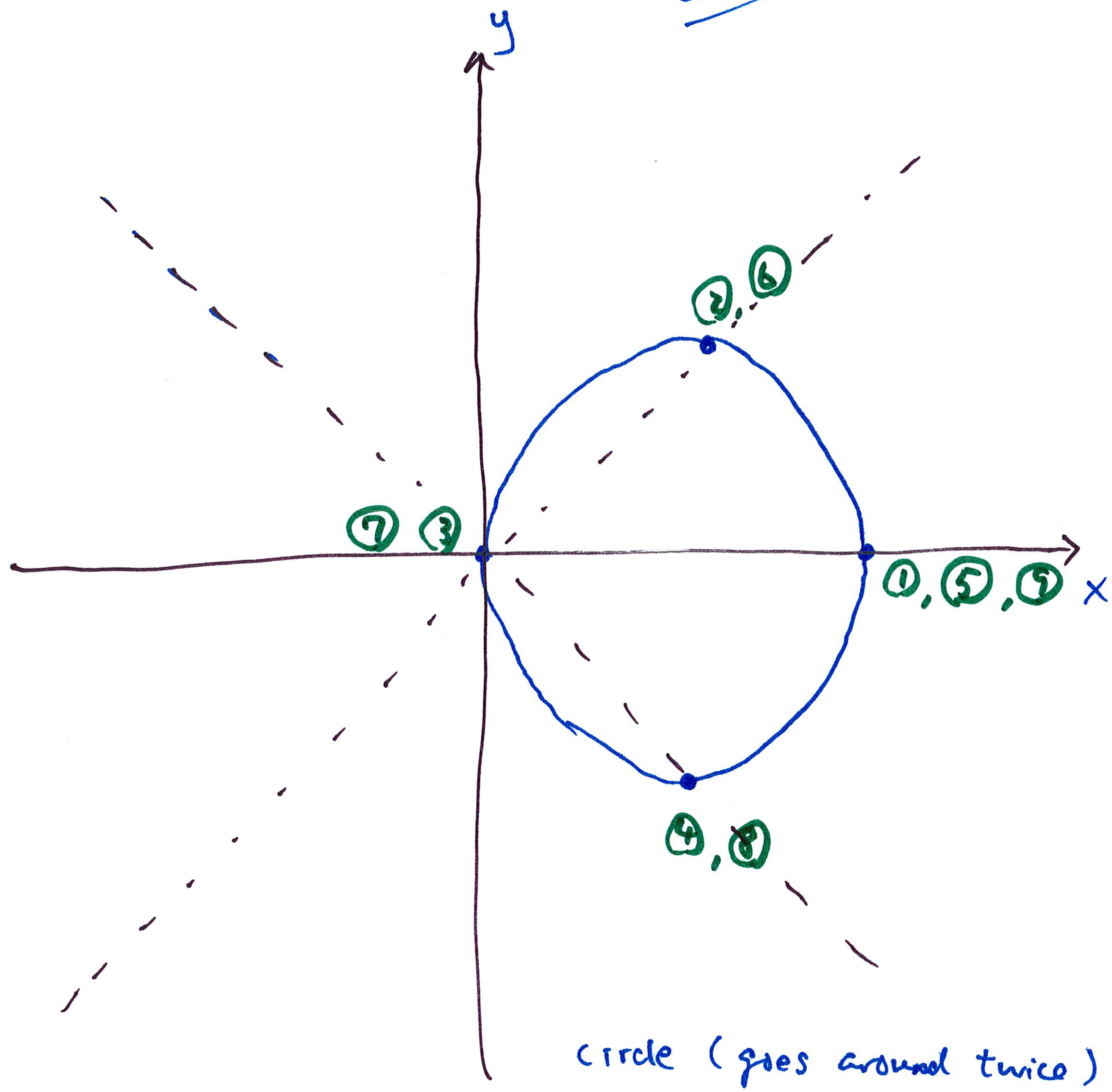
12.2 Polar Coordinates (continued)

