

MATH 231 U1, Spring 2009  
Answers to HW 30 (section 9.4)  
Due Wednesday, April 27th, 2009

#14. Find the rectangular coordinates of the point  $(r, \theta) = (-1, \pi/3)$ .

ANSWER

$$x = -1 \cos\left(\frac{\pi}{3}\right) = -\frac{1}{2}$$

and

$$y = -1 \sin\left(\frac{\pi}{3}\right) = -\frac{\sqrt{3}}{2}$$

Drawing a picture can be very helpful too, especially if you get confused about signs!!!

#26. Sketch the graph of  $r = 2 \sin \theta$  and find a corresponding  $xy$ -equation.

ANSWER

Your sketch should be of a circle with radius  $\frac{1}{2}$  and center  $(0, \frac{1}{2})$ .

$r = \sin \theta$ , gives the  $xy$ -equation

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

(Note that  $\sin \theta = \frac{y}{r} = \frac{y}{\sqrt{x^2 + y^2}}$ .)

This gives

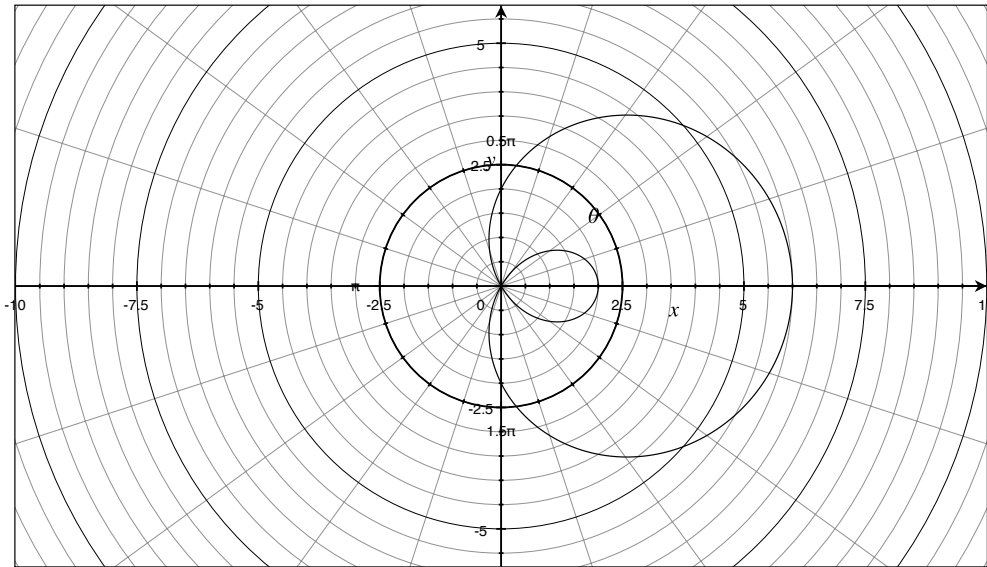
$$x^2 + y^2 = y.$$

You should be able to recognize  $x^2 + y^2 = y$  as an equation giving a circle by completing the square:

$$\begin{aligned}x^2 + y^2 &= y \\x^2 + y^2 - y &= 0 \\x^2 + y^2 - y + \frac{1}{4} &= \frac{1}{4} \\x^2 + \left(y - \frac{1}{2}\right)^2 &= \left(\frac{1}{2}\right)^2\end{aligned}$$

Which is the equation of the circle with radius  $\frac{1}{2}$  and center  $(0, \frac{1}{2})$ .

#34. Sketch the curve given by  $r = 2 + 4 \cos \theta$ . find all values of  $\theta$  where  $r = 0$  and find a domain of values for  $\theta$  that produces one copy of the graph.



Note that  $r = 0$  whenever  $2 + 4 \cos \theta = 0$ , that is when,

$$2 = -4 \cos \theta$$

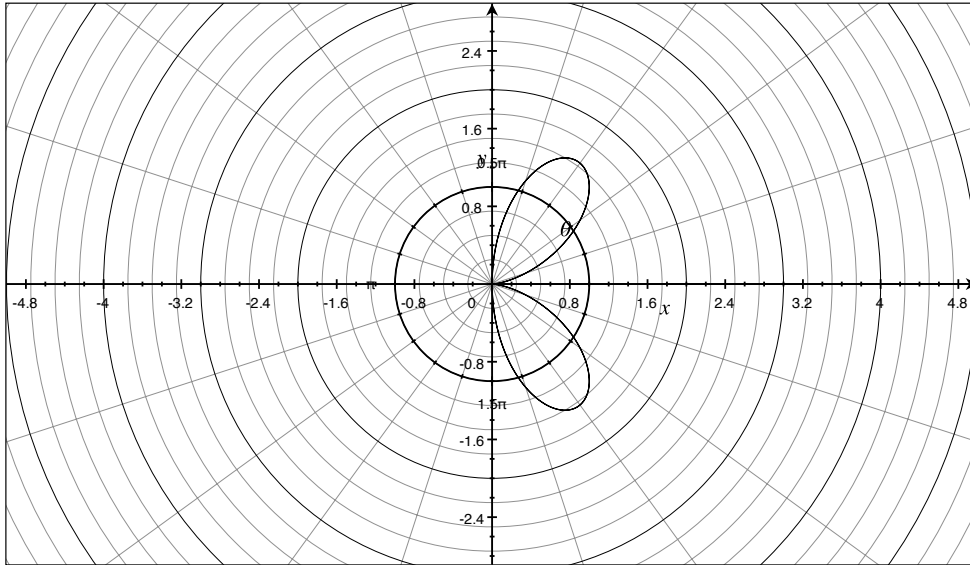
$$-\frac{1}{2} = \cos \theta$$

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

for integers  $k$ .

The domain  $\theta \in [0, 2\pi]$  produces one copy of the graph.

#51. Graph  $r = 4 \cos \theta \sin^2 \theta$  and explain why there is no curve to the left of the  $y$ -axis.



There is no curve on the left of the  $y$ -axis because the corresponding  $x$  values are

$$x = r \cos \theta = 4 \cos^2 \theta \sin^2 \theta,$$

and therefore the  $x$  values are always positive.