

6.5 Graphs of Polar Equations

$$r = 5 \cos 2\theta$$

$$r = 3 + 3 \cos \theta$$

$$r = 5$$

Types of Symmetry

1. The x-axis (polar axis)
2. The y-axis
3. The origin (the pole)

Symmetry Test for Polar Equations # 54

The graph of a polar equation has the indicated symmetry if when replaced you get an equivalent expression

Symmetry	Replace	By
1. The x-axis (polar axis)	(r, θ)	$(r, -\theta)$ or $(-r, \pi - \theta)$
2. The y-axis	(r, θ)	$(-r, -\theta)$ or $(r, \pi - \theta)$
3. The origin (the pole)	(r, θ)	$(-r, \theta)$ or $(r, \theta + \pi)$

Find the Symmetry of $r = 4 \sin 3\theta$

Rose Curves $r = a \sin n\theta$ $r = a \cos n\theta$

Analyze means find:

1. # of Petals

2. Length of Petals

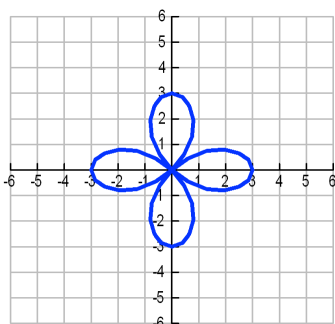
3. Domain

4. Range

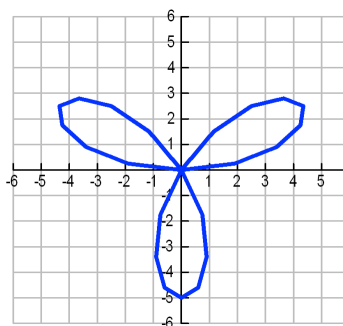
5. Symmetry

1. # of Petals

$$r = 3 \cos 2\theta$$



$$r = 5 \sin 3\theta$$



of Petals:

2. Length of Petals

Trace our Petals in the calculator

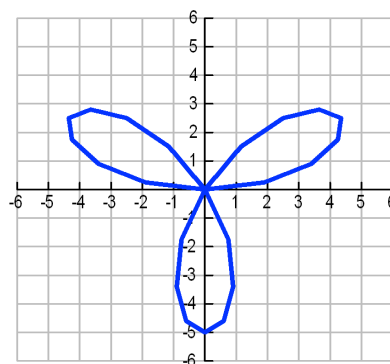
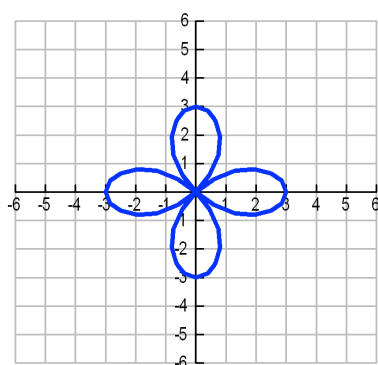
What do you find about the max and mins?

Length of Petals:

3. Domain/ 4. Range

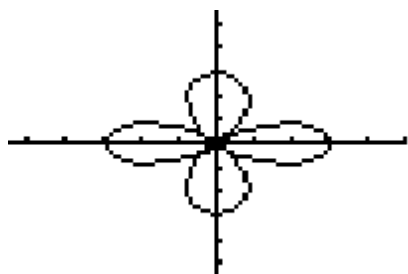
What do you put into a polar equation? (Domain)

What do you get out of a polar equation? (Range)

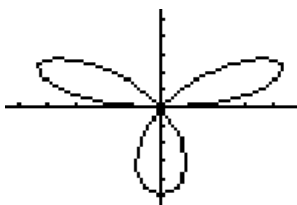


5. Symmetry

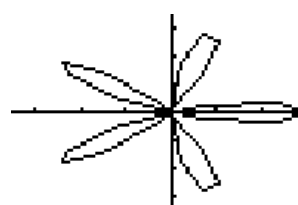
$$r = 3\cos 2\theta$$



$$r = 3\sin 3\theta$$



$$r = 3\cos 5\theta$$



What do you conclude about their symmetry?

