

Polar Concepts

Name: _____

1. Give the number of petals of each rose curve.

a.) $r = 5 \sin \theta$ *circle*

b.) $r = 4 \cos 6 \theta$ *12*

c.) $r = -7 \sin 12 \theta$ *24*

d.) $r = 8 \cos 17 \theta$ *17*

2. Match each equation with its description

a.) $r = 6 \sin \theta$ *iv*

i. Cardioid

b.) $r = 7 - \sin \theta$ *ii*

ii. Dimpled Limacon

c.) $r = 5 - 5 \cos \theta$ *i*

iii. Limacon with inner loop

d.) $r = 7 \csc \theta$ *v*

iv. Circle

e.) $r = 2 + 3 \sin \theta$ *iii*

v. line

3. Explain how the graph of $r = a + 2 \sin \theta$ changes as "a" increases from 0 to 5.

a=0 circle

at a=2 cardioid the dimpled limaçon

at limaçon w/ large inner loop

as a continues to ↑ loop shrinks & outer loop grows

4. The maximum r-value of a polar equation is the largest value of 1/1 among the pairs (r, θ) that satisfy the equation.

5. Tell the kind of symmetry that each polar equation has if replacing (r, θ) by the indicated pair produces an equivalent polar equation. Choose from polar axis, y-axis, the pole or none of these.

a.) $(r, -\theta)$ *polar axis*

b.) $(-r, \theta)$ *pole (180° pt symmetry)*

c.) $(-r, \pi - \theta)$ *polar axis*

d.) $(r, \pi - \theta)$ *$\theta = \pi/2$ (y-axis)*

e.) $(r, \theta + \pi)$ *pole*

f.) $(-r, -\theta)$ *$\theta = \pi/2$ y-axis*

all (a, b) with the same b - look for symmetry

6. Give the rectangular coordinates of a point whose polar coordinates are (r, θ) .

$$(r \cos \theta, r \sin \theta)$$

7. Give a formula for the polar coordinates with $r > 0$ and $0 \leq \theta < 2\pi$ of a point whose rectangular coordinates are (x, y) located in the given quadrant.

a.) Quadrant I

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \tan^{-1} \frac{y}{x}$$

b.) Quadrant II

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \pi + \tan^{-1} \frac{y}{x}$$

c.) Quadrant III

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \pi + \tan^{-1} \frac{y}{x}$$

d.) Quadrant IV

$$r = \sqrt{x^2 + y^2}$$

$$\theta = 2\pi + \tan^{-1} \frac{y}{x}$$

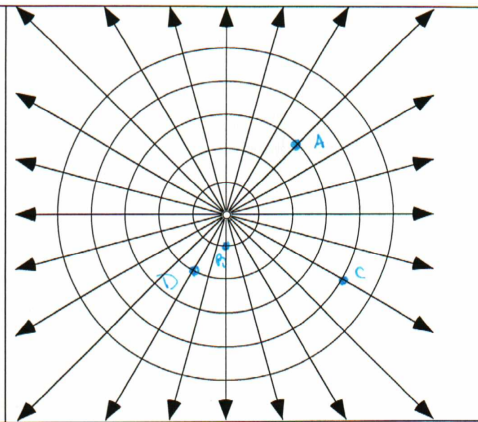
8. Sketch and label the point.

a.) $(3, 45^\circ)$

b.) $(1, 1.5\pi)$

c.) $(-4, 120^\circ)$

d.) $(-2, \pi/3)$



9. Find all the polar coordinates with $-2\pi \leq \theta \leq 2\pi$ for the point whose rectangular coordinates are $(-2, 0)$.

$$(2, \pi) \quad (-2, 0) \quad (-2, -2\pi) \quad (2, \pi) \quad (-2, 2\pi)$$

10. Find the error in this student's attempt to convert $r = -5 \sin \theta$ into rectangular form.

$$r = -5 \sin \theta$$

$$\sqrt{x^2 + y^2} = -5 \frac{y}{\sqrt{x^2 + y^2}}$$

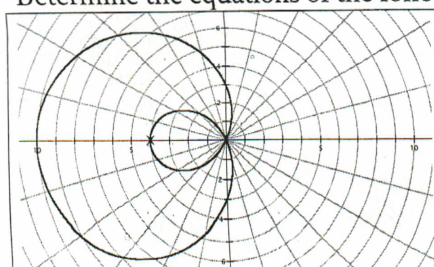
$$x^2 + y^2 = -5y$$

$$x^2 + y^2 + 5y = 0$$

$$r^2 = -5r \sin \theta$$

$$x^2 + y^2 = -5y$$

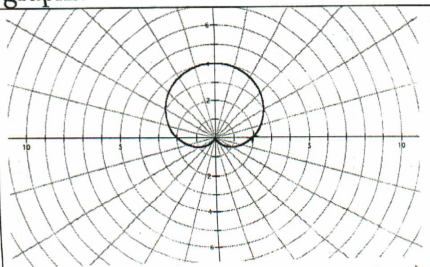
Determine the equations of the following graphs.



Sum = 10
Difference = 4

$-a = \text{loop}$
 $+a = \text{total}$
 $2a = 10$
 $2 - a = 4$
 $2b = 14$
 $b = 7$
 $a = 3$

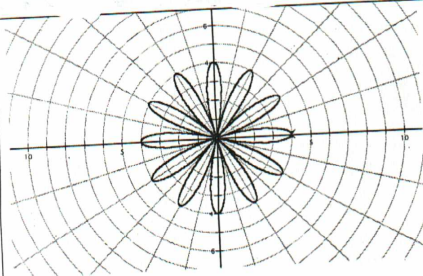
limaçon with loop
negative cosine
 $3 - 7 \cos \theta = r$



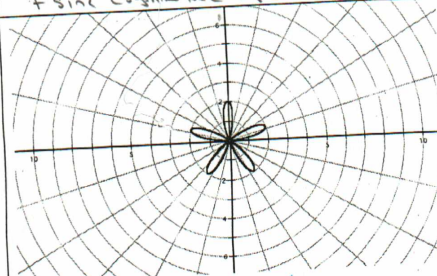
$$2 + 2 \sin \theta = r \quad a = b$$

cardioid
+ sine (symmetric top half)

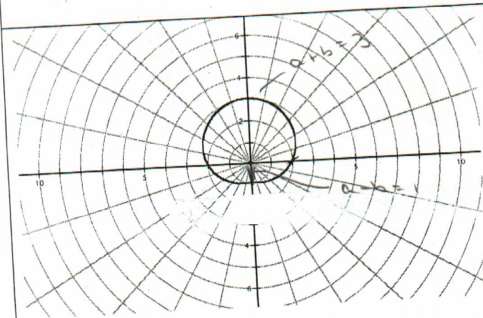
$a + a = 4$
 $2a = 4$
 $a = 2$



$$4 \cos 6\theta = r$$



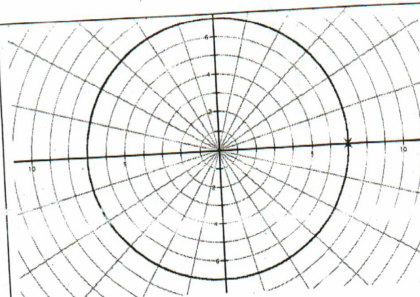
$$r = 2 \sin 5\theta$$



$a - b = 1$
 $a + b = 3$
 $2a = 4$
 $a = 2$
 $b = 1$

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

limaçon symmetric over "y-axis"



$$r = 7$$