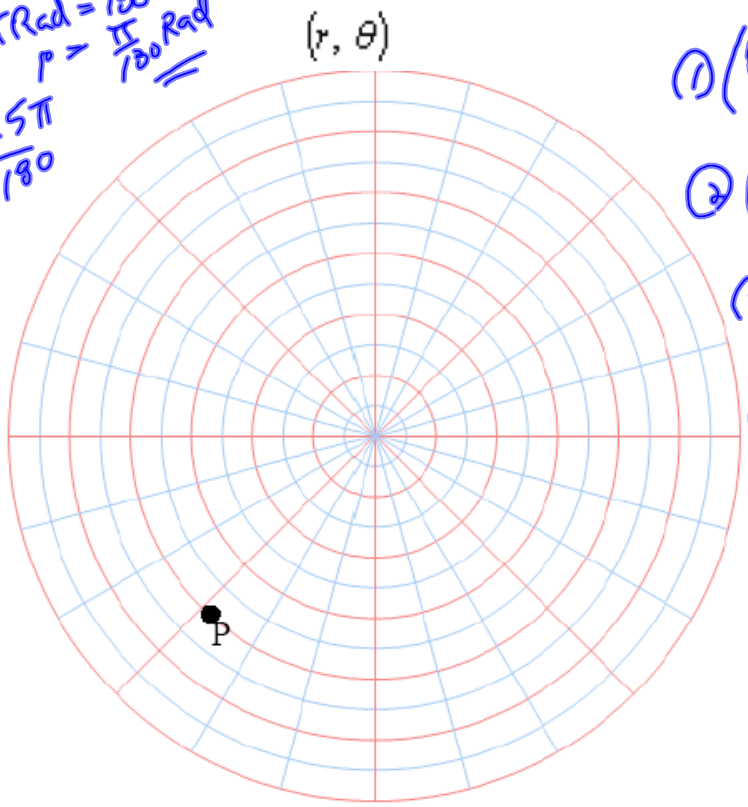
WARM-UP...

State 4 coordinates that describe the point P in BOTH rads & deg...

1) (+ , +)
2) (+ , -)
3) (- , +)
4) (- , -)

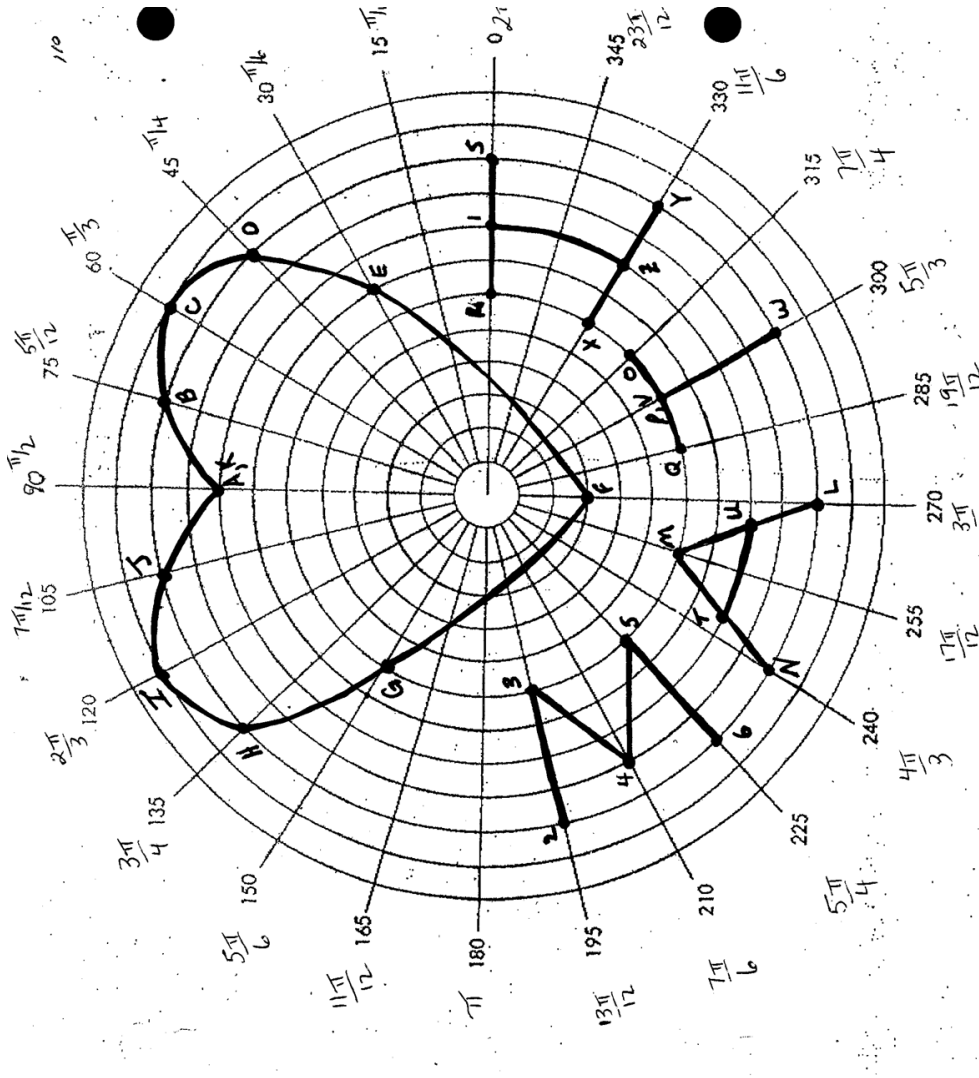
π Rad