

### 3.14A Polar Function Graphs

### 3.14A Practice

AP Precalculus

Describe the equation of the polar function. Fill in the table.

1.  $r = 6 \cos(5\theta)$

Type:

Line      Circle      **Rose**  
Opens:      Petals: **5**

Max distance from pole: **6**

Cycle:  **$[0, \pi]$**

$6 \cos(5 \cdot \frac{\pi}{6})$   
 $6 \cos(\frac{5\pi}{6})$   
 $6(-\frac{\sqrt{3}}{2})$   
 $-3\sqrt{3}$

$\theta$	$r$
$\frac{\pi}{6}$	$-3\sqrt{3}$
$\pi$	$-6$

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

Type:

Line      **Circle**      Rose  
Opens: **up**      Petals:

Max distance from pole: **4**

Cycle:  **$[0, \pi]$**

$4 \sin(\frac{\pi}{3})$   
 $4(\frac{\sqrt{3}}{2})$   
 $2\sqrt{3}$

$4 \sin(\frac{\pi}{2})$   
 $4(1)$   
**4**

$\theta$	$r$
$\frac{\pi}{3}$	$2\sqrt{3}$
$\frac{\pi}{2}$	<b>4</b>

3.  $r = 7$

Type:

Line      **Circle**      Rose  
Center: **pole**      Petals:

Max distance from pole: **7**

Cycle:  **$[0, 2\pi]$**

$r = 7$

$4 \sin(\frac{\pi}{2})$   
**4**

$\theta$	$r$
$\frac{\pi}{4}$	<b>7</b>
$\frac{3\pi}{2}$	<b>7</b>

4.  $r = \cos(6\theta)$

Type:

Line      Circle      **Rose**  
Opens:      Petals: **12**

Max distance from pole: **1**

Cycle:  **$[0, 2\pi]$**

$\cos(6 \cdot \frac{\pi}{6})$   
 $\cos(\pi)$   
**-1**

$\theta$	$r$
$\frac{\pi}{6}$	<b>-1</b>
$\frac{\pi}{2}$	<b>-1</b>

$\cos(6 \cdot \frac{\pi}{2})$   
 $\cos(3\pi)$   
**-1**

5.  $\theta = \frac{2\pi}{3}$

Type:

**Line**      Circle      Rose  
Opens:      Petals:

Max distance from pole: **undefined**

Cycle: **none**

$\theta = \frac{2\pi}{3}$

$\theta$	$r$
$\frac{2\pi}{3}$	5
$\frac{2\pi}{3}$	-2

$\theta = \frac{2\pi}{3}$   
 $-8 \sin(3 \cdot \frac{\pi}{4})$   
 $-8 \sin(\frac{3\pi}{4})$   
 $-8 \cdot \frac{\sqrt{2}}{2}$   
 $-4\sqrt{2}$

$\theta$	$r$
$\frac{\pi}{4}$	$-4\sqrt{2}$
$\frac{\pi}{2}$	<b>8</b>

$-8 \sin(3 \cdot \frac{\pi}{2})$   
 $-8 \sin(\frac{3\pi}{2})$   
 $-8(-1)$   
**8**

6.  $r = -8 \sin(3\theta)$

Type:

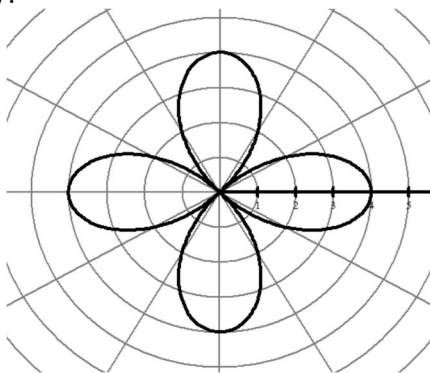
Line      Circle      **Rose**  
Opens:      Petals: **3**

Max distance from pole: **8**

Cycle:  **$[0, \pi]$**

Write the equation of the polar function.

