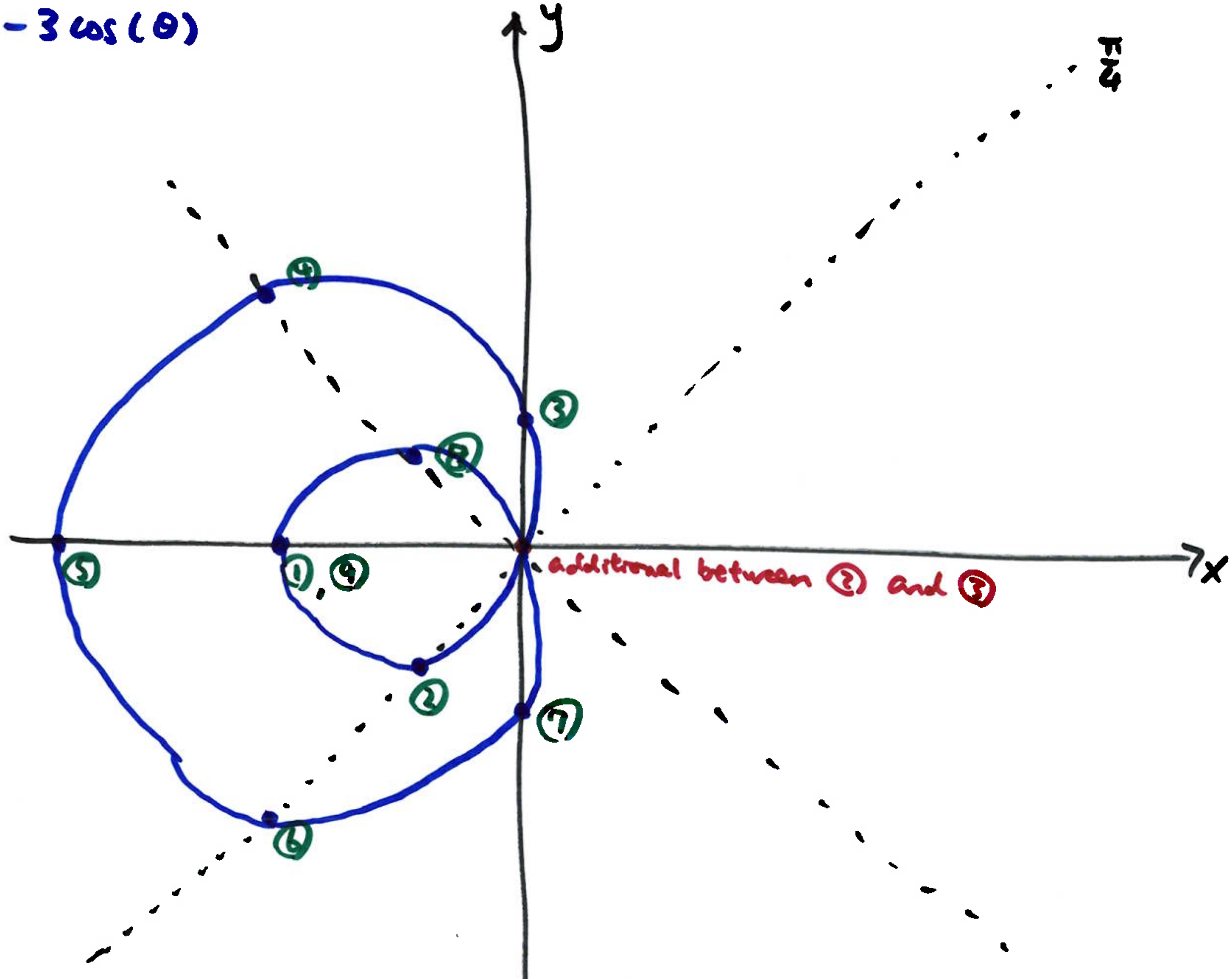
$r = \cos(n\theta)$ and $r = \sin(n\theta)$ are roses (circle is a ~~p~~ one-petal rose)

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



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