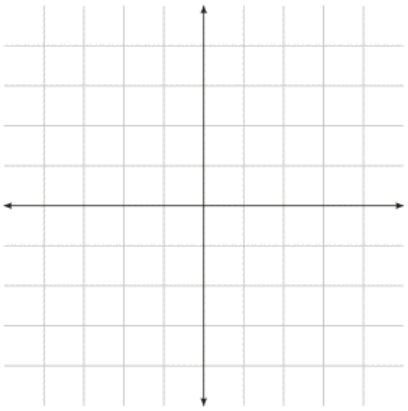
Name_____

Activity – Polar Coordinates

We typically plot points on an x-y grid called the Cartesian (or rectangular) coordinate system. We could also define and plot these points on what we call a polar coordinate system. Since this system is based from the pole and uses distances and angles, it works nicely when we have circular things.

Part 1. Plotting Polar Points

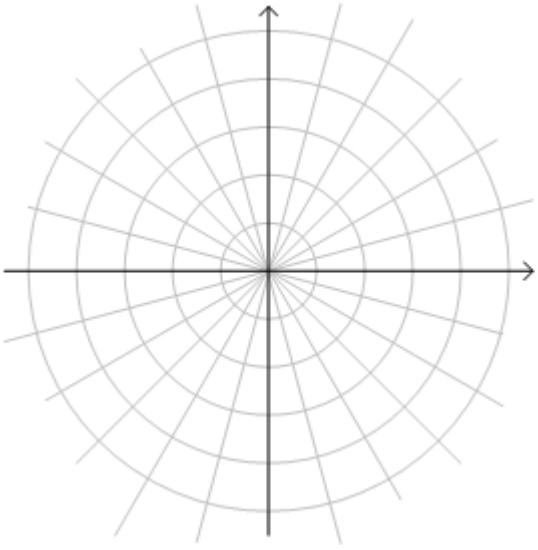


a) First let's plot the point (4,3). Draw a line segment from the point to the origin. How long is this line segment?

If this line segment is the terminal side of an angle in standard position, what is the measure of the angle in degrees? (Round to one decimal place).

We are going to define points in the polar coordinate system by their distance *r* from the pole (center of our grid) and by their angle θ. They will be in ordered pairs (r,θ). In polar coordinates then, the point (3,4) would be $(\_\_\_\_, \_\_\_\_\_)$.

Plot this point on the polar graph paper by finding the angle θ and then moving out from the pole by *r*.



Now on this same graph, let's plot the point $(5,-323.1°)$.

Can you express another point in polar coordinates to represent this point?

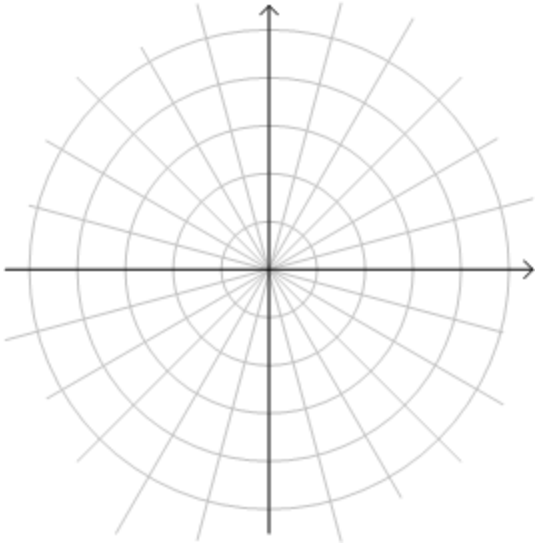
Now let's plot $(-5,216.9°)$. A negative *r* is measured from the pole in the opposite direction of the terminal side of the angle given.

Can you express another point with a negative *r* that would represent this point?

b) Plot the following points.

