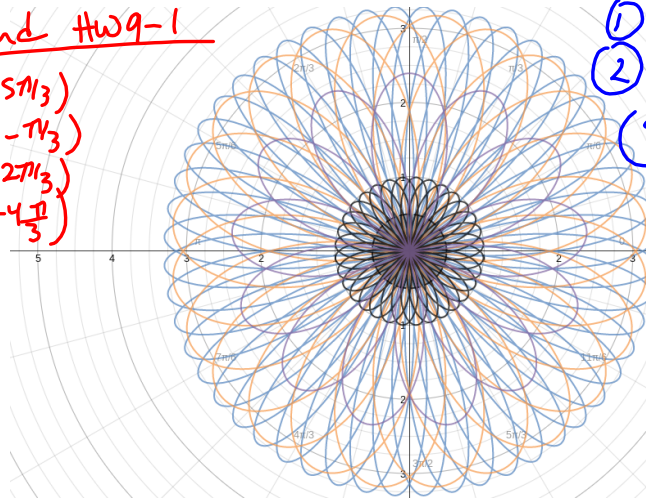


Ch 9 Polar Key for all HW is posted, check before class.

Correction HW9-1

2 c)  $(4, 5\pi/3)$   
 $(4, -\pi/3)$   
 $(-4, 2\pi/3)$   
 $(-4, -4\pi/3)$

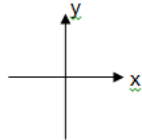


① mode = radi and Polar  
 ②  $r = 4 \cos(6\theta)$

③ Window

$\theta_{\min} = 0$   
 $\theta_{\max} = 2\pi$   
 $\theta_{\text{step}} = \pi/24$   
 $x_{\min} = -6.4$   
 $x_{\max} = 6.4$   
 $y_{\min} = -4.6$   
 $y_{\max} = 4.6$   
 $y_{\text{scr}} = 1$

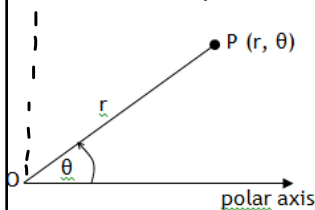
Rectangular or Cartesian Coordinate System →  $(x, y)$



Directed distance from coordinate axes to the point  $(x, y)$

Polar Coordinate System →

$(r, \theta)$



O → origin or pole

Initial axis → polar axis

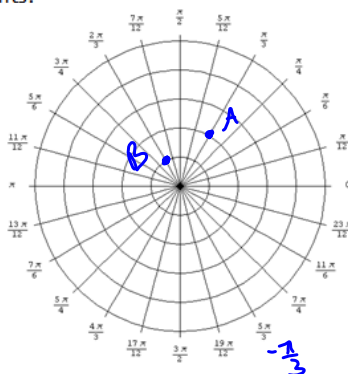
$r$  → directed distance from O to P

$\theta$  → directed angle, counterclockwise from polar axis to  $\overline{OP}$

Plot the following points:

1. A  $(2, \frac{\pi}{3})$

2. B  $(-1, -\frac{\pi}{3})$



To graph

① rotate the directed angle

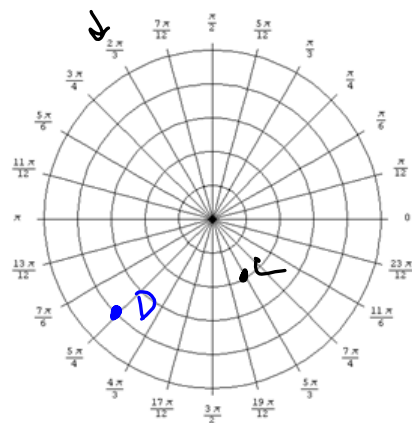
② move directed distance  $r$  from the pole.

$r > 0$ : move along  $\overrightarrow{OP}$

$r < 0$ : move in opposite direction of ray  $\overrightarrow{OP}$

3.  $C\left(-2, \frac{2\pi}{3}\right)$

4.  $D\left(4, \frac{5\pi}{4}\right)$



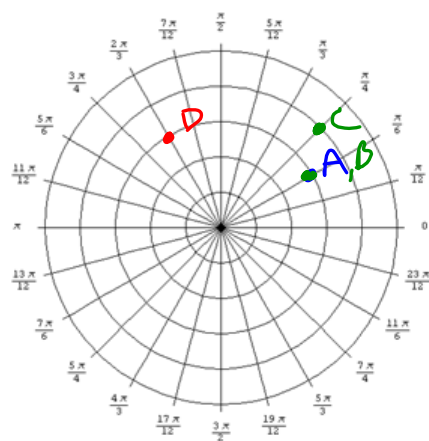
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5.  $A\left(3, \frac{\pi}{6}\right)$