Rose Curves

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of Petals: n , if n is odd
 $2n$, if n is even

Length of Petals: $|a|$

Domain: All real Numbers

Range: $[-|a|, |a|]$

Symmetry: n even, Symmetric about x , y -axis, and origin
 n odd, $r = a \cos n\theta$ symmetric about x -axis
 n odd, $r = a \sin n\theta$ symmetric about y -axis

Limaçon Curves

pronounced: LEE-ma-sohn

Analyzing means find:

1. Type

2. Domain

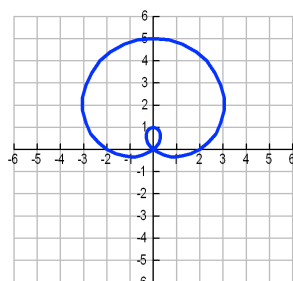
3. Range

4. Symmetry

1. Type

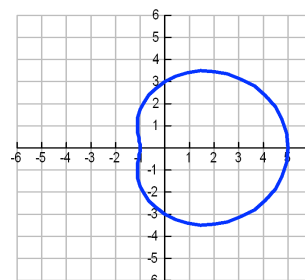
$$r = 2 + 3 \sin \theta$$

Looped
Limaçon



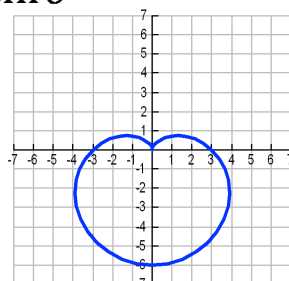
$$r = 3 + 2 \cos \theta$$

Dimpled
Limaçon



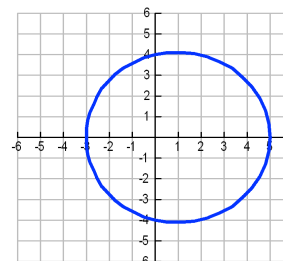
$$r = 3 - 3 \sin \theta$$

Cardioid



$$r = 4 + \cos \theta$$

Convex
Limaçon



2/3 Domain and Range

What do you put into a polar equation? (Domain)

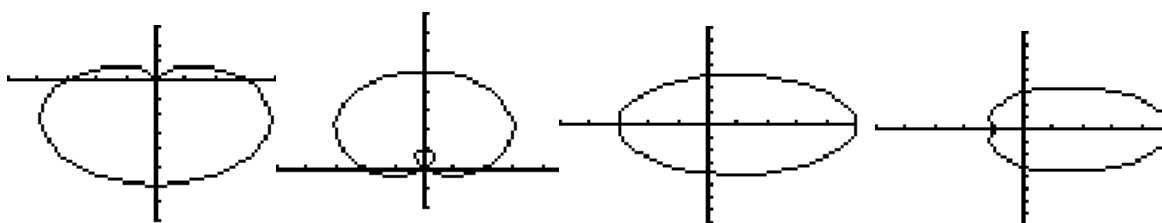
What do you get out of a polar equation? (Range)

Domain:

Range:

4. Symmetry

$$r = 3 - 3\sin\theta \quad r = 2 + 3\sin\theta \quad r = 4 + \cos\theta \quad r = 3 + 2\cos\theta$$



What do you conclude about their symmetry?

Limaçon Curves

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Domain: All real Numbers

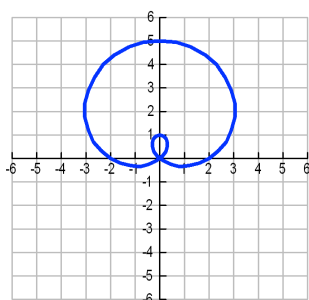
Range: $[a-b, a+b]$

Symmetry: $r = a \pm b \sin \theta$ symmetric about x-axis
 $r = a \pm b \cos \theta$ symmetric about y-axis

1. Type

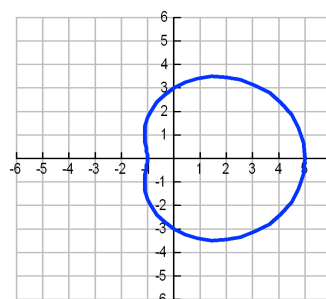
$$r = 2 + 3 \sin \theta$$

Looped
Limaçon



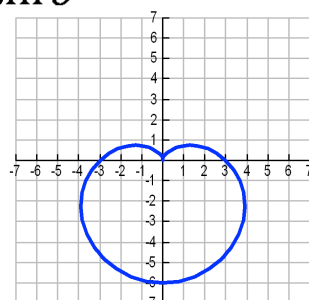
$$r = 3 + 2 \cos \theta$$

Dimpled
Limaçon



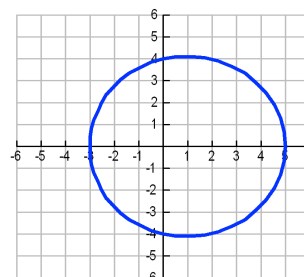
$$r = 3 - 3 \sin \theta$$

Cardioid



$$r = 4 + \cos \theta$$

Convex
Limaçon



Archimedes Curve

$$r = \theta$$