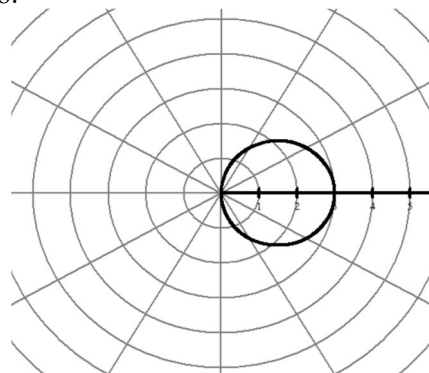
7.



Equation:  $r = 4 \cos(2\theta)$

rose starts on polar axis = cosine

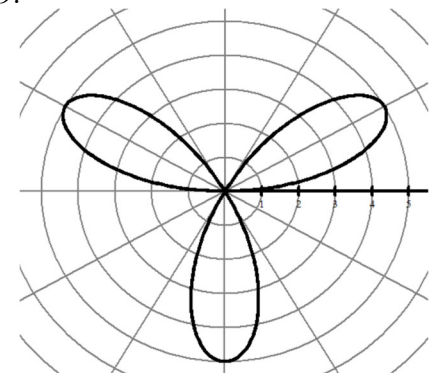
8.



Equation:  $r = 3 \cos(\theta)$

circle that opens right = + cosine

9.

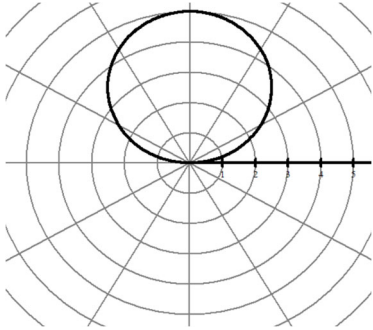


Equation:  $r = 5 \sin(3\theta)$

rose does not start on polar axis = sine

Write the equation of the polar function.

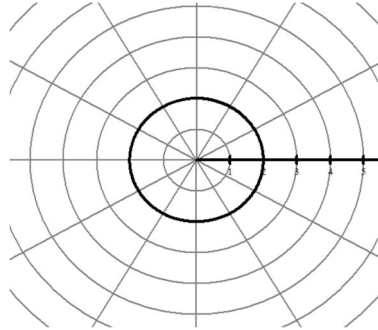
10.



Equation:  $r = 5 \sin(\theta)$

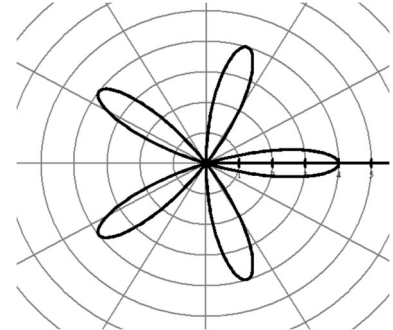
circle that opens up = + sine

11.



Equation:  $r = 2$

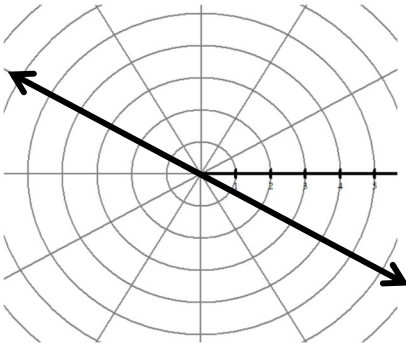
12.



Equation:  $r = 4 \cos(5\theta)$

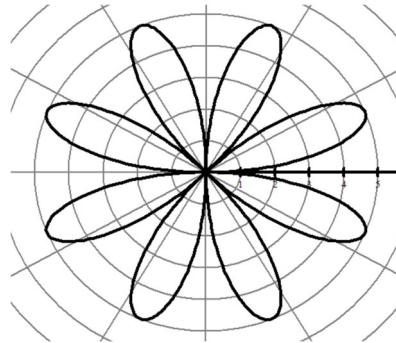
rose starts on polar axis = cosine

13.



