

Objective(s): Graph basic polar equations.

Warmup (10 min):

1. Convert each of the following from rectangular coordinates to polar coordinates.

A.) $(4, -4\sqrt{3})$

$$r = \sqrt{4^2 + (-4\sqrt{3})^2} = \sqrt{16 + 48} = \sqrt{64} = 8$$

$$\theta = \tan^{-1}\left(\frac{-4\sqrt{3}}{4}\right)$$

$$\theta = 300^\circ$$

$$(8, 300^\circ)$$

B.) $(5, -5)$

$$r = \sqrt{5^2 + (-5)^2} = \sqrt{50} = 5\sqrt{2}$$

$$\theta = \tan^{-1}\left(-\frac{5}{5}\right)$$

$$\theta = 315^\circ$$

$$(5\sqrt{2}, 315^\circ)$$

2. Convert from polar coordinates to rectangular coordinates.

A.) $(6, -120^\circ)$

$$x = 6 \cos(-120^\circ) = 6\left(-\frac{1}{2}\right) = -3$$

$$y = 6 \sin(-120^\circ) = 6\left(-\frac{\sqrt{3}}{2}\right) = -3\sqrt{3}$$

$$(-3, -3\sqrt{3})$$

B.) $(2, \frac{\pi}{4})$

$$x = 2 \cos\left(\frac{\pi}{4}\right) = 2\left(\frac{\sqrt{2}}{2}\right) = \sqrt{2}$$

$$y = 2 \sin\left(\frac{\pi}{4}\right) = 2\left(\frac{\sqrt{2}}{2}\right) = \sqrt{2}$$

$$(\sqrt{2}, \sqrt{2})$$

3. Give 3 additional coordinates for $(2, 210^\circ)$

$$(2, -150^\circ)$$

$$(-2, 30^\circ)$$

$$(-2, -330^\circ)$$

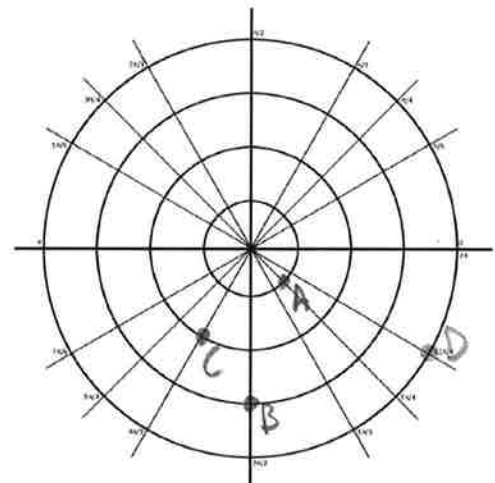
4. Plot and label the following points.

A $(1, -45^\circ)$

B $(3, \frac{3\pi}{2})$

C $(-2, -300^\circ)$

D $(-4, 150^\circ)$



Graphs of basic Polar equations:

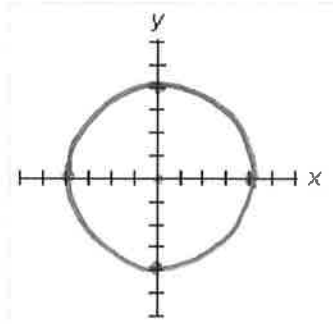
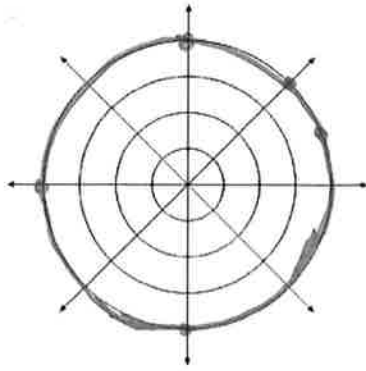
Convert to rectangular form and then graph. Compare with the polar graph.

A.) $r = 2$

$r^2 = 4$

$x^2 + y^2 = 4$

θ	r
0	2
$\pi/6$	2
$\pi/4$	2
$\pi/2$	2
π	2
$3\pi/2$	2



B.) $\theta = \frac{\pi}{3}$

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

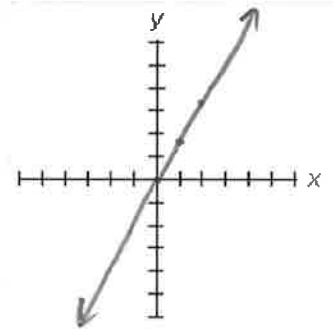
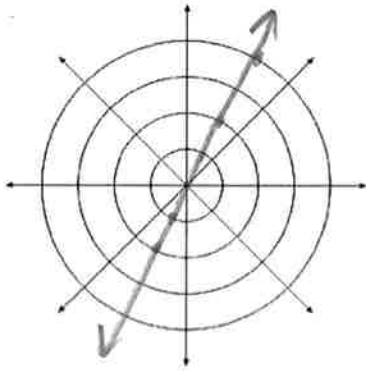
$\frac{y}{x} = \sqrt{3}$

