6.5 Graphs of Polar Equations

I. General Form

- **Graphs of Polar Functions**
  - An infinite collection of rectangular coordinates (*x*, *y*) can be represented by an equation in terms of *x* and/or *y*.

- Collections of polar coordinates can be represented in a similar fashion, where:

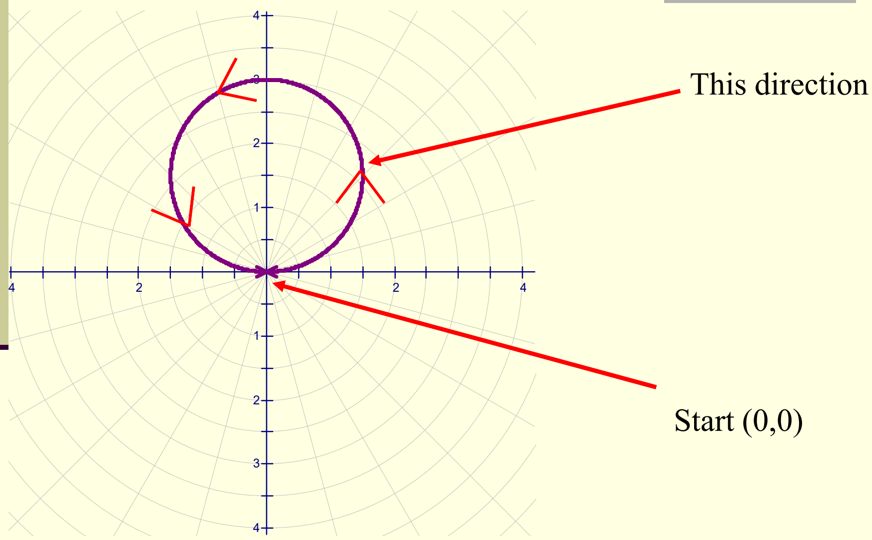
$$r = a \pm b\sin(c\theta)$$

or

$$r = a \pm b\cos(c\theta)$$

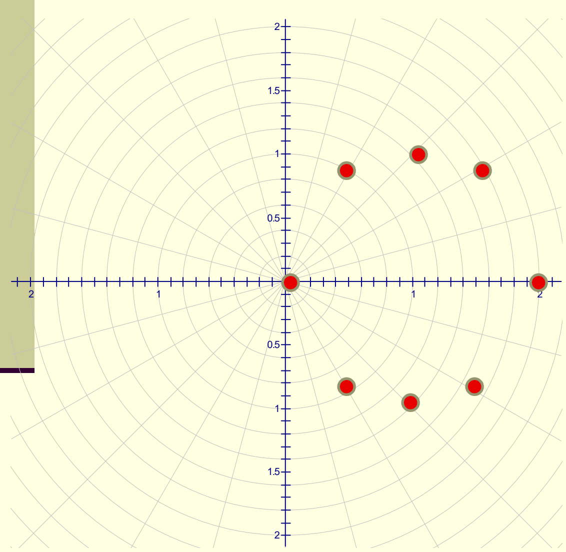
On your TI-83+, change your MODE to POLAR.
Set your window to [0,2π];[-5,5]; [-5,5] and graph

