

Polar Graphs: Day 2 {Limacons and Intersections}

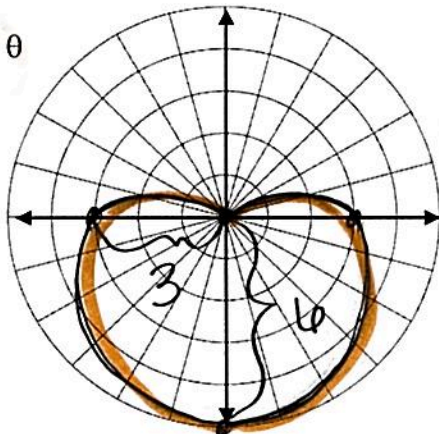
Name Key

Limacons $r = a \pm b \cos \theta$ or $r = a \pm b \sin \theta$

Cardioids:

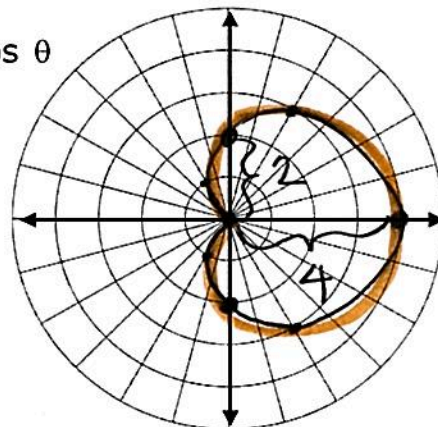
1) $r = 3 - 3 \sin \theta$

$a = 3$
 $a + b = 6$



2) $r = 2 + 2 \cos \theta$

$a = 2$
 $a + b = 4$



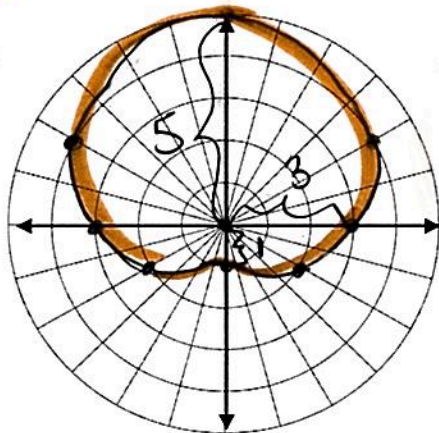
Things to remember:

- $a = b$
- a is the distance across the cardioid
- $a + b$ is the length of the cardioid
- \sin graphs are on the y -axis
- \cos graphs are on the x -axis

Dimpled limacons:

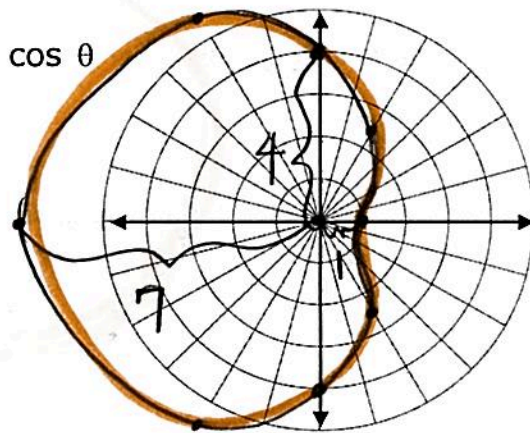
3) $r = 3 + 2 \sin \theta$

$a = 3$
 $a + b = 5$
 $a - b = 1$



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

$a = 4$
 $a + b = 7$
 $a - b = 1$

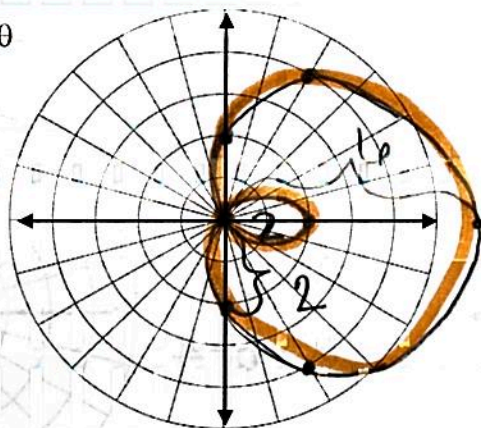


- $1 < \frac{a}{b} < 2$ { a is just a little bigger than b }
- a is the distance across the cardioid
- $a + b$ is the length of the cardioid from the pole
- $a - b$ is the length of the dimple
- \sin graphs are on the y -axis
- \cos graphs are on the x -axis

Limacons with an inner loop:

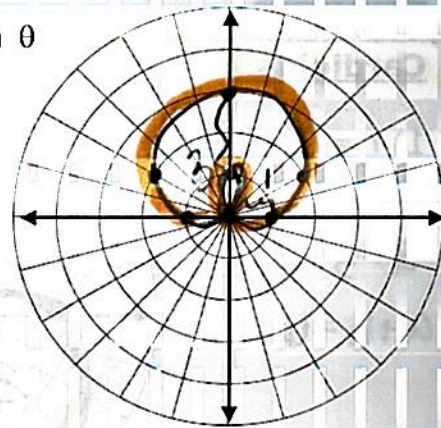
5) $r = 2 + 4 \cos \theta$

$a = 2$
 $a + b = 4$
 $b - a = 2$



6) $r = 1 + 2 \sin \theta$

$a = 1$
 $a + b = 3$
 $b - a = 1$

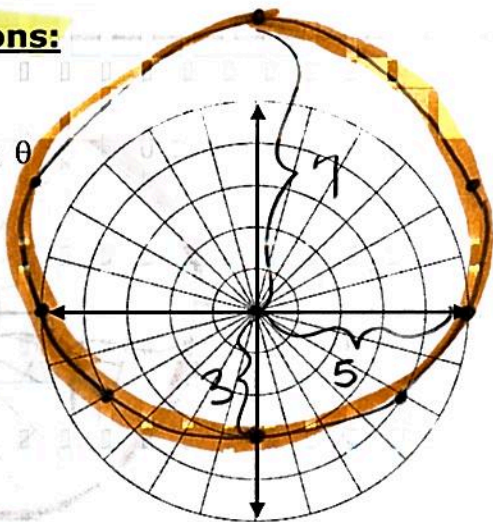


- a is less than b
- a is the distance across the cardioid
- $a + b$ is the length of the cardioid from the pole
- $b - a$ is the length of the loop
- \sin graphs are on the y -axis
- \cos graphs are on the x -axis

Convex limacons:

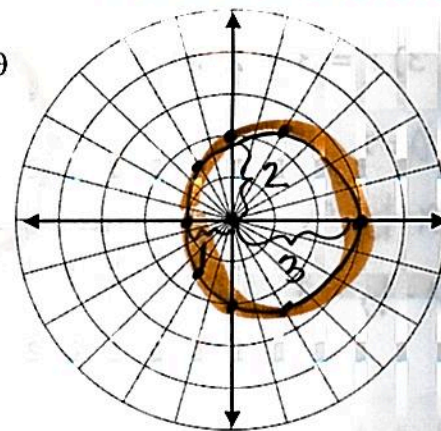
7) $r = 5 + 2 \sin \theta$

$a = 5$
 $a + b = 7$
 $a - b = 3$



8) $r = 2 + |\cos \theta|$

$a = 2$
 $a + b = 3$
 $a - b = 1$



- $\frac{a}{b} \geq 2$ { a is a lot bigger than b }
- a is the distance across the cardioid
- $a + b$ is the length of the cardioid from the pole
- $a - b$ is the length of the distance from the pole in the opposite direction
- \sin graphs are on the y -axis
- \cos graphs are on the x -axis

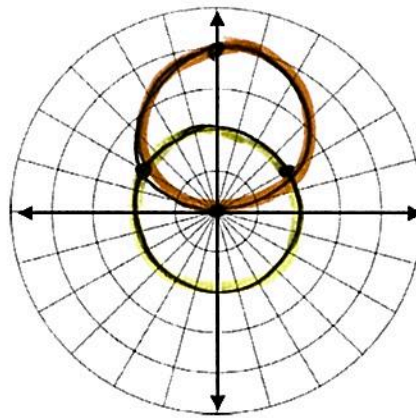
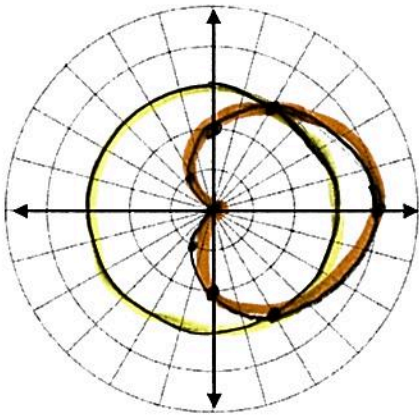
Algebraically - set equations =

Intersections of Conics

Sketch the two conics, then find the intersections points algebraically.

9) $r = 2 + 2 \cos \theta$, $r = 3$

10) $r = 4 \sin \theta$, $r = 2$



Intersection:

Intersection:

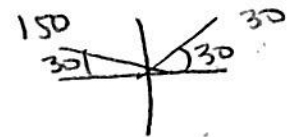
$$\frac{2 + 2 \cos \theta}{2} = \frac{3}{-2}$$

$$\frac{4 \sin \theta}{4} = \frac{2}{4}$$

✓	S	A	✓
	T	C	

$$\frac{2 \cos \theta}{2} = \frac{1}{2}$$

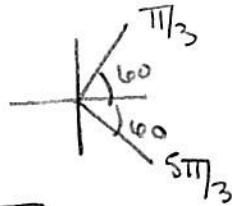
$$\sin \theta = \frac{1}{2}$$



$$\cos \theta = \frac{1}{2}$$

S	A	✓
T	C	✓

$$\theta = \frac{\pi}{3}, \frac{5\pi}{3}$$



$$\theta = \frac{\pi}{6}, \frac{5\pi}{6}$$

$$(2, \frac{\pi}{6}) \text{ and } (2, \frac{5\pi}{6})$$

$$(3, \frac{\pi}{3}) \text{ and } (3, \frac{5\pi}{3})$$

2000

2000

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Intersection

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