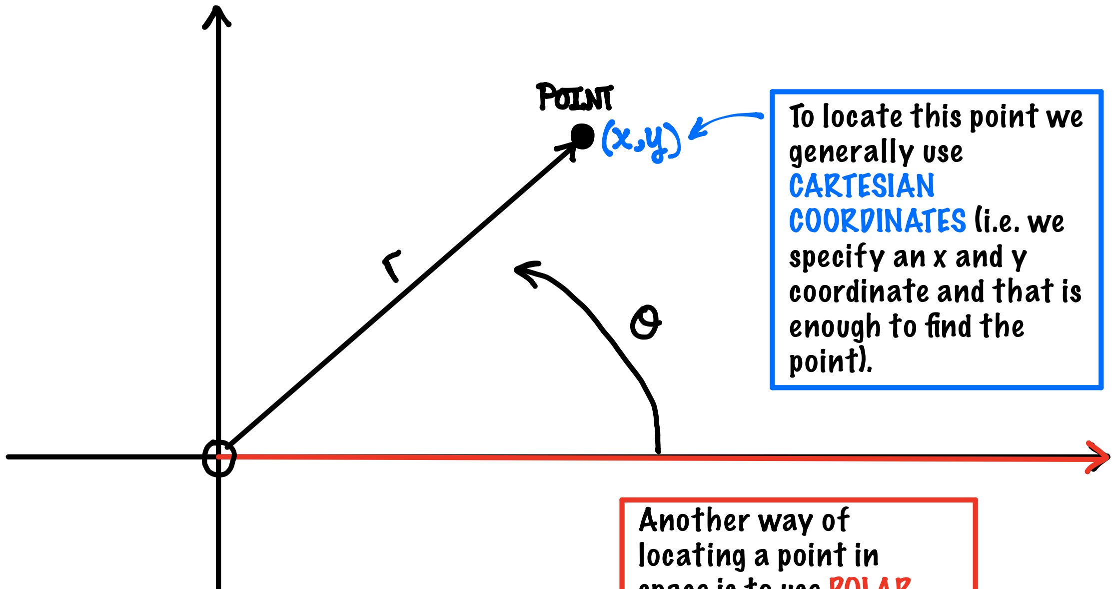
CH 10.3 POLAR COORDINATES

PART 1: AN INTRODUCTION

** In 2D we use the XY Cartesian Plane to help us organize points in space:

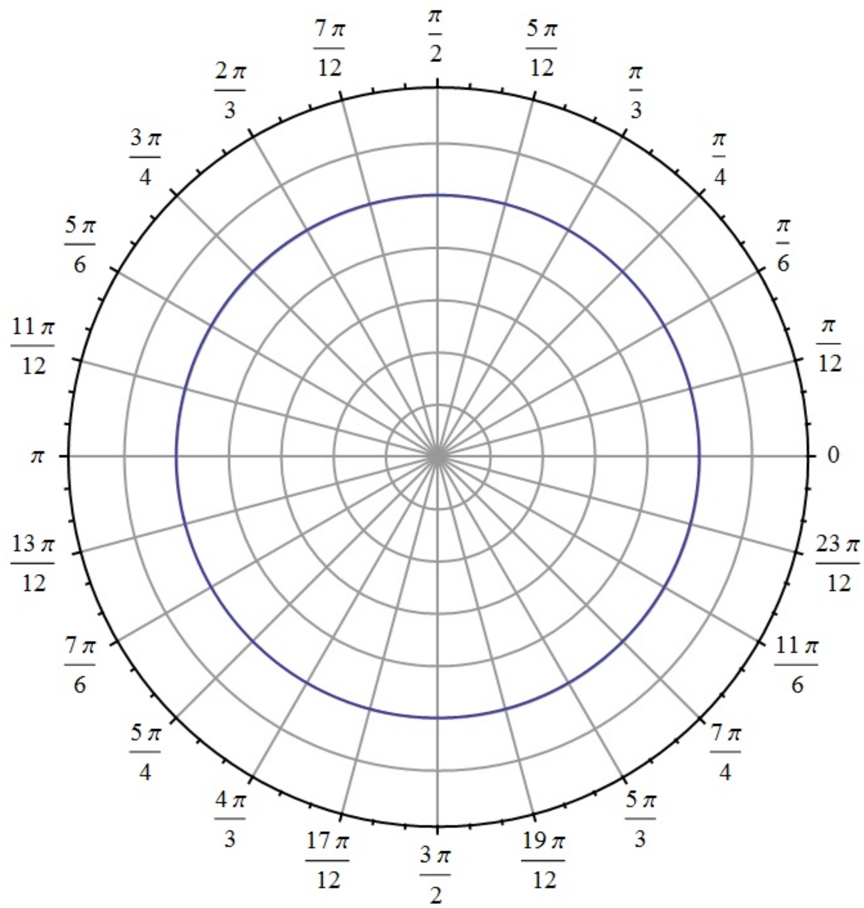


To locate this point we generally use CARTESIAN COORDINATES (i.e. we specify an x and y coordinate and that is enough to find the point).