Equation:  $\theta = \frac{5\pi}{6}$  or  $\frac{11\pi}{6}$

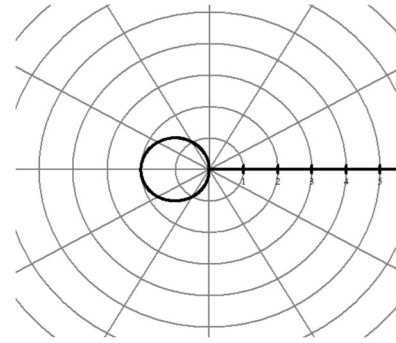
14.



Equation:  $r = 5 \sin(4\theta)$

rose does not start on polar axis = sine

15.

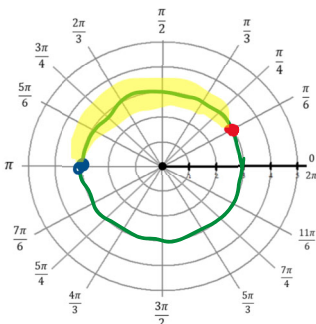


Equation:  $r = -2 \cos(\theta)$

circle that opens left = - cosine

Sketch a graph. Find the endpoints of the restricted domain and highlight this interval on the function. (Use graphing calculator to verify your answers)

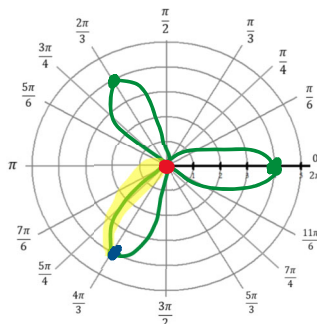
16.  $r = 3$



Endpoints of  $\frac{\pi}{6} \leq \theta \leq \pi$

$(3, \frac{\pi}{6})$   $(3, \pi)$

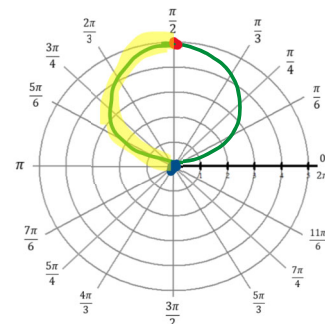
17.  $r = 4 \cos(3\theta)$



Endpoints of  $\frac{\pi}{6} \leq \theta \leq \frac{\pi}{3}$

$4 \cos(3 \cdot \frac{\pi}{6})$   $4 \cos(3 \cdot \frac{\pi}{3})$   
 $4 \cos(\frac{\pi}{2})$   $4 \cos(\pi)$   
 $4(0)$   $4(-1)$   
 $(0, \frac{\pi}{6})$   $(-4, \frac{\pi}{3})$