graphs of polar equations

example $r = \cos(\theta)$

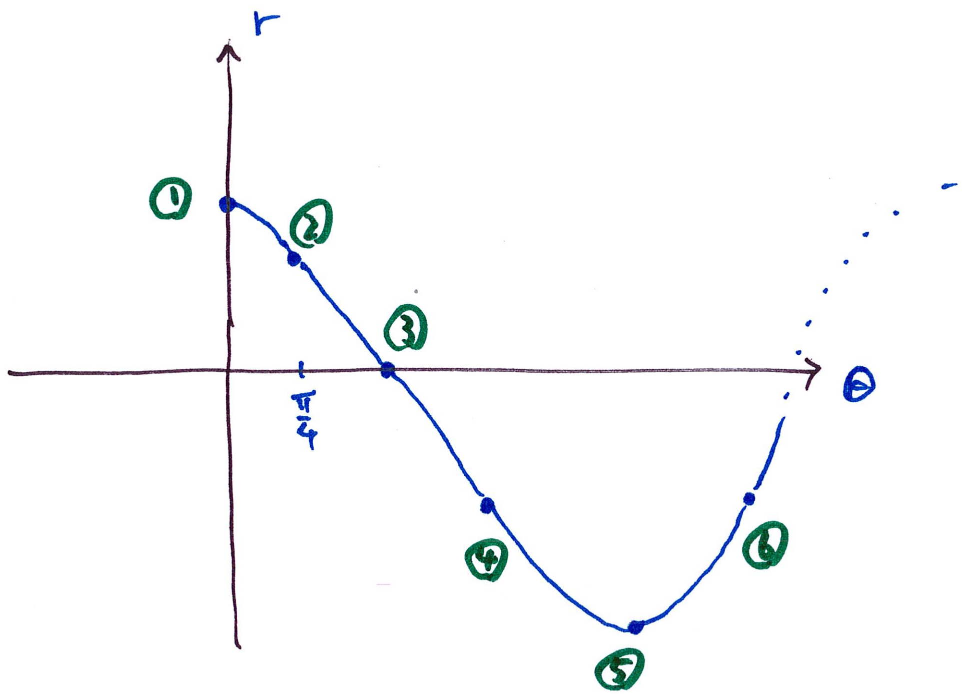
	θ	r		(r, θ)
1	0	1	$\Rightarrow$	$(1, 0)$
2	$\frac{\pi}{4}$	$\frac{1}{\sqrt{2}} \approx 0.7$	$\Rightarrow$	$(\frac{1}{\sqrt{2}}, \frac{\pi}{4})$
3	$\frac{\pi}{2}$	0		
4	$\frac{3\pi}{4}$	$-\frac{1}{\sqrt{2}} \approx -0.7$		
5	π	-1		
6	$\frac{5\pi}{4}$	-0.7		
7	$\frac{3\pi}{2}$	0		
8	$\frac{7\pi}{4}$	0.7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

Polar graph



circle (goes around twice)

