

Pick up a sheet of polar graph paper for HW.

$$150^\circ \cdot \frac{\pi}{180} =$$

HW 9-2 tonight: Work only in radians. If degrees are given, convert to radians by multiplying by $\pi/180$.

#s 2, 4, 7, 10 graph on polar graph paper and all on **one grid**. Label each point.

Omit #52.

Do the warm-up as I check homework.

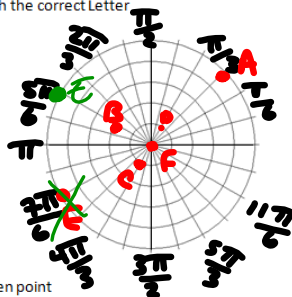
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Polar Coordinates: Work may be done on this sheet

1) Plot the following points in a polar coordinate system: Label with the correct Letter

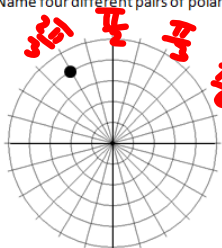
A $(5, \frac{\pi}{3})$ B $(-2, \frac{-\pi}{6})$ C $(1, \frac{-2\pi}{3})$ D $(-1, \frac{5\pi}{4})$

E $(-5, \frac{11\pi}{6})$ F $(0, \pi)$



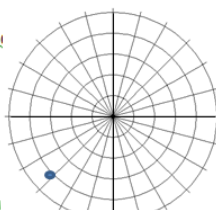
2) Name four different pairs of polar coordinates that represent the given point

a)



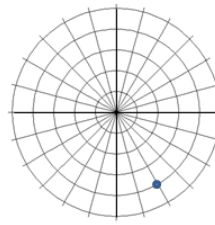
$(4, \frac{2\pi}{3})$
 $(4, \frac{14\pi}{3})$
 $(-4, \frac{5\pi}{3})$
 $(-4, \frac{11\pi}{3})$

b)



$(4, \frac{5\pi}{4})$
 $(4, \frac{13\pi}{4})$
 $(-4, \frac{\pi}{4})$
 $(-4, \frac{7\pi}{4})$

c)

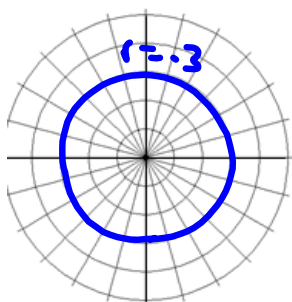


$(4, \frac{5\pi}{3})$
 $(4, \frac{11\pi}{3})$
 $(-4, \frac{2\pi}{3})$
 $(-4, \frac{8\pi}{3})$

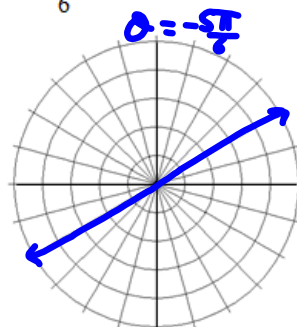
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3) Graph each polar equation:

a) $r = -3$



b) $\theta = \frac{-5\pi}{6}$



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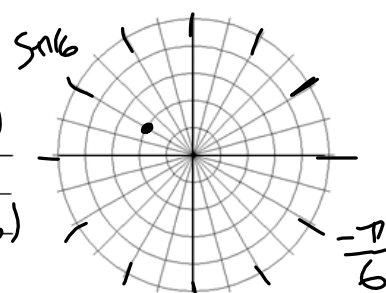
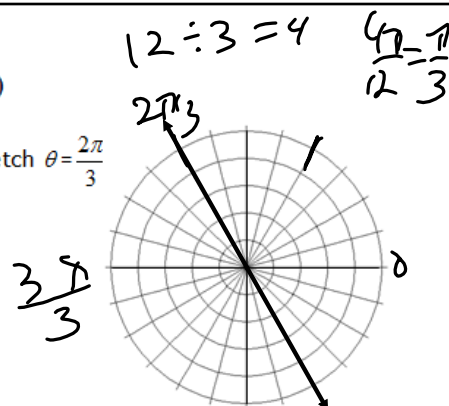
Warm-Up. Plot the point and name it 4 ways (3 additional)

$\left(-2, -\frac{\pi}{6}\right)$

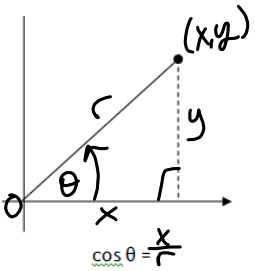
$(-2, 11\pi/6)$

$(2, 5\pi/6)$

$(2, -7\pi/6)$

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

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

rectangular to polar
 $(x, y) \rightarrow (r, \theta)$
 $r = \sqrt{x^2 + y^2}$
 $\tan \theta = \frac{y}{x}$