$y = \sqrt{3} \cdot x$

y-int.: (0,0)

slope: $\frac{\sqrt{3}}{1}$

θ	r
$\pi/3$	1
$\pi/3$	-1
$\pi/3$	2
$\pi/3$	-2
$\pi/3$	4



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

$r^2 = 4r \cos \theta$

$x^2 + y^2 = 4x$

$x^2 - 4x + y^2 = 0$

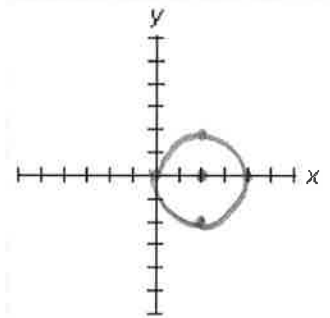
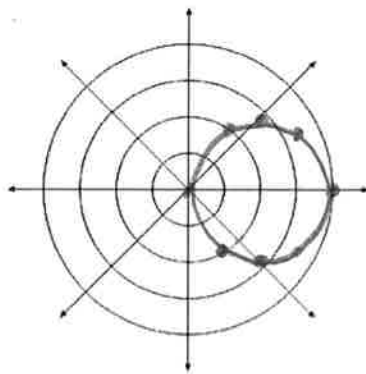
$x^2 - 4x + 4 + y^2 = 0 + 4$

$(x-2)^2 + y^2 = 4$

Center: (2,0)

radius: 2

θ	r
0	4
$\pi/6$	$2\sqrt{3} \approx 3.4$
$\pi/4$	$2\sqrt{2} \approx 2.8$
$\pi/3$	2
$\pi/2$	0
$2\pi/3$	-2
$3\pi/4$	$-2\sqrt{2} \approx -2.8$
$5\pi/6$	$-2\sqrt{3} \approx -3.4$



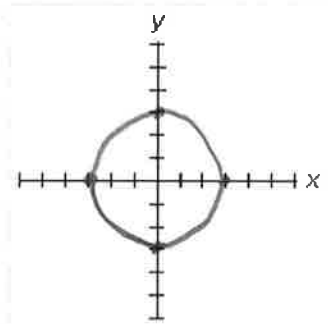
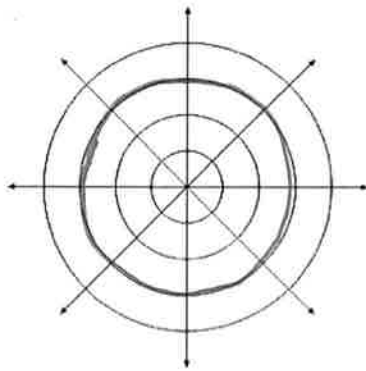
You Try!

1. Convert to rectangular form and then graph. Compare with the polar graph.

A.) $r = 3$

$r^2 = 9$

$x^2 + y^2 = 9$



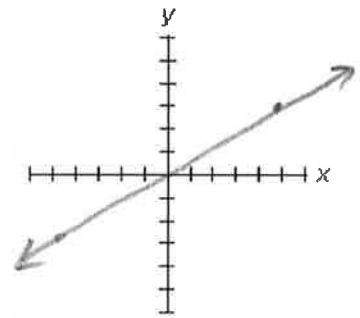
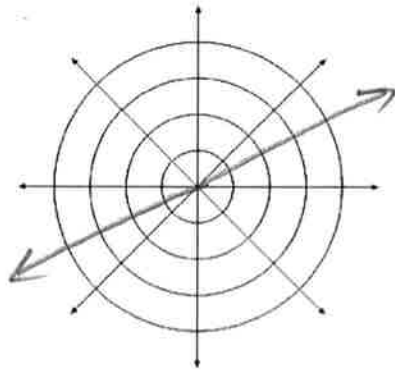
B.) $\theta = \frac{\pi}{6}$

$\tan \theta = \tan \frac{\pi}{6}$

$\frac{y}{x} = \frac{\sqrt{3}}{3}$

$y = \frac{\sqrt{3}}{3}x$

$\hookrightarrow \approx \frac{3}{5}$



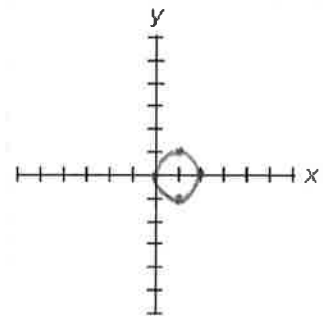
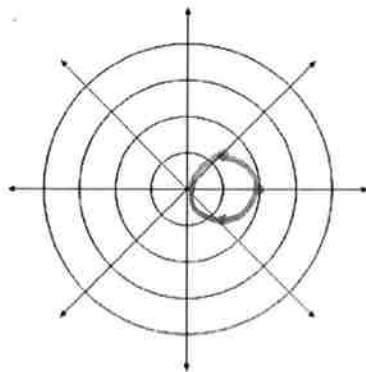
C.) $r = 2\sin\theta$

