Rectangular Coordinates (x, y)
Polar Coordinates $(r,\ \theta)$

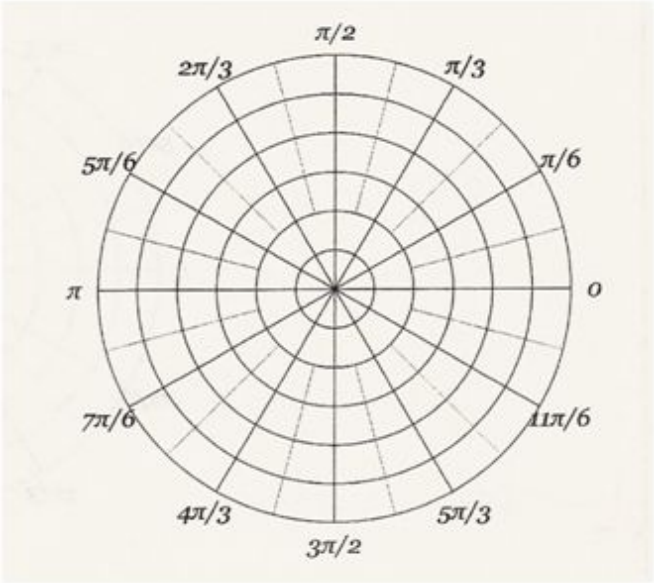
1. Graph the following polar coordinates:

$P\left(4, \frac{5\pi}{3}\right)$

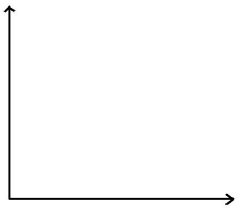
$Q\left(3, \frac{7\pi}{6}\right)$

$R\left(-2, \frac{5\pi}{4}\right)$

$S\left(1, -\frac{\pi}{3}\right)$



2. Fill in the information below:



$\sin\theta =$ so $y =$

$\cos\theta =$ so $x =$

$\tan\theta =$

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

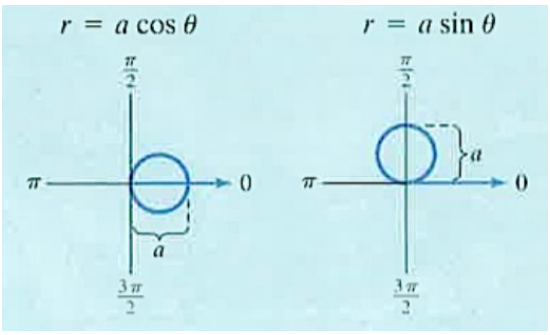
3. Convert $\left(2, \frac{5\pi}{6}\right)$ to rectangular coordinates.

4. Convert $(3,-3)$ to polar coordinates.

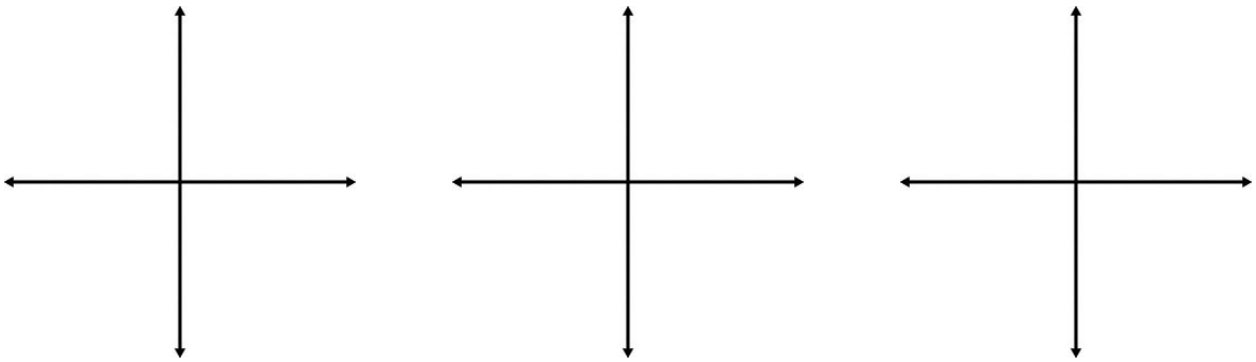
5. Convert the following equations to polar form:
   a. $y = 4$
   b. $x^2 + y^2 = 25$

Circles

The graphs of $r = a\cos\theta$ and $r = a\sin\theta$ are circles



6. Sketch the following:
   a. $r = 3\sin\theta$
   b. $r = 2\cos\theta$
   c. $r = -4\cos\theta$

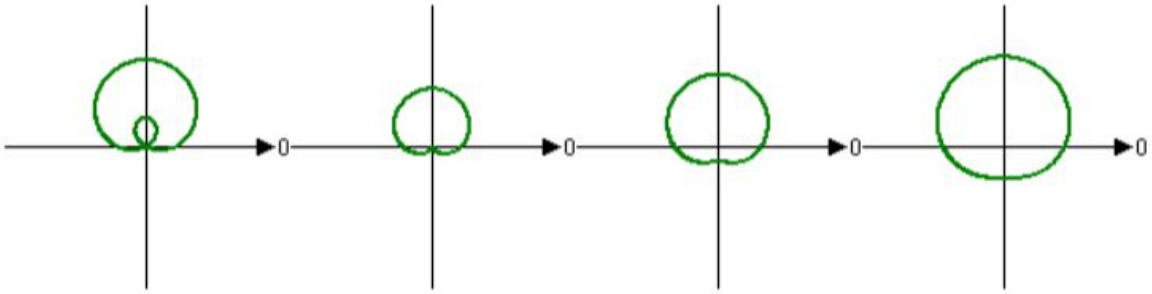


Limacons:

$$r = a \pm b\sin\theta \quad \text{or} \quad r = a \pm b\cos\theta$$

$\frac{a}{b} < 1$ $\quad$ $\frac{a}{b} = 1$ $\quad$ $1 < \frac{a}{b} < 2$ $\quad$ $\frac{a}{b} \geq 2$

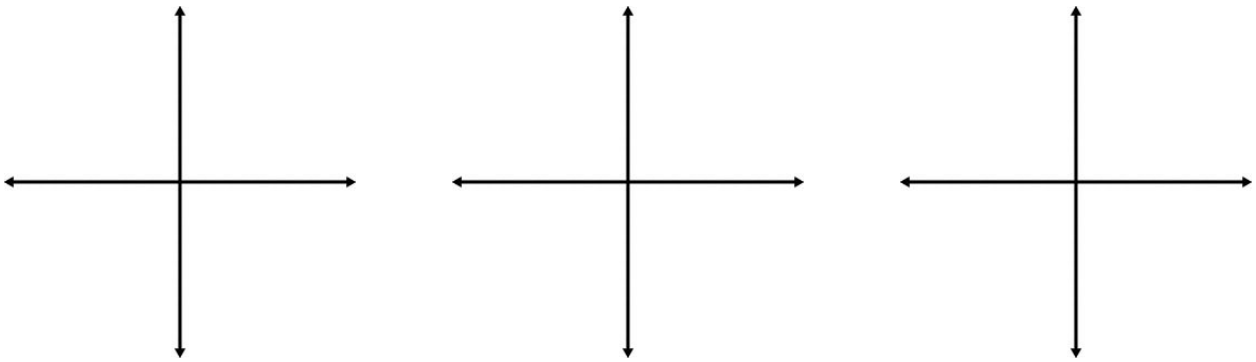
$r = a + b\sin\theta$



***If it were minus rather than plus then the graphs would be on the other side of the x-axis

*cosine has similar graphs but along the x-axis.

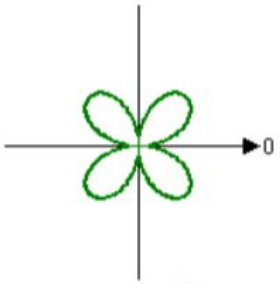
7. Sketch the following graphs:
   a. $r = 2 + 3\sin\theta$ b. $r = 4 - 4\cos\theta$ c. $r = 5 - 2\sin\theta$



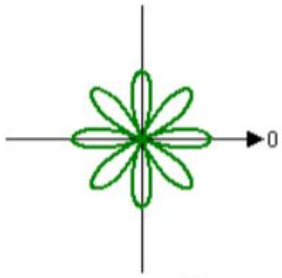
Rose Curves

$r = a \sin n\theta$ or $r = a \cos n\theta$

If n is an even integer, then the rose will have 2n petals.

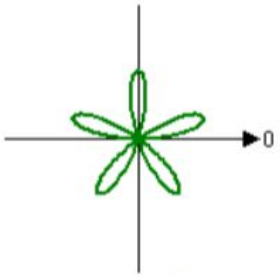


r = a sin 2θ

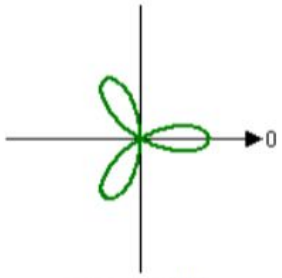


r = a cos 4θ

If n is an odd integer, then the rose will have n petals.



r = a sin 5θ

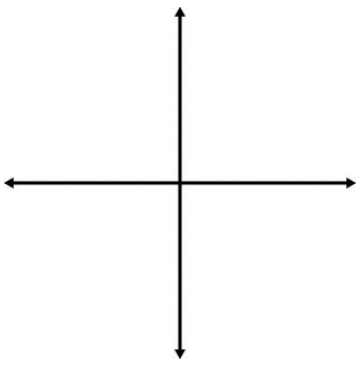


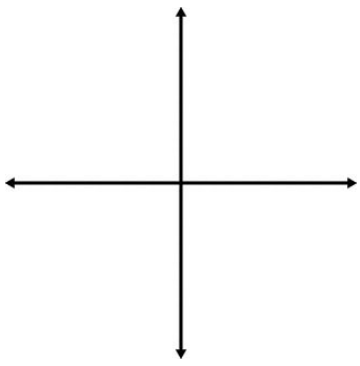
r = a cos 3θ

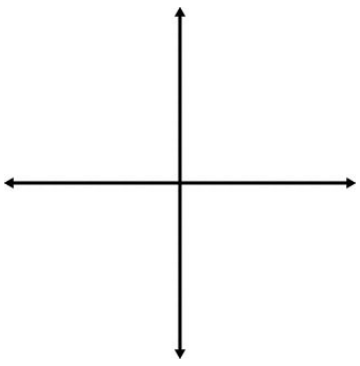
*Easiest way to graph is to find where sin or cos is equal to 0

8. Sketch the following graphs:

a. $r = 4 \sin 3\theta$ b. $r = 2 \cos 2\theta$ c. $r = 2 \sin 5\theta$







9. To find the slope of a tangent line to the polar graph $r = f(\theta),$ we can use the facts that $x = r\cos\theta$ and $y = r\sin\theta$, together with the product rule:

$$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} =$$

10. Find $\frac{dy}{dx}$ and the slope of the graph of the polar curve at the given value of θ.

$r = 3 + 2\sin\theta$ $\qquad\qquad$ $\theta = \frac{\pi}{6}$