$\cos \theta = \frac{x}{r}$
 $\sin \theta = \frac{y}{r}$

$x = r \cos \theta$
 $y = r \sin \theta$

polar to rectangular
 $(r, \theta) \rightarrow (x, y)$
 $x = r \cos \theta$
 $y = r \sin \theta$

Converting Rectangular Coordinates to Polar Coordinates:
 Steps:
 1) Plot the point first!
 2) Find r using $r^2 = x^2 + y^2 \rightarrow r = \sqrt{x^2 + y^2}$
 3) Use $\theta = \tan^{-1} \frac{y}{x}$ to find reference angle for θ
 4) Determine the quadrant the angle is in by looking at your plotted point and find the angle
 5) Write answer in the form (r, θ)

	$\pi/6$	$\pi/4$	$\pi/3$
$\sin \theta$	$1/2$	$\sqrt{2}/2$	$\sqrt{3}/2$
$\cos \theta$	$\sqrt{3}/2$	$\sqrt{2}/2$	$1/2$
$\tan \theta$	$1/\sqrt{3}$	1	$\sqrt{3}$

Convert the rectangular coordinates to polar coordinates:
 1. $(-1, 1) \rightarrow (r, \theta) = (1, \frac{3\pi}{4})$
 $r = \sqrt{(-1)^2 + 1^2} = \sqrt{2}$
 $\tan \theta = \frac{y}{x} = \frac{1}{-1} = -1$
 $\tan \theta = -1 \rightarrow \theta = \frac{7\pi}{4}$
 II: $\pi - \frac{7\pi}{4} = \frac{3\pi}{4}$

2. $(0, -5) \rightarrow (r, \theta) = (5, \frac{3\pi}{2})$
 $r = \sqrt{0^2 + (-5)^2} = 5$
 $\tan \theta = \frac{y}{x} = \frac{-5}{0} = \text{undefined}$
 $\tan \frac{3\pi}{2} = \text{undefined}$

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3. $(-1, \sqrt{3}) \rightarrow (r, \theta) = (2, \frac{2\pi}{3})$
 $r = \sqrt{(-1)^2 + (\sqrt{3})^2} = \sqrt{4} = 2$
 $\tan \theta = \frac{y}{x} = \frac{\sqrt{3}}{-1} = -\sqrt{3}$
 $\alpha = \frac{\pi}{3}$
 III: $\pi - \frac{\pi}{3} = \frac{2\pi}{3}$

4. $(12, -5) \rightarrow (r, \theta) = (13, 5.89)$
 $r = \sqrt{12^2 + (-5)^2} = \sqrt{144 + 25} = \sqrt{169} = 13$
 $\tan \theta = \frac{-5}{12}$
 $\alpha = \tan^{-1}(\frac{5}{12}) = .394 \text{ rad}$
 IV: $\theta = 2\pi - \alpha = 5.89$

5. $(0, -2) \rightarrow (r, \theta) = (2, \frac{3\pi}{2})$
 $r = \sqrt{0^2 + (-2)^2} = 2$
 $\tan \theta = \frac{-2}{0} = \text{undefined}$
 $\theta = \frac{3\pi}{2}$

6. $(-4\sqrt{3}, 4) \rightarrow (r, \theta) = (8, \frac{5\pi}{6})$
 $r = \sqrt{(-4\sqrt{3})^2 + 4^2} = \sqrt{48 + 16} = \sqrt{64} = 8$
 $\tan \theta = \frac{y}{x} = \frac{4}{-4\sqrt{3}} = -\frac{1}{\sqrt{3}}$
 $\tan \theta = -\frac{1}{\sqrt{3}}, \alpha = \frac{\pi}{6}$
 II: $\theta = \pi - \frac{\pi}{6} = \frac{5\pi}{6}$

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Rectangular to Polar Form equations:

REPLACEMENTS: $x = r \cos \theta$

$y = r \sin \theta$

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

Convert the equation from Rectangular Form to Polar Form

1) $x^2 + y^2 = 6$

(a) $r^2 = 6$
 $r = \pm \sqrt{6}$

(b)

$x = 12$

$r \cos \theta = 12$

$r = \frac{12}{\cos \theta} = 12 \cdot \frac{1}{\cos \theta}$

$r = 12 \sec \theta$

2) $x^2 + y^2 - 4y = 0$
(a) $r^2 - 4r \sin \theta = 0$
 $r^2 = 4r \sin \theta$
 $r = 4 \sin \theta$

(b)

$y = -5$

$r \sin \theta = -5$

$r = \frac{-5}{\sin \theta}$

$r = -5 \csc \theta$

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