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

$x^2 + y^2 = 2y$

$x^2 - 2y + 1 + y^2 = 1$

$(x-1)^2 + y^2 = 1$



2. Describe the graph of:

A.) $r = 17$

- A circle with center at $(0,0)$ and radius of 17

B.) $\theta = \frac{13\pi}{4}$

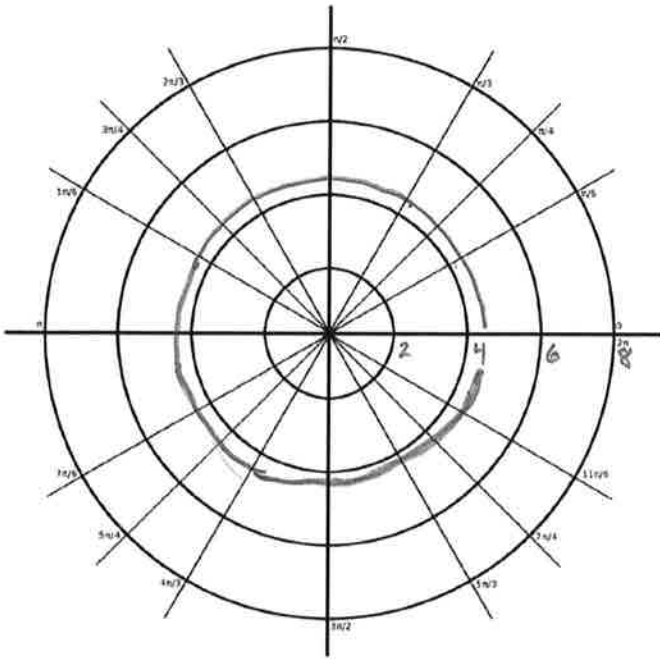
$\frac{13\pi}{4} - \frac{8\pi}{4} = \frac{5\pi}{4}$ or 225°

- A line through 225° and 45°

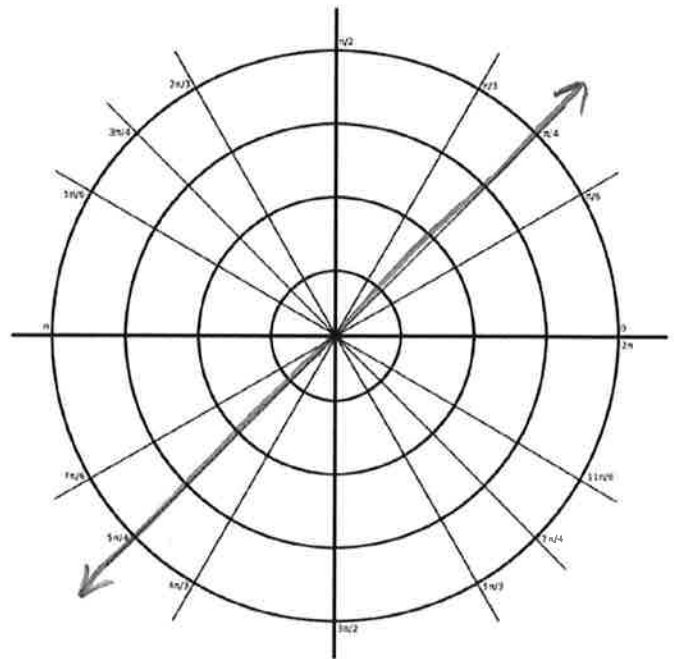
Additional Practice:

Graph each polar equation.

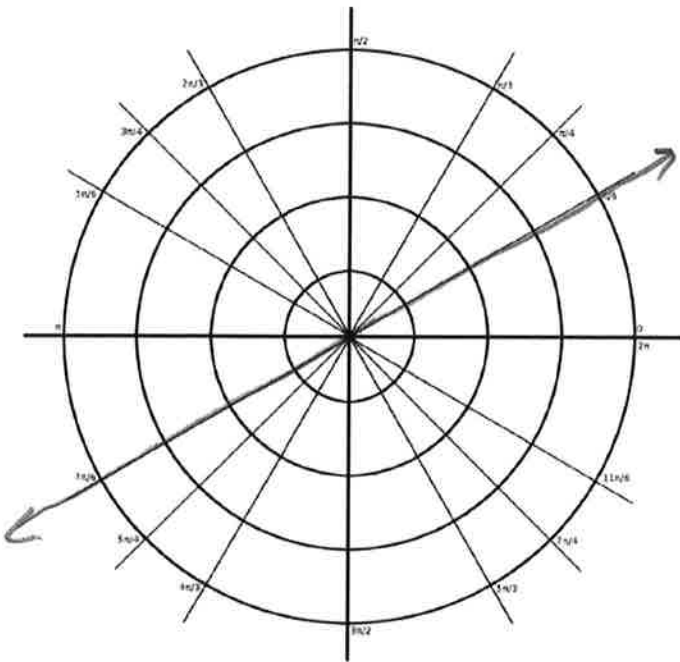
1. $r = 4.5$



2. $\theta = \frac{5\pi}{4}$



3. $\theta = -150^\circ$



4. $r = -2.25$