$$r = 3\sin\theta$$



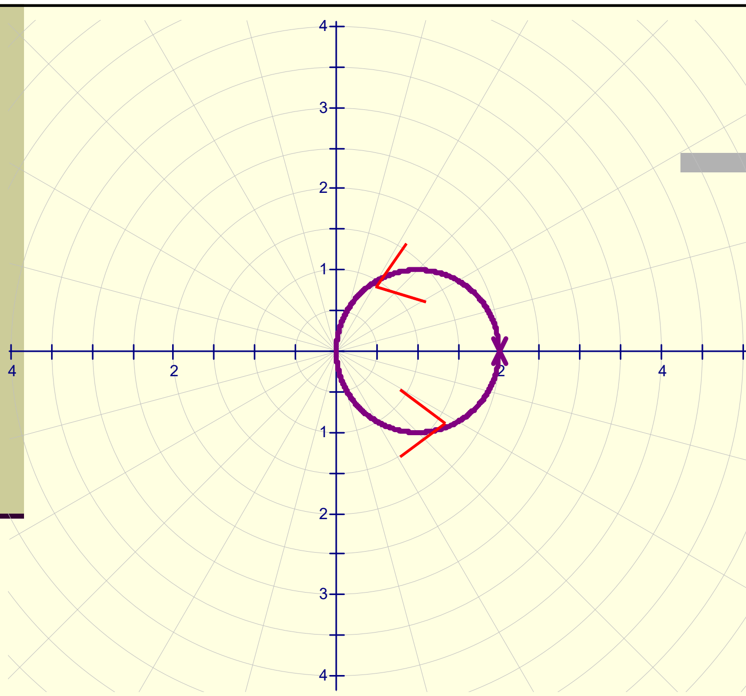
Ex. 1- Try a few of these.

1.) $r = 2\cos\theta$

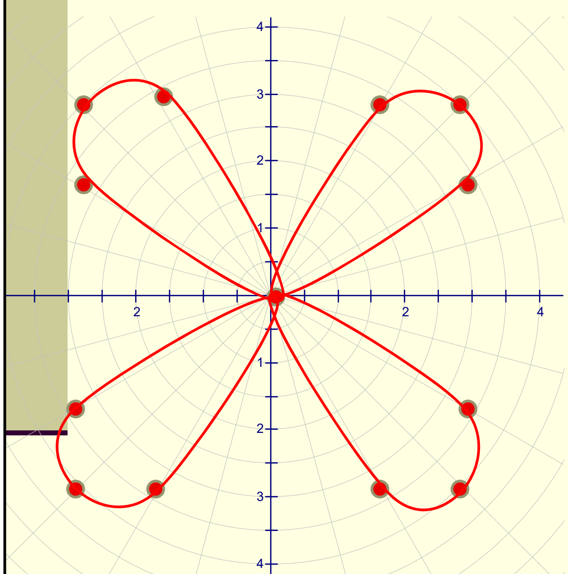


Make a table!!!

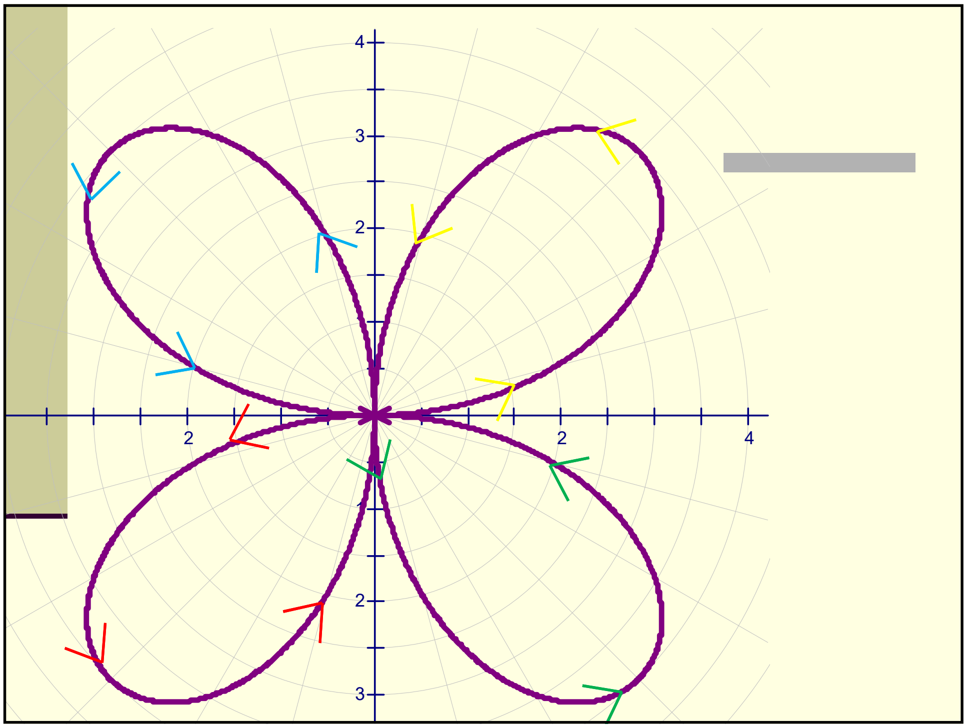
θ	r		θ	r
0	2		π	-2
$\pi/6$	$\sqrt{3}$		$7\pi/6$	$-\sqrt{3}$
$\pi/4$	$\sqrt{2}$		$5\pi/4$	$-\sqrt{2}$
$\pi/3$	1		$4\pi/3$	-1
$\pi/2$	0		$3\pi/2$	0
$2\pi/3$	-1		$5\pi/3$	1
$3\pi/4$	$-\sqrt{2}$		$7\pi/4$	$\sqrt{2}$
$5\pi/6$	$-\sqrt{3}$		$11\pi/6$	$\sqrt{3}$



