Section 6.5 Analyzing Polar Graphs

ROSE CURVES $r = a\cos(n\theta)$ $r = a\sin(n\theta)$ **where n is an integer greater than 1**

1. Graph: $r = 3\cos 2\theta$ $|a| = 3$ $n = 2$

(x, y) (r, θ)

$y = \cdots x$ $r = \cdots \theta$

range ↑ domain

How to graph a Polar Equation in the calculator.

Change Mode to POL (polar) *stay in radian mode

Type in equation for r1

Adjust window

$\theta min = 0, \theta max = 2\pi, \theta step = \pi/15$

X [-4,4]

Y[-4,4]

* x and y values will vary depending on the given equation

Change format (2nd zoom) to PolarGC

Analyze the graph:

Domain: $(-\infty, \infty)$ Range: $[-3, 3]$ Continuity: Continuous Boundedness: Bounded

Symmetry: in x-axis, in y-axis, about the origin Number of Petals: Petals: 4

Graphs of Rose Curves

The graphs of $r = a\cos n\theta$ and $r = a\sin n\theta$, where $n > 1$ is an integer, have the following characteristics:

Domain: $(-\infty, \infty)$
Range: $[-|a|, |a|]$
Continuous
Symmetry: n even, symmetric about x-axis, y-axis, and the origin
n odd, $r = a\cos n\theta$ symmetric about x-axis
n odd, $r = a\sin n\theta$ symmetric about y-axis
Bounded
Maximum $|r|$ value: $|a|$
No asymptotes
Number of petals: n, if n is odd; $2n$, if n is even

$r = 3\cos 3\theta$ → sym in x-axis
$r = 3\sin 3\theta$ → sym in y-axis
] 3 petals

Limaçon Curves

The limaçon curves are graphs of polar equations of the form

$$r = a \pm b \sin\theta \quad \text{and} \quad r = a \pm b \cos\theta,$$

where $a > 0$ and $b > 0$. *Limaçon*, pronounced "LEE-ma-sohn," is Old French for "snail." There are four different shapes of limaçons, as illustrated in Figure 6.52.

$a - b\sin\theta$

2. Graph $r = 3 - 3sin\theta$ in a graphing calculator, and analyze the graph.

Domain

$(-\infty, \infty)$

cont.

bounded.

Range $[0, 6]$ $[3-3, 3+3]$

sym. about y-axis

max $|r|$ value: 6

3. Graph $r = 2 + 3cos\theta$ in a graphing calculator, and analyze the graph.

Domain $(-\infty, \infty)$

Range $[-1, 5]$

$2-3$ $2+3$

Sym. about x-axis

max $|r|$ value = 5

Graphs of Limaçon Curves

The graphs of $r = a \pm b \sin\theta$ and $r = a \pm b \cos\theta$, where $a > 0$ and $b > 0$, have the following characteristics:

Domain: $(-\infty, \infty)$
Range: $[a - b, a + b]$
Continuous
Symmetry: $r = a \pm b \sin\theta$, symmetric about y-axis
$r = a \pm b \cos\theta$, symmetric about x-axis
Bounded
Maximum $|r|$ value: $a + b$
No asymptotes