

Precalculus Honors

Polar Graphs and Equations



Lesson 2: Polar Graphs and Equations

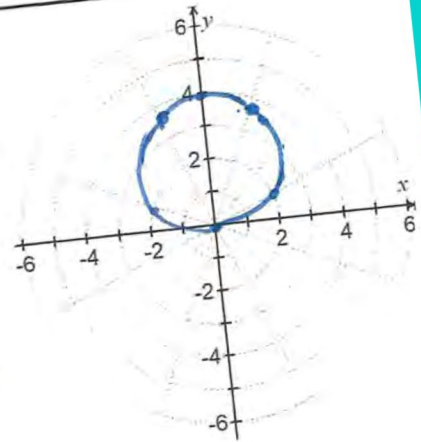
An equation whose variables are polar coordinates is called a **polar equation**. The graph of a polar equation consists of all points whose polar coordinates satisfy the equation.

EX #1: Point-Plotting Method.

Sketch the graph of $r = 4 \sin \theta$

θ	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π
r	0	2	3.46	4	3.46	2	0

symmetric with respect to y-axis
w/r/t



Completely Editable

6.2

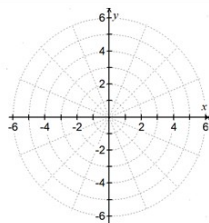
Lesson 6.2: Polar Graphs and Equations

An equation whose variables are polar coordinates is called a **polar equation**. The **graph of a polar equation** consists of all points whose polar coordinates satisfy the equation.

EX #1: Point-Plotting Method.

Sketch the graph of $r = 4 \sin \theta$

θ	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π
r							



If a polar equation involves only $r = a \sin \theta$ or $r = a \cos \theta$ your graph will be a circle. Can you describe the direction?

Tests for Symmetry

In order to graph other polar equations, we will use symmetry. Symmetry will make this much easier. Simply replace:

TEST	Verbally
$(r, \pi - \theta)$ $(-r, -\theta)$	
$(r, -\theta)$ $(-r, \pi - \theta)$	
$(-r, \theta)$ $(r, \pi + \theta)$	

The three tests are sufficient to guarantee symmetry.

That is... If a graph fails symmetry test it doesn't *must* be symmetric. The Quick Tests:

1. $r = f(\sin \theta)$ symmetric w/r/t: y-axis

Cardioid

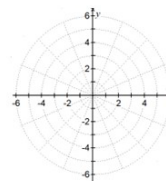
$$r = a \pm b \cos(\theta) \quad \text{and} \quad r = a \pm b \sin(\theta)$$

EX #2: Can you describe or explain a pattern?

A. $r = 2 + 2 \cos \theta$

Symmetry:

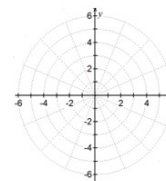
ratio:



B. $r = 2 - 2 \sin \theta$

Symmetry:

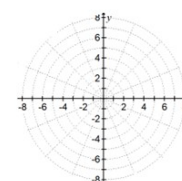
ratio:



D. $r = 5 - 2 \sin \theta$

Symmetry:

ratio:



Limaçon

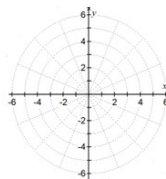
$$r = a \pm b \cos(\theta) \quad \text{and} \quad r = a \pm b \sin(\theta)$$

EX #3: Can you describe or explain a pattern?

A. $r = 1 - 2 \cos \theta$

Symmetry:

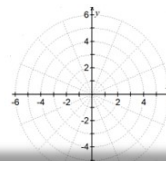
ratio:



B. $r = 1 + 2 \sin \theta$

Symmetry:

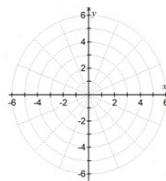
ratio:



C. $r = 1 + 2 \cos \theta$

Symmetry:

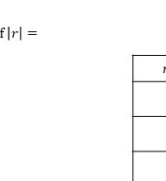
ratio:



D. $r = 1 - 2 \sin \theta$

Symmetry:

ratio:



Rose Curve

$$r = a \cos(n\theta) \quad \text{or} \quad r = a \sin(n\theta)$$

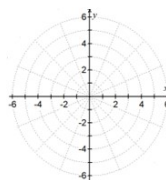
EX #4: For $n \geq 2$: if n is odd there will be _____ petals.