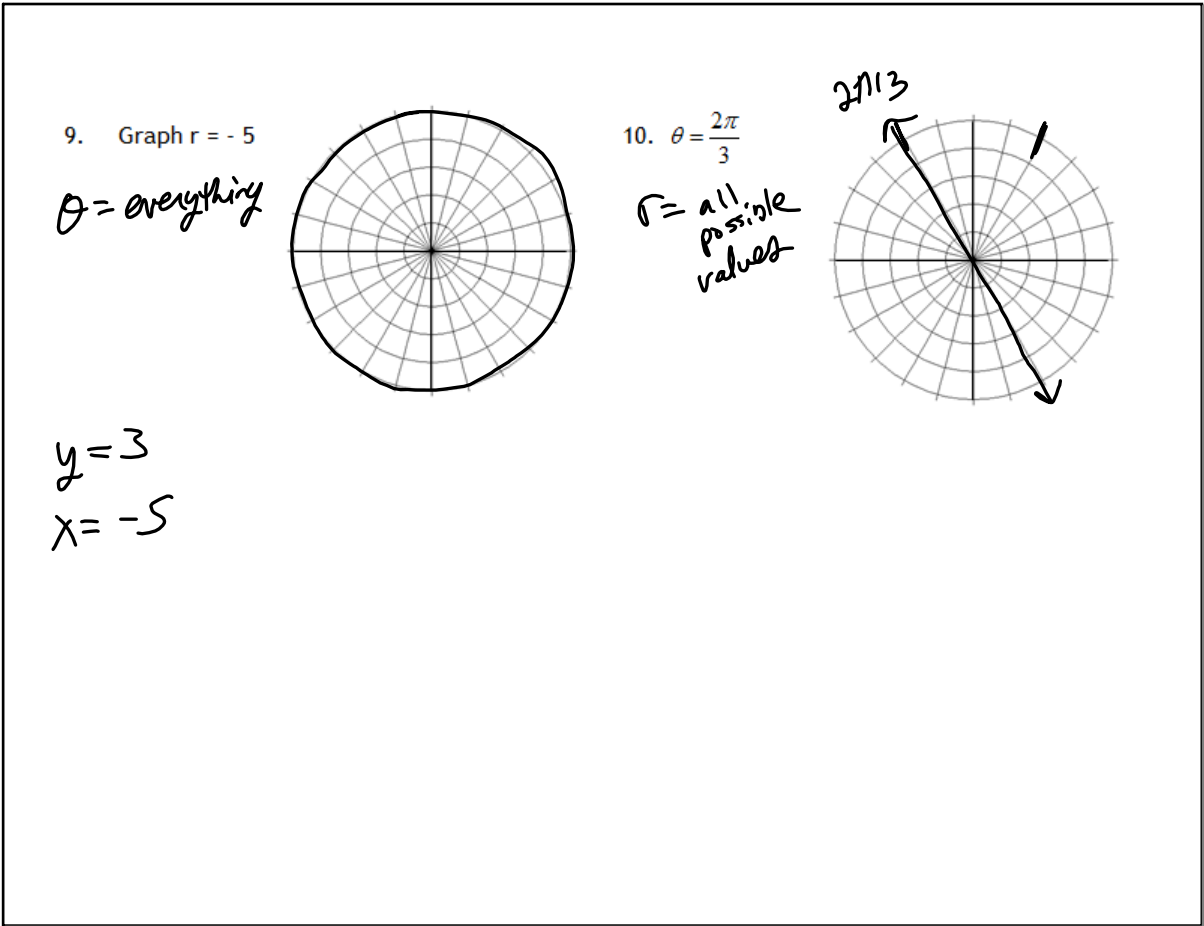
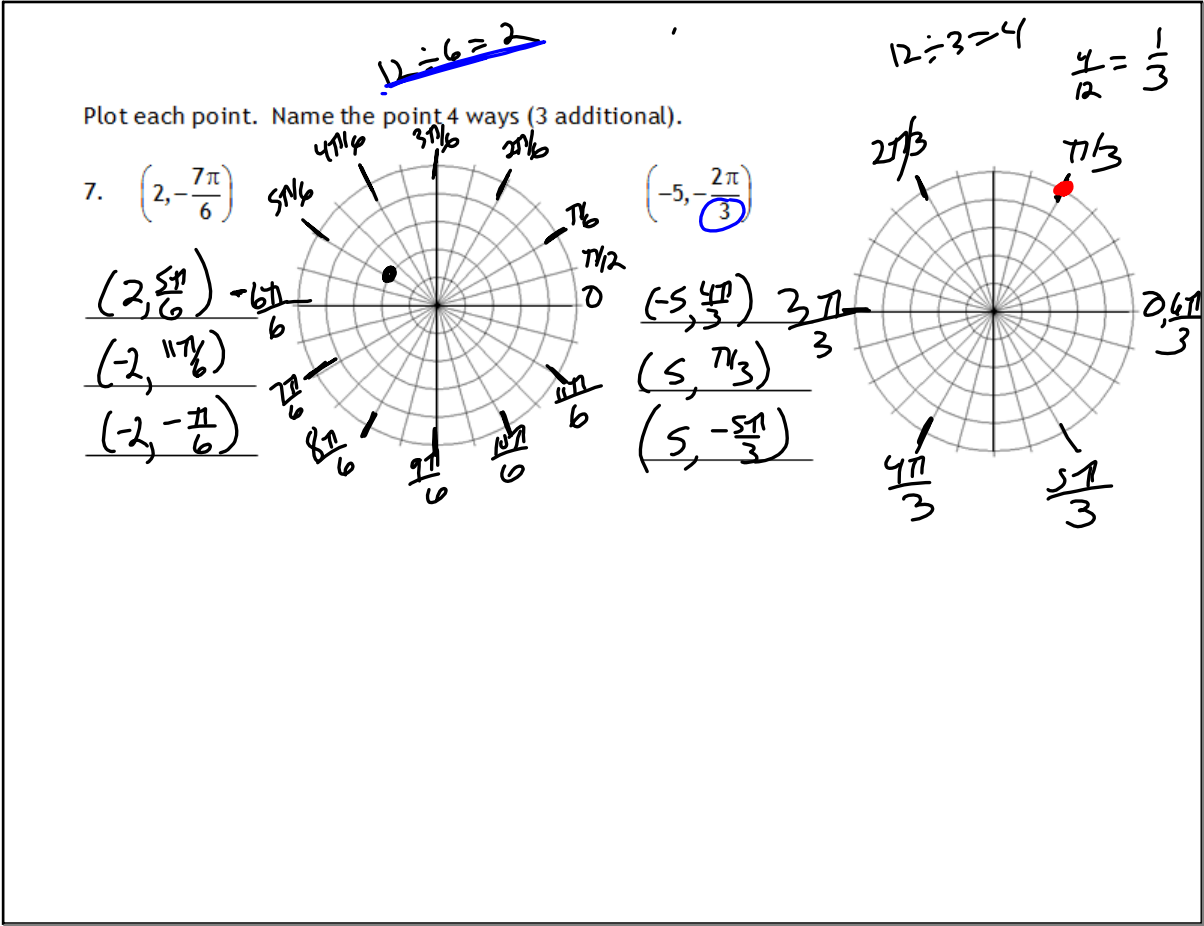
6.  $B\left(3, -\frac{11\pi}{6}\right)$