2.) $r = -4\sin(2\theta)$



θ	r		θ	r
0	0		π	0
$\pi/6$	$-2\sqrt{3}$		$7\pi/6$	$2\sqrt{3}$
$\pi/4$	-4		$5\pi/4$	4
$\pi/3$	$-2\sqrt{3}$		$4\pi/3$	$2\sqrt{3}$
$\pi/2$	0		$3\pi/2$	0
$2\pi/3$	$-2\sqrt{3}$		$5\pi/3$	$2\sqrt{3}$
$3\pi/4$	-4		$7\pi/4$	4
$5\pi/6$	$-2\sqrt{3}$		$11\pi/6$	$2\sqrt{3}$



II. Analyzing Polar Equations

- Characteristics of a Polar:
  - Much the same as the characteristics of a rectangular equation.

Domain

Range (r – values)

Continuity

Symmetry

Boundedness

Max r-values

Asymptotes

Petals

II. Analyzing Polar Equations

- Symmetry Tests

TEST	REPLACE	WITH
x-axis	(r,θ)	$(r,-\theta)$ or $(-r,\pi-\theta)$
y-axis	(r,θ)	$(-r,-\theta)$ or $(r,\pi-\theta)$
Origin	(r,θ)	$(-r,\theta)$ or $(r,\theta-\pi)$

II. Analyzing Polar Equations

- Determine the symmetry for $r = 2sin\theta$.

x-axis: $r = 2\sin(-\theta) = -2\sin\theta$ **NO!**

y-axis: $-r = \sin(-\theta) = -2\sin\theta$ **YES!**

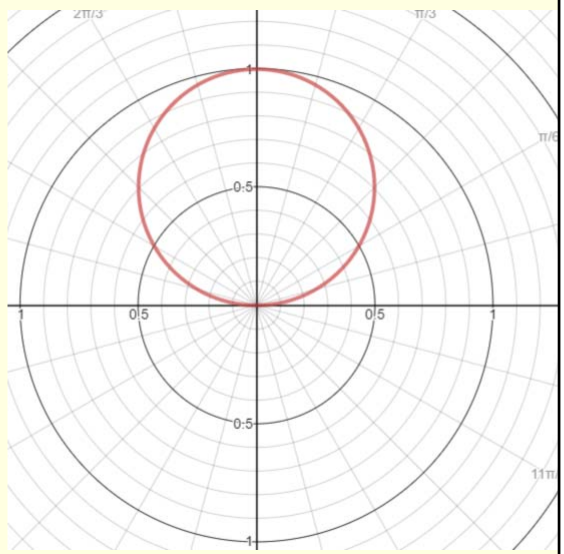
$r = 2\sin\theta$

Origin: $-r = 2\sin\theta$ **NO!**

$r = -2\sin\theta$

II. Analyzing Polar Equations

Analyze $r = sin\theta$



Domain: $(-\infty, \infty)$

Range: [0, 1]