A. $r = 2 \cos(3\theta)$

Symmetry:

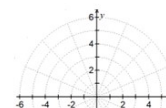
n :

petals:



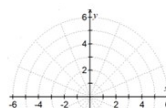
C. $r = 3 \cos(4\theta)$

Symmetry:



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

Symmetry:



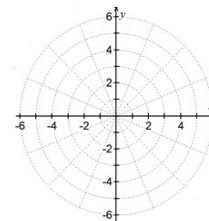
Zeros and Maximum R-Values

EX #5: Find zeros of $r^2 = 16 \sin 2\theta$

Zeros of r occur at:

Max of $|r| =$

r	θ



Graphing a Logarithmic Spiral

EX #6: Use a calculator to complete the table below. Then, graph the spiral $r = e^{\frac{\theta}{4}}$. We call this a logarithmic spiral because the equation may be written as $\theta = 4 \ln(r)$.

θ	$-\frac{3\pi}{2}$	$-\pi$	$-\frac{\pi}{2}$	$-\frac{\pi}{4}$	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$
r								



NOTES

6.2

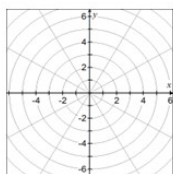
Graphs of Polar Equations Homework

Name _____

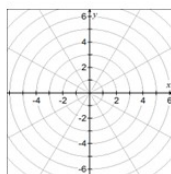
Date _____ Period _____

Problems 1–6, transform each polar equation to an equation in rectangular coordinates.

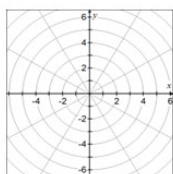
1. $\theta = \frac{\pi}{4}$



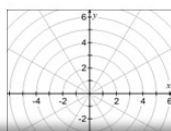
2. $r \sin \theta = 3$



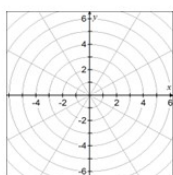
3. $r = -4 \sin \theta$



4. $r \csc \theta = 2$



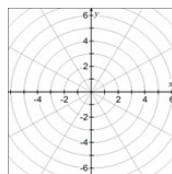
5. $r = 3 \cos \theta$



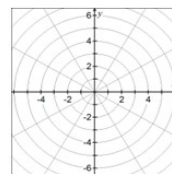
6. $r \cos \theta = -$

Problems 7–14, identify and graph each polar equation.

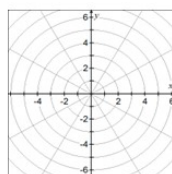
7. $r = 2 + 2 \sin \theta$



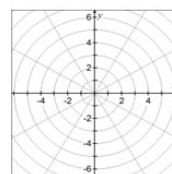
8. $r = 4 - 2 \cos \theta$



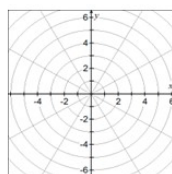
9. $r = 1 - 2 \sin \theta$



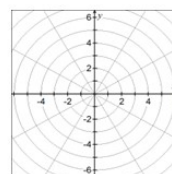
10. $r^2 = 9 \cos(2\theta)$



11. $r = 2 - 3 \cos \theta$



12. $r = 2 + 4 \sin \theta$



13. $r^2 = \sin(2\theta)$

14. $r = 2 \cos(3\theta)$

Practice Sets

Lesson Warm-Ups

	Range: Symmetry: Maximum r -value:
3. Find the length of each petal of the polar curve $r = 3 - 4 \cos(2\theta)$	4. Identify the point where maximum r -values occur on the graph of $r = 2 \cos(2\theta)$ $[0, 2\pi]$

Name _____ Date _____ Period _____	
Lesson 6.2: Polar Equations and Graphs Warm-Up # 2	
1. Determine the symmetry for $r = 2 + 2 \cos(\theta)$.	2. Identify the graph of $r = 2 - 4 \sin(\theta)$ Domain: Range: Symmetry: Maximum r -value:
3. Find the length of each petal of the polar curve $r = 2 + 5 \sin(2\theta)$	4. Identify the point where maximum r -values occur on the graph of $r = 3 \cos(2\theta)$ $[0, 2\pi]$

6.2 Polar Equations and Graphs Form A Name _____ Date _____ Period _____ 1. Determine the symmetry for $r = 1 - 3 \sin \theta$ 2. Identify the points where maximum r -values occur on the graph of $r = 3 \cos 2\theta$ from $[0, 2\pi]$ 3. Analyze the graph of $r = 3 - 3 \sin(\theta)$ Domain: Range: Symmetry: Maximum r -values:	6.2 Polar Equations and Graphs Form B Name _____ Date _____ Period _____ 1. Determine the symmetry for $r = 2 - 4 \cos \theta$ 2. Identify the points where maximum r -values occur on the graph of $r = 4 \sin 2\theta$ from $[0, 2\pi]$ 3. Analyze the graph of $r = 3 - 4 \sin(\theta)$ Domain: Range: Symmetry: Maximum r -values:
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Daily Lesson Quiz

Grade: _____	Grade: _____
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