18.  $r = 5 \sin(\theta)$



Endpoints of  $\frac{\pi}{2} \leq \theta \leq \pi$

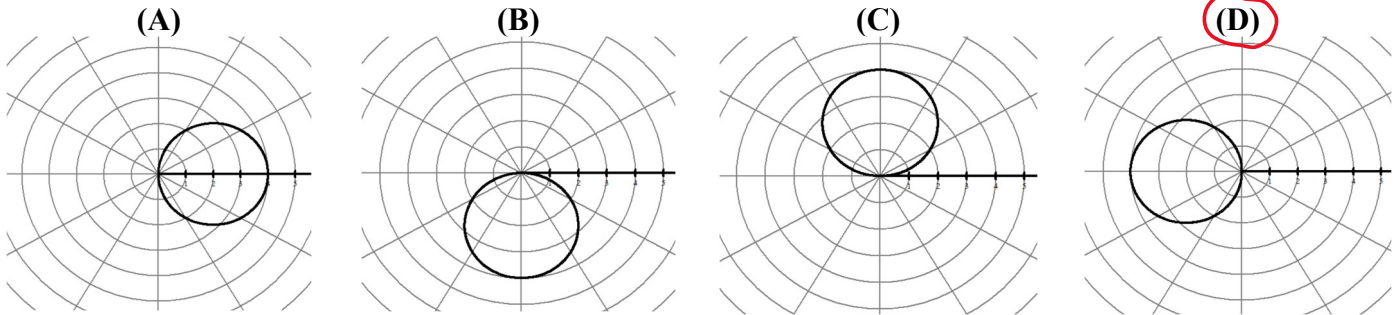
$5 \sin(\frac{\pi}{2})$   $5 \sin(\pi)$   
 $5(1)$   $5(0)$   
 $(5, \frac{\pi}{2})$   $(0, \pi)$

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## 3.14A Test Prep

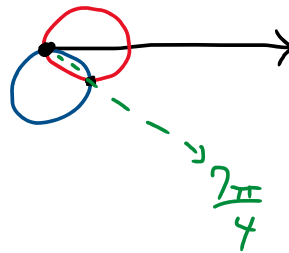
19. Which of the following is the graph of the polar function  $r = f(\theta)$ , where  $f(\theta) = -4 \cos \theta$ , in the polar coordinate system for  $0 \leq \theta \leq 2\pi$ ?

negative cosine circle so it opens left and has radius of 4



20. The graph of polar function  $r = f(\theta)$  and  $r = g(\theta)$ , where  $f(\theta) = 4 \cos \theta$  and  $g(\theta) = -4 \sin \theta$ , in the polar coordinate system for  $0 \leq \theta \leq 2\pi$ . Which of the following is a possible polar coordinate for  $f(\theta) = g(\theta)$ ?

- (A)  $(2\sqrt{2}, \frac{\pi}{4})$
- (B)  $(2\sqrt{2}, \frac{3\pi}{4})$
- (C)  $(2\sqrt{2}, \frac{5\pi}{4})$
- (D)  $(2\sqrt{2}, \frac{7\pi}{4})$



$$\frac{4 \cos \theta}{4} = \frac{-4 \sin \theta}{4}$$

$$\cos \theta = -\sin \theta$$

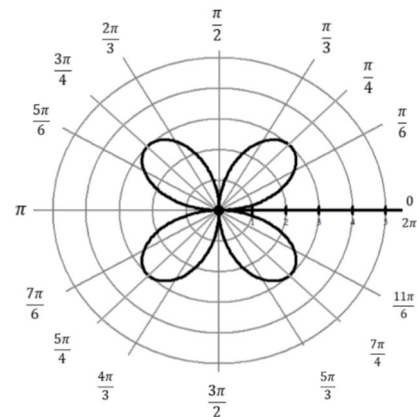
$$\theta = \frac{3\pi}{4} \text{ or } \frac{7\pi}{4}$$

$$4 \cos\left(\frac{7\pi}{4}\right) = -4 \sin\left(\frac{7\pi}{4}\right)$$

$$r = 2\sqrt{2} \rightarrow 4\left(\frac{\sqrt{2}}{2}\right) = -4\left(-\frac{\sqrt{2}}{2}\right)$$

21. The graph of the polar function  $r = f(\theta)$ , is given the polar coordinate system. Which of the following defines  $f(\theta)$  for  $0 \leq \theta \leq 2\pi$ ?

- (A)  $f(\theta) = 3 \sin(2\theta)$
- (B)  $f(\theta) = 3 \sin(4\theta)$
- (C)  $f(\theta) = 3 \cos(2\theta)$
- (D)  $f(\theta) = 3 \cos(4\theta)$



sine rose because it doesn't start on polar axis

has 4 petals which is even so  $n = 2$

maximum distance from pole is 3