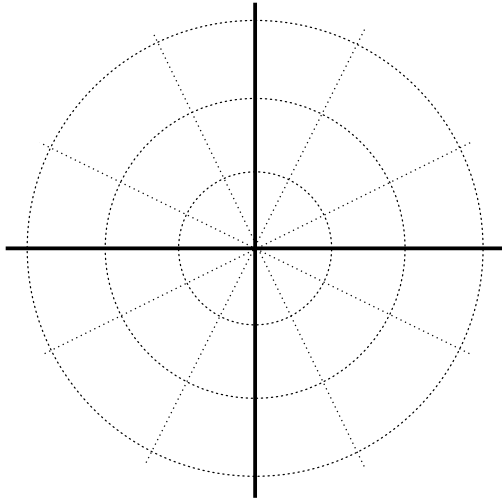


Section 10.3: Polar Coordinates

Definition: The **polar coordinate system** is a way to reference the points in the xy-plane where each point is of the form (r, θ) . r is the distance from the point in the plane to the **pole** (or origin). θ is the angle from the **polar axis** (positive x-axis) to the line segment connecting the point and the origin. This angle is positive when measured in the counterclockwise direction and negative when measured in the clockwise direction.

Example: Plot these points: $A\left(1.5, \frac{7\pi}{6}\right)$, $B\left(-2, \frac{3\pi}{4}\right)$, $C\left(2, \frac{-\pi}{4}\right)$.



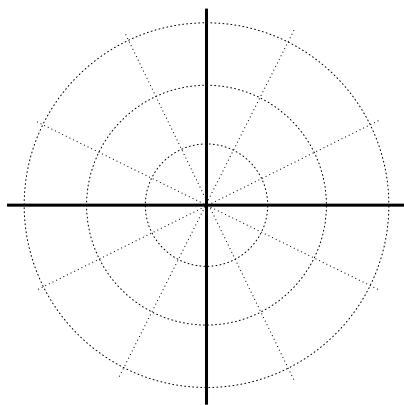
Example: Give a polar coordinate of the Cartesian point $(0, 3)$.

Converting Between Polar and Cartesian Coordinates:

Example: Convert the point $\left(1.5, \frac{\pi}{6}\right)$ from polar to Cartesian coordinates.

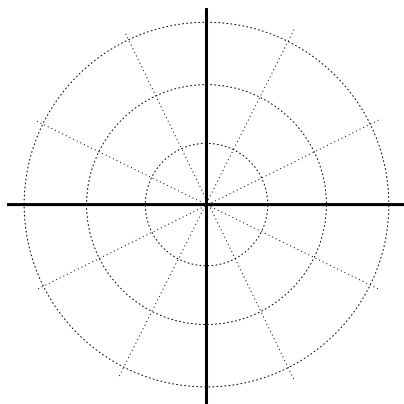
Example: Convert the point $(1, -\sqrt{3})$ from Cartesian to polar coordinates.

Example: Sketch the region in the plane consisting of points whose polar coordinates satisfies these conditions: $1 \leq r \leq 2$, $\pi/3 \leq \theta \leq 3\pi/4$



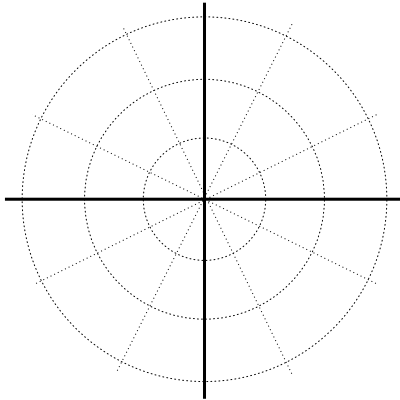
Example: Find a Cartesian equations for the polar equation and sketch the graph.

$$r = 10 \cos \theta$$



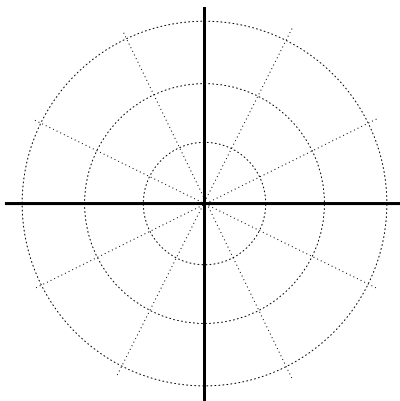
Example: Find a Cartesian equations for the polar equation and sketch the graph.

$$r = -4 \sin \theta$$



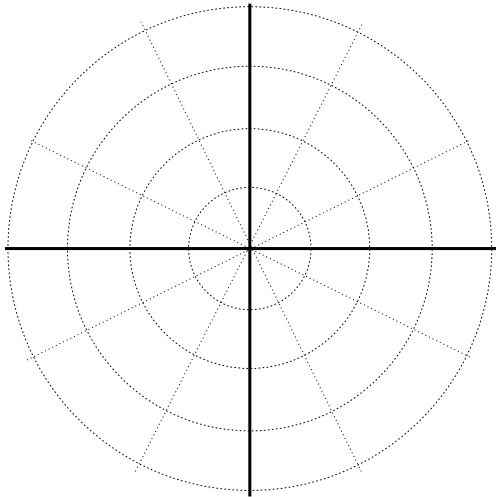
Example: Find a Cartesian equations for the polar equation and sketch the graph.

$$r = 1 + \cos \theta$$



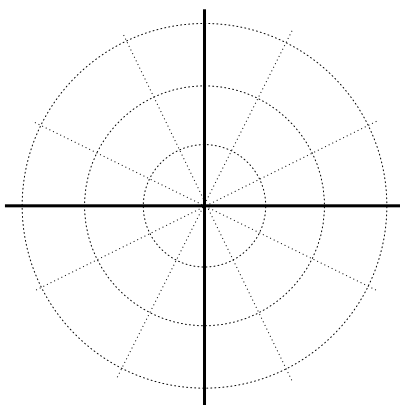
Example: Sketch the graph of the limaçon.

$$r = 3 + 5 \sin \theta$$



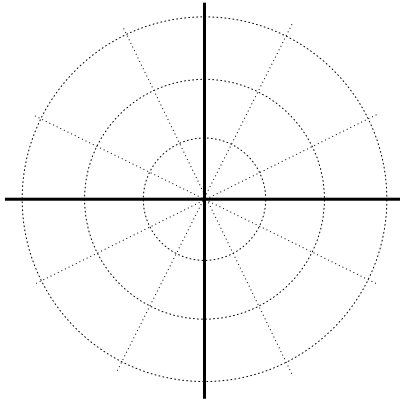
Example: Sketch the graph of the rose.

$$r = \cos 2\theta$$



Example: Sketch the graph of the rose.

$$r = 2 \sin 3\theta$$



Note: Here is a link that gives some of the conditions for the number of loops in the polar graph.

[https://en.wikipedia.org/wiki/Rose_\(mathematics\)](https://en.wikipedia.org/wiki/Rose_(mathematics))

Example: Find a polar equation for the Cartesian equations.

$$y^2 = 5x$$