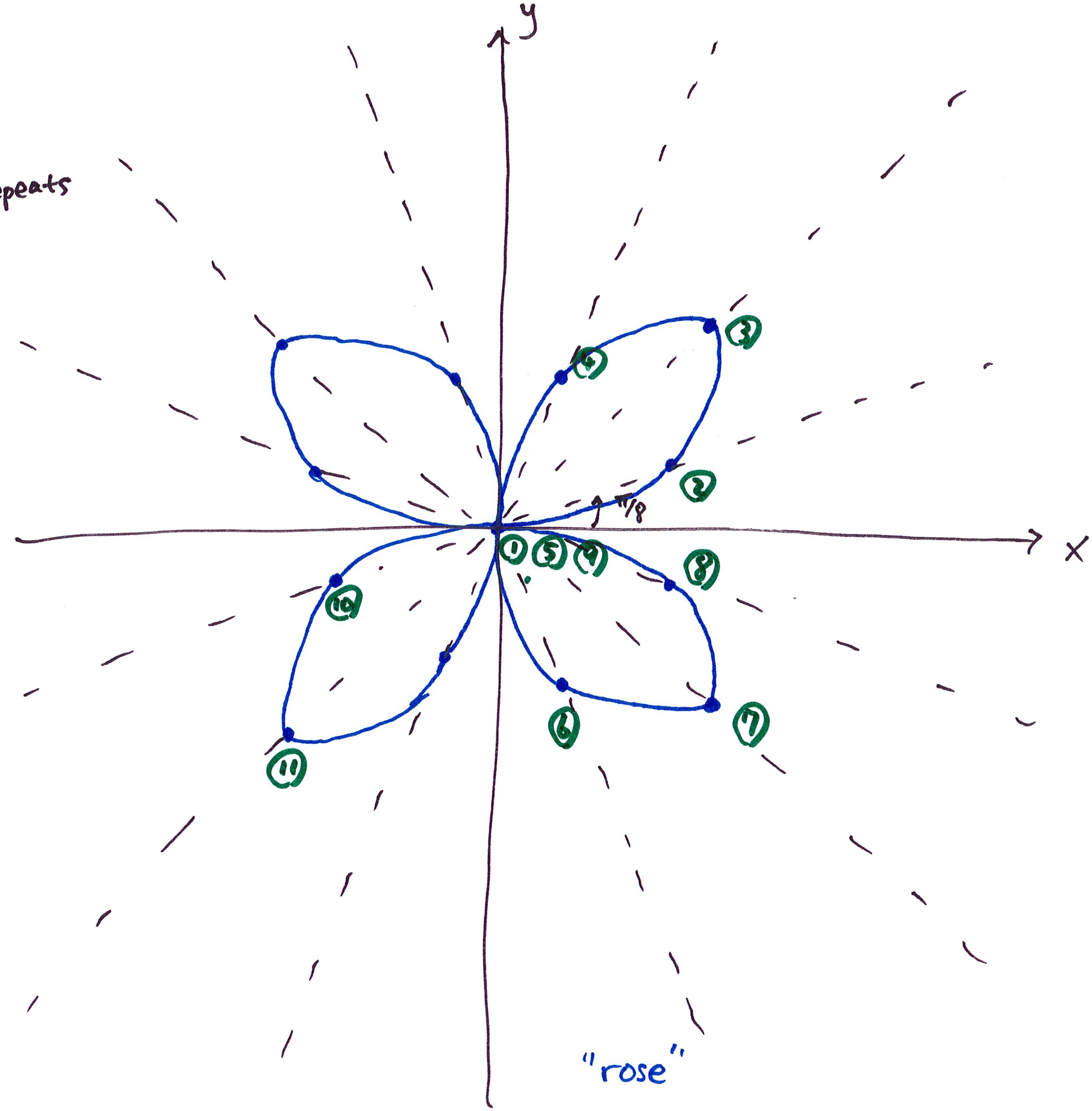
Its Cartesian graph is



example $r = \sin(2\theta)$ choose θ to go up to 2π

	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

cycle repeats



$r = \cos(n\theta)$ and $r = \sin(n\theta)$, where n is an integer

are both roses (same shape, one is shifted from the other)

if n is odd, the rose has n petals (see first example)

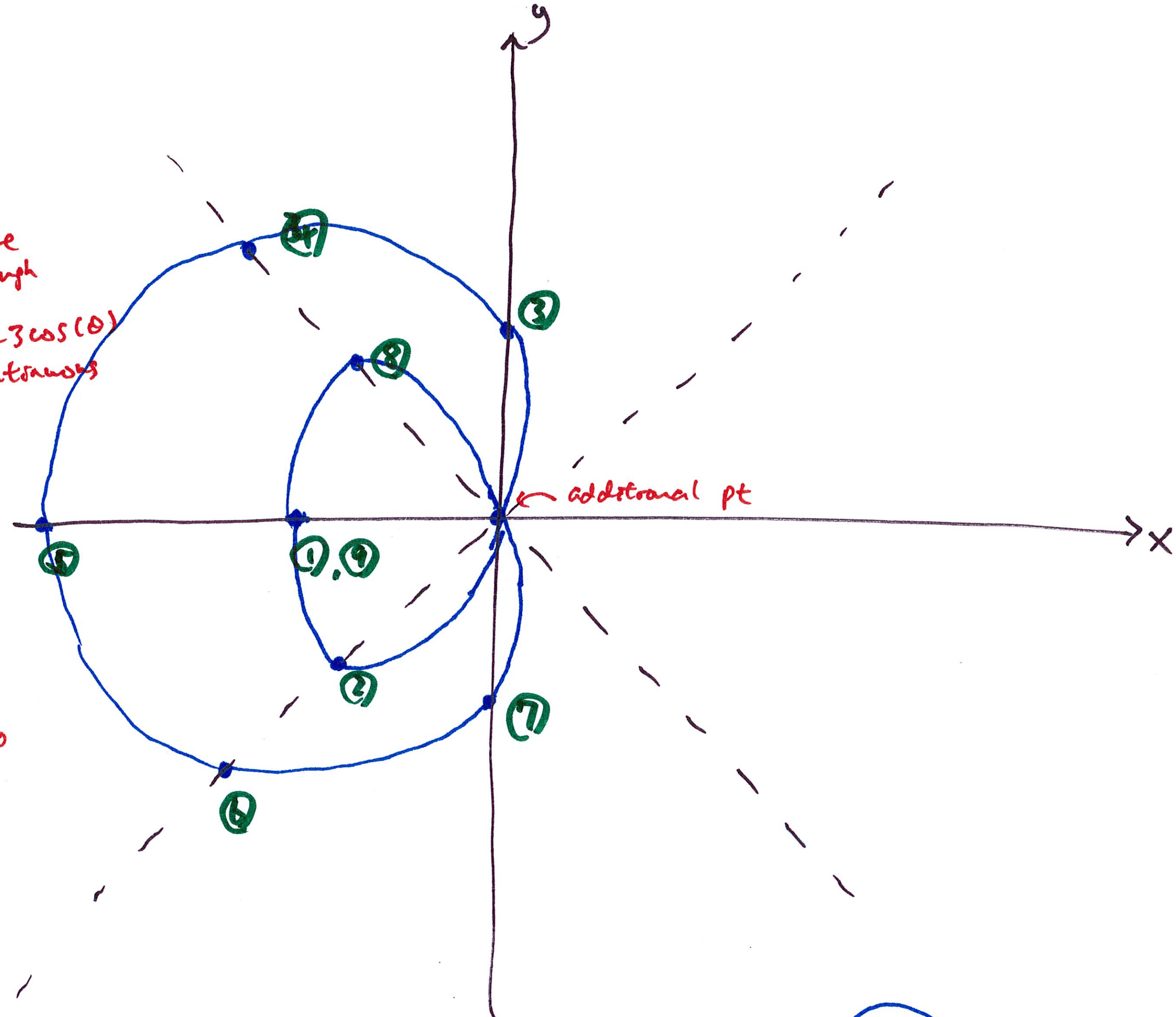
if n is even, the rose has $2n$ petals (see second example)

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

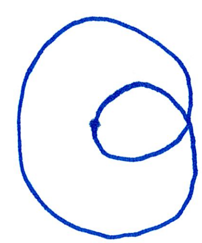
must have gone through $r=0$ since $1-3\cos(\theta)$ is continuous

must go through 0



insert more as needed for example, from 2 to 3 and 7 to 8

this should really look like

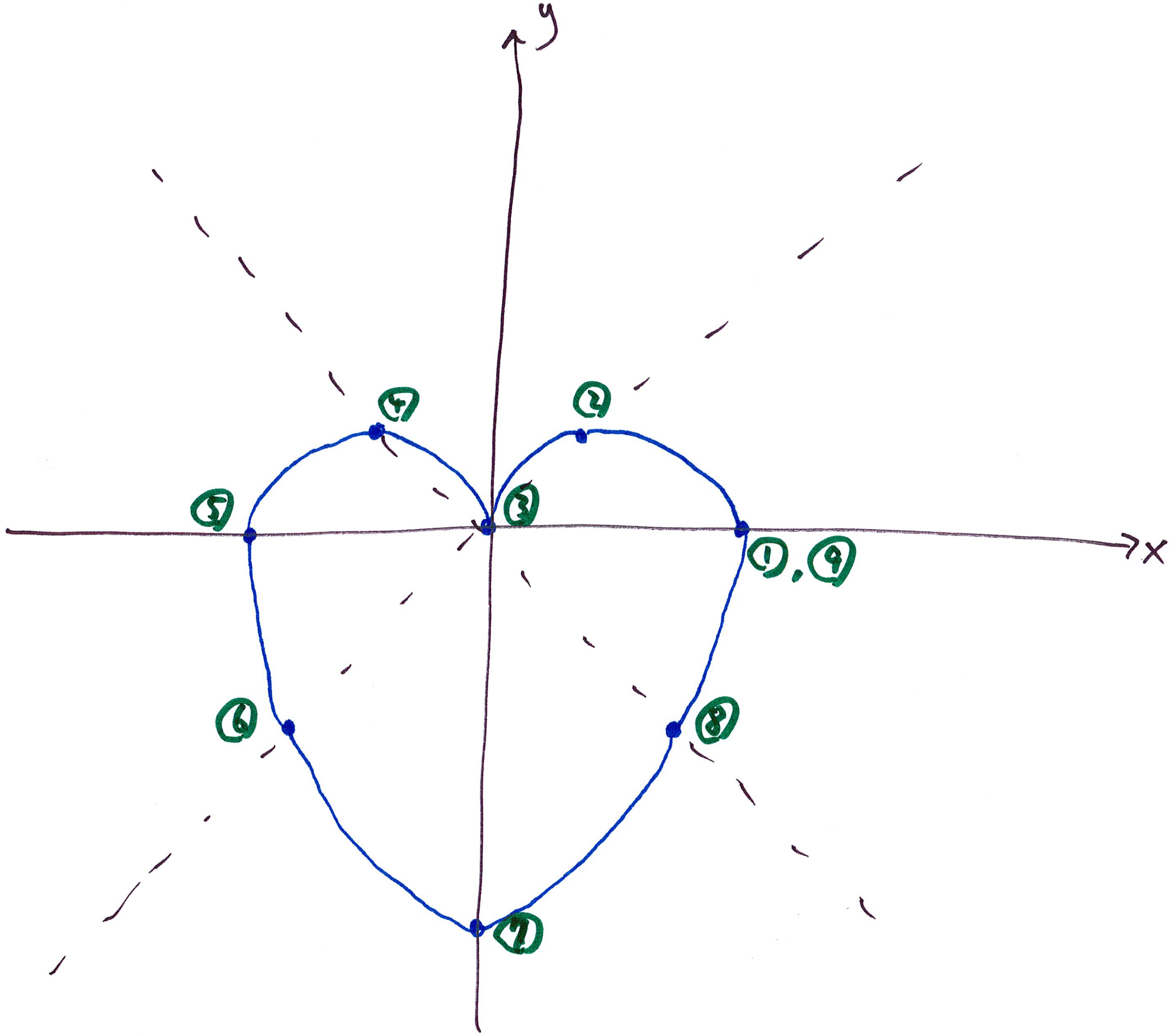


like a circle inside a circle

shape is called "limaçon" (snail)

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



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