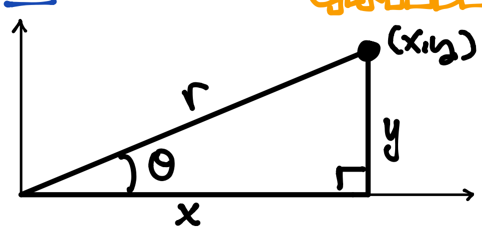
Another way of locating a point in space is to use POLAR COORDINATES where we specify an angle and a radius.

NOTE: POLAR COORDINATES ARE NOT UNIQUE.

Some TRICKY things about polar coordinates:



PART 2: CONVERTING CARTESIAN ⇔ POLAR



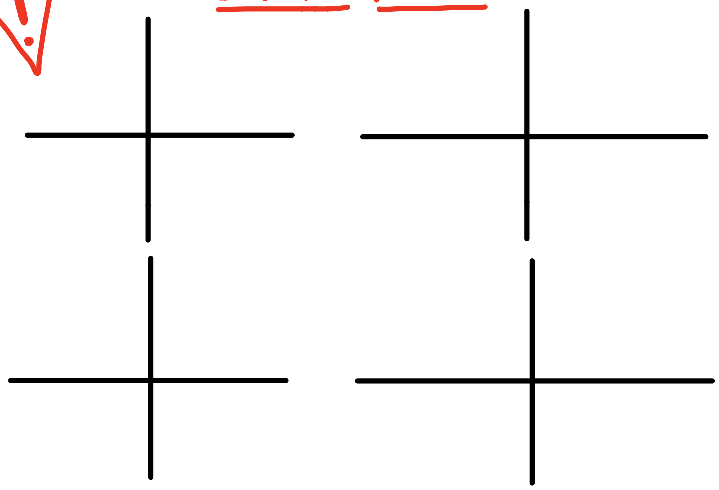
POLAR ⇒ CARTESIAN

GIVEN r and θ

CARTESIAN ⇒ POLAR

GIVEN x and y.

Recall **Reference Angles**



Ex 1. Convert each order pair from Cartesian coordinates to **POLAR COORDINATES.**

A $(3,4)$

Sol:

* Can you find another polar coordinate for this ordered pair? How about with negative "r"?

B $(-4,-4)$

Sol:

Ex 2. Convert each coordinate from polar coordinates to **CARTESIAN COORDINATES**

A $(2,\pi)$

Sol:

B $(42,-\pi/2)$

Sol:

PART 3: POLAR CURVES

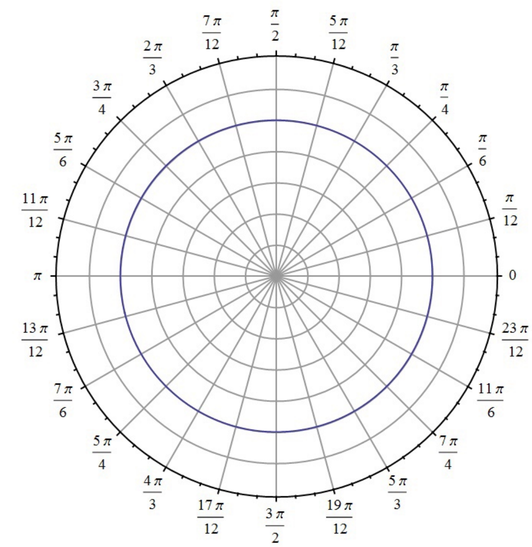
$$\boxed{r = f(\theta)}$$

* Given a function in **POLAR COORDINATES,** we can sketch a curve by creating a table of values (for various angles, find the corresponding radius)

Ex 3. Graph the following:

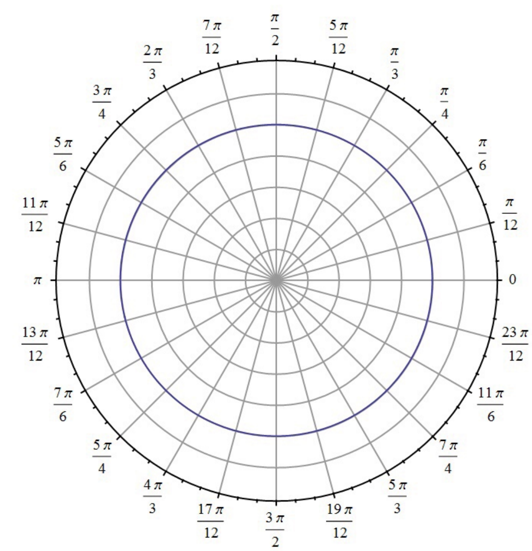
A $r = 4$

sol:



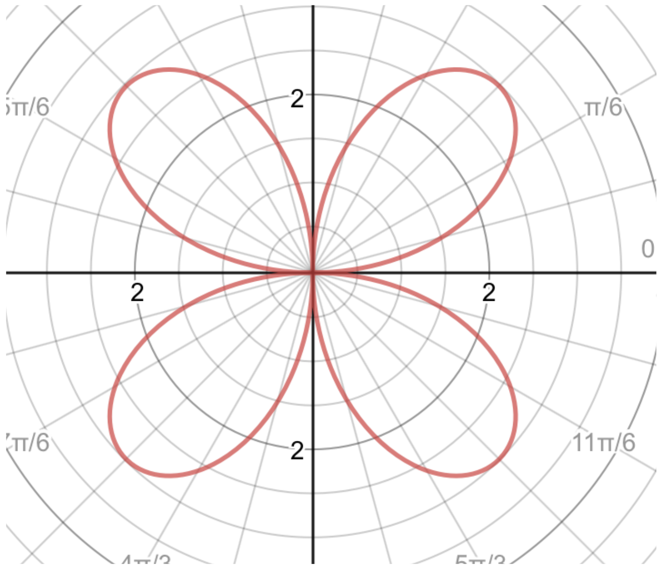
B $r = \theta$

sol:



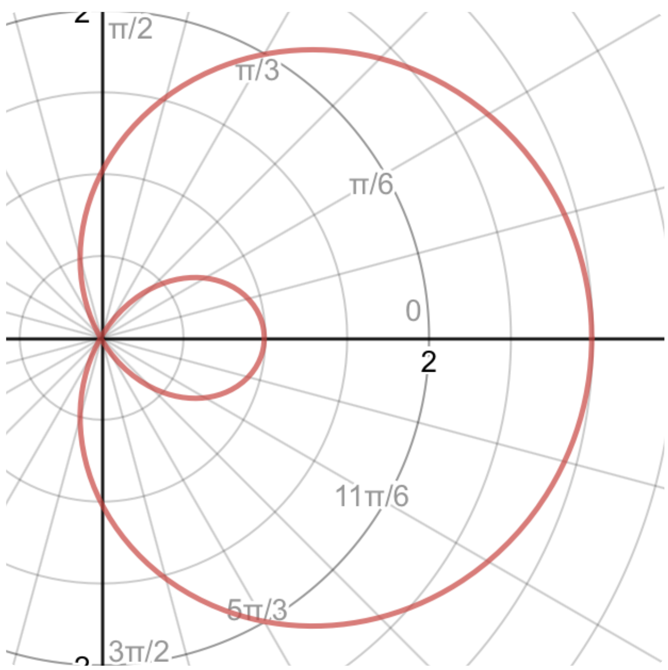
$\boxed{C}$ $r = 3\sin(2\theta)$

sol:



$\boxed{D}$ $r = 1 + 2\cos(\theta)$

sol:

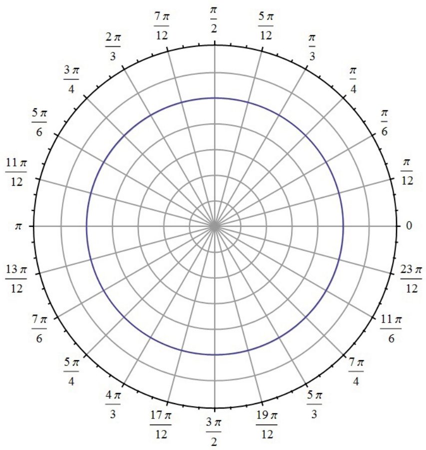


NOTE: We can also easily sketch regions (wedges, discs, etc) using polar coordinates and inequalities. Check it out:

Ex 4: Sketch each of the following regions:

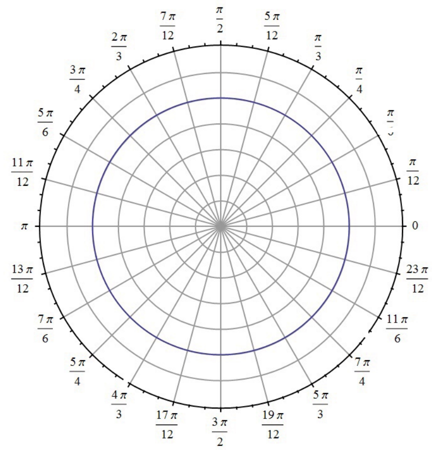
$\boxed{A}$ $r \le 1$, $\pi/2 \le \theta \le 3\pi/2$

sol:



$\boxed{B}$ $1 \le r < 2$, $\pi < \theta \le 2\pi$

sol:



PART 4: SLOPE AND TANGENT LINES

** Suppose we have the following function in POLAR COORDINATES: $r = f(\theta)$
This is a special type of PARAMETRIC EQ with parameter θ

SLOPE of A POLAR GRAPH.

THE EQUATION of A TANGENT LINE:

$$y - y_1 = m(x - x_1)$$

Ex 5: Find the equation of the **TANGENT LINE** to the graph of $r = 3\sin(2\theta)$ when $\theta = \pi/4$

Sol: