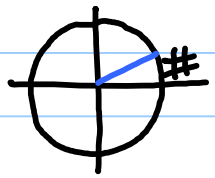
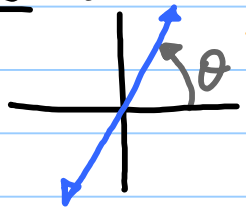
12/13 THU

6.4 Graphs of Polar Equations

Circle: $r = \#$ **Line:** $\theta = \#$

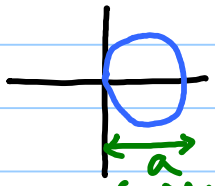


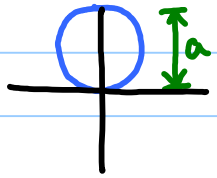


for all r values

Circles

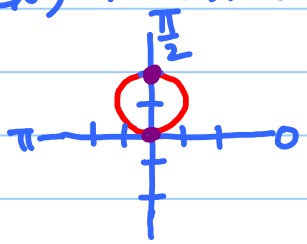
$r = a\cos\theta$ $r = a\sin\theta$





Test points: $0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$

ex) $r = 2\sin\theta$



θ	$\sin\theta$
0	0
$\frac{\pi}{2}$	2
π	0
$\frac{3\pi}{2}$	-2

Roses

$r = a\sin(n\theta)$ $r = a\cos(n\theta)$

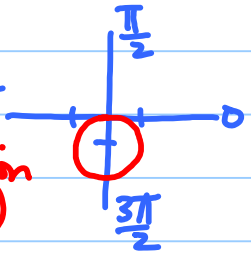
a: petal length

n: # of petals

n odd: # petals

n even: double # of petals

ex) $r = -2\sin\theta$

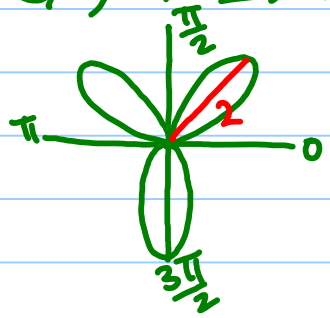


$-$: vert reflection (polar axis)

ex) $r = 2\sin 3\theta$

petal length: 2

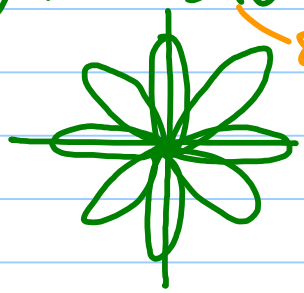
3 petals



ex) $r = 3\cos 4\theta$

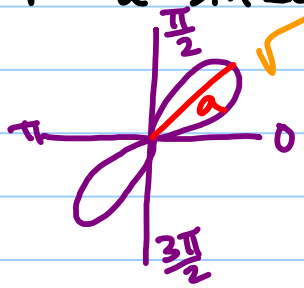
petal length: 3

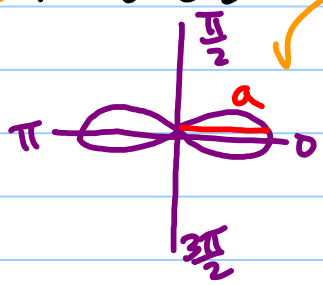
8 petals



Lemniscate (∞) propeller

$r^2 = a^2\sin 2\theta$ $r^2 = a^2\cos 2\theta$, $a \neq 0$

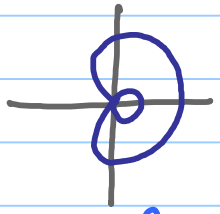




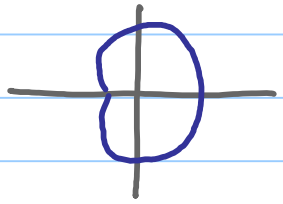
Limacons

$r = a + b\sin\theta$
$r = a - b\sin\theta$

If $\frac{a}{b} < 1$, → Inner Loop

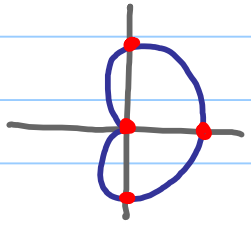


If $1 < \frac{a}{b} < 2$, → dimple
→ no loop

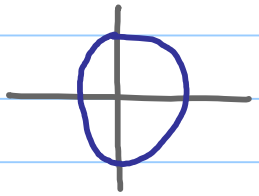


$r = a + b\cos\theta$
$r = a - b\cos\theta$

If $\frac{a}{b} = 1$ → Cardioid (heart)

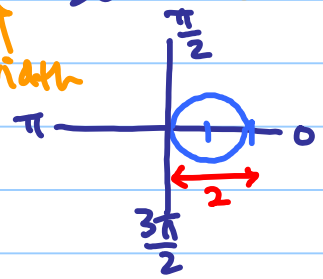


If $\frac{a}{b} \geq 2$ → no dimple
→ no loop

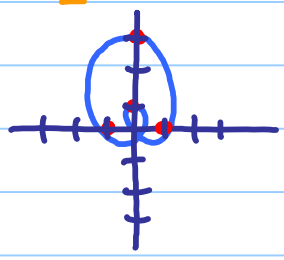


HW p 683, #14-32 even
(label parts, test 4 pts, identify the shape)

ex 1) $r = 2\cos\theta$ ← circle
width

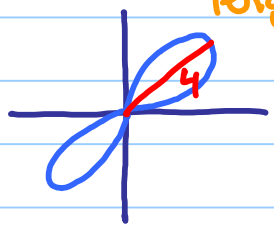


ex2) $r = 1 + 2\sin\theta$ ← limacon
$\frac{1}{2} < 1$ → Inner Loop

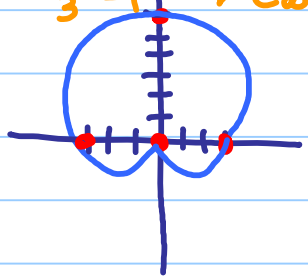


θ	1+2sinθ
0	1
π/2	3
π	1
3π/2	-1

ex3) $r^2 = 16\sin 2\theta$ ← lemniscate
length = 4



ex4) $r = 3 + 3\sin\theta$ → limacon
$\frac{3}{3} = 1$ → Cardioid



θ	3+3sinθ
0	3
π/2	6
π	3
3π/2	0