$P\left(2,\frac{\pi}{3}\right)$ $Q\left(-1,\frac{\pi}{2}\right)$ $R\left(3,\frac{4\pi}{3}\right)$

$S\left(-2,\frac{\pi}{4}\right)$ $T\left(-4,\frac{11\pi}{6}\right)$ $U\left(-\frac{3\pi}{4},4\right)$



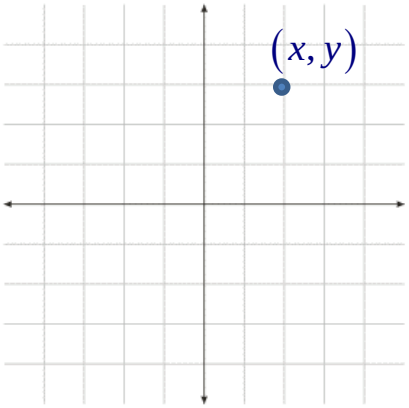
c) For each of the points plotted above, list two other ways to represent that point in polar coordinates.

P: *Q:* *R:*

S: *T:* *U:*

Part 2: Converting Between Coordinate Systems.

a) Let's start with the Cartesian point (*x*,*y*). Draw a line segment from the point to the origin and label it *r*.



- Make a right triangle with the point at one vertex and *r* as the hypotenuse. Label the lengths of the two legs of this triangle with *x* and *y*. Label the angle from the *x* axis to the hypotenuse θ.

To convert to polar coordinates then, how would be find *r*?

How would we find θ?

What if we knew *r* and θ? Can you see how to find *x* and *y*?

b) Complete the following:

Cartesian to Polar	Polar to Cartesian
$r =$	$x =$
$\theta =$	$y =$

c) Convert the following Cartesian points to polar coordinates in radians.

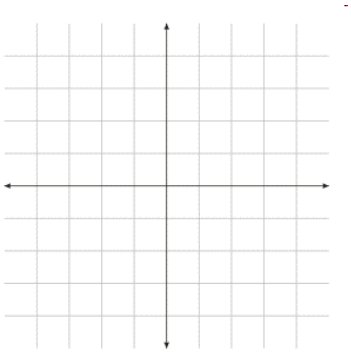
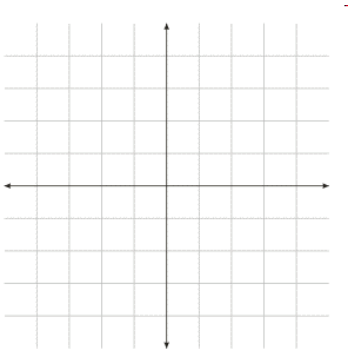
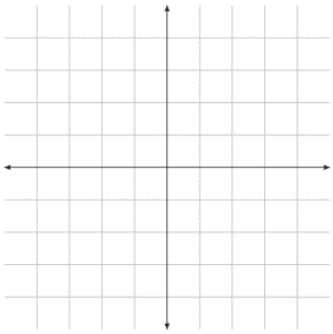
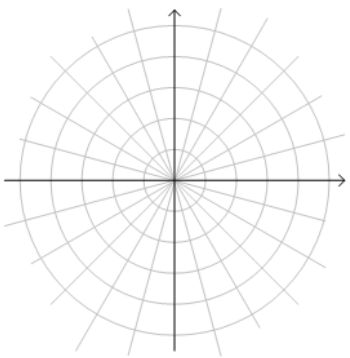
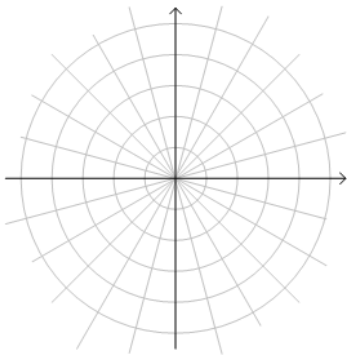
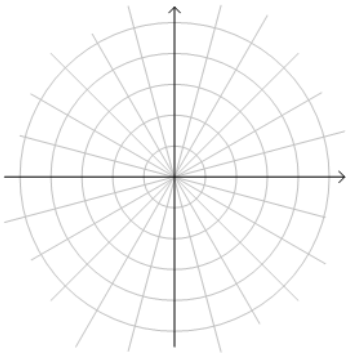
i) $(-2,5)$ ii) $(-1,-2)$ iii) $(3,-1)$

d) Convert the following polar points to Cartesian.

i) $\left(2,\frac{\pi}{4}\right)$ ii) $\left(-1,\frac{5\pi}{6}\right)$ iii) $\left(4,-\frac{2\pi}{3}\right)$

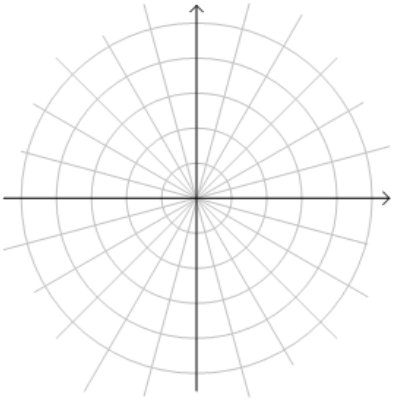
e) Graph each equation and then convert to a polar equation and graph.

i) $y=x$ ii) $x^2+y^2=16$ iii) $x^2=4y$

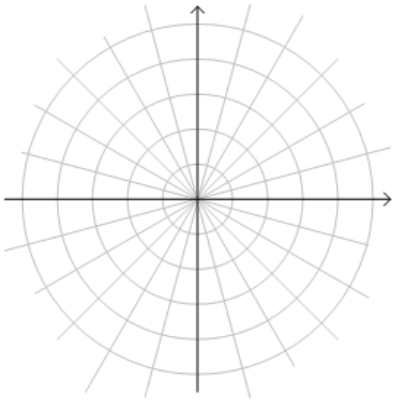







f) Convert the polar equations to rectangular. Then using both what you know about the shape of the graph from rectangular and plotting some points, graph the polar equation.

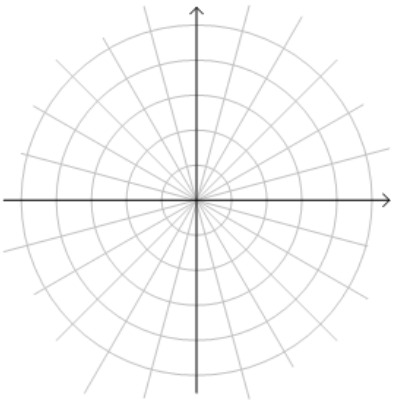
i) $\theta = -\frac{\pi}{4}$



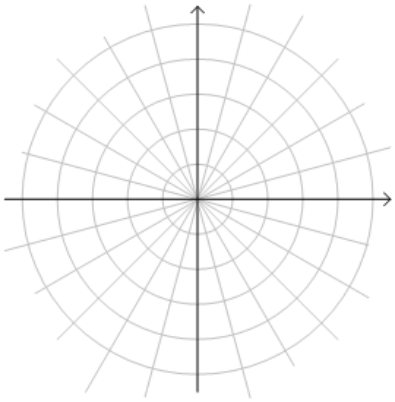
ii) $r = 4$



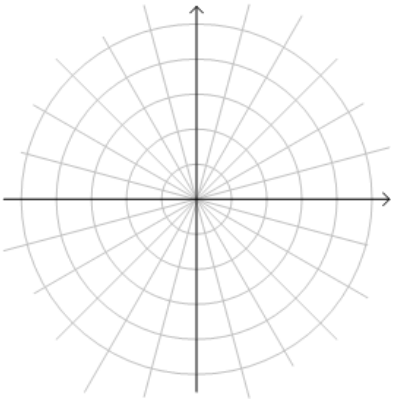
iii) $r = 2\sin\theta$



iv) $r = 4\cos\theta$



v) $r = \frac{3}{\sin\theta}$



vi) $r = 3\sec\theta$