Continuity: Yes

Symmetry: $y-$axis

Boundedness: BDD

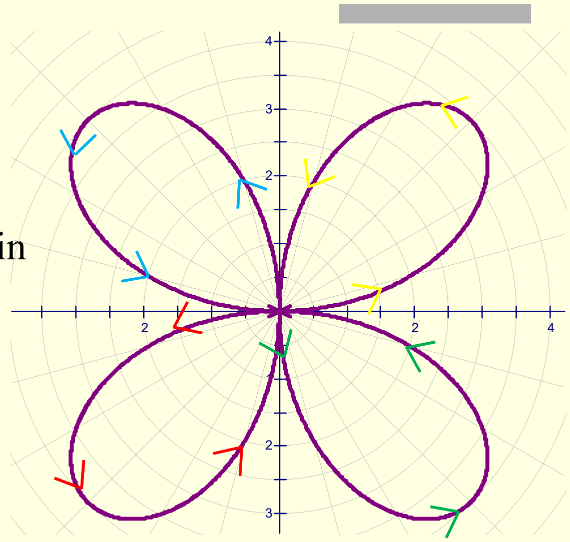
Max r-values: 1

Asymptotes:None

Petals: None

II. Analyzing Polar Equations

Analyze $r = -4sin(2\theta)$



Domain: $(-\infty, \infty)$

Range: [-4, 4]

Continuity: Yes

Symmetry: $y, x,$ origin

Boundedness: BDD

Max r-values: 4

Asymptotes:None

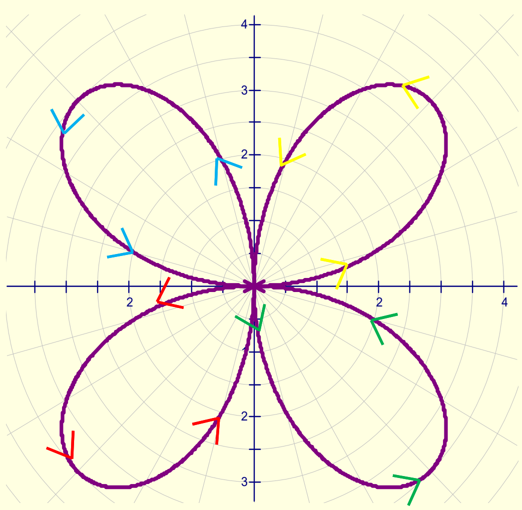
Petals: 4

II. Analyzing Polar Equations

Use your graphing calculator to analyze the following polar equations:

$$r = 3\sin(4\theta) \qquad r = 5\cos(3\theta) \qquad r = 2\sin(3\theta)$$

$$r = -4\cos(4\theta) \qquad r = 6\cos(-6\theta)$$



III. Rose Curves

- ***ROSE CURVE***
  - Any polar equation in the form of $r = asin(n\theta)$ or $r = acos(n\theta)$ where n is an integer greater than 1.

If n is odd, there are n petals.

If n is even, there are $2n$ petals.

III. Rose Curves

For all rose curves $r = asin(n\theta)$ and $r = acos(n\theta)$:

Domain: $(-\infty, \infty)$	Bound.: BDD
Range: $[-\lvert a\rvert, \lvert a\rvert]$	Max r-values: $\lvert a\rvert$
Continuity: Yes	Asym.: None
Sym: n - even : all three n - odd: cos - x-axis sin - y-axis	Petals: n odd $-$ n n even $-$ $2n$

MORE EXCITEMENT TO COME TOMORROW!!!!!