7.  $C\left(4, \frac{\pi}{4}\right)$

8.  $D\left(-3, \frac{5\pi}{3}\right)$



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

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

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

rectangular to polar

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

polar to rectangular

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

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

**Converting Rectangular Coordinates to Polar Coordinates:**

**Steps:**

- Plot the point first!
- Find  $r$  using  $r^2 = x^2 + y^2 \rightarrow r = \sqrt{x^2 + y^2}$   
 $\tan \theta = y/x$
- Use  $\theta = \tan^{-1}(y/x)$  to find reference angle for  $\theta$
- Determine the quadrant the angle is in by looking at your plotted point and find the angle
- Write answer in the form  $(r, \theta)$

**Convert the rectangular coordinates to polar coordinates:**

1.  $(-1, 1) \rightarrow (r, \theta) = (1\sqrt{2}, \frac{3\pi}{4})$

(2)  $r = \sqrt{x^2 + y^2}$   
 $r = \sqrt{(-1)^2 + 1^2}$   
 $r = \sqrt{1+1} = \sqrt{2}$

(3)  $\tan \theta = \frac{y}{x} = \frac{1}{-1} = -1$   
 $\tan \theta = -1 \rightarrow \theta = \frac{7\pi}{4}$   
 II:  $\pi - \frac{7\pi}{4} = \frac{3\pi}{4}$

2.  $(0, -5) \rightarrow (r, \theta) = (5, \frac{3\pi}{2})$

(2)  $r = \sqrt{0^2 + (-5)^2}$   
 $r = \sqrt{25} = 5$

(3)  $\tan \theta = \frac{y}{x} = \frac{-5}{0} = \text{undefined}$   
 $\tan \frac{3\pi}{2} = \text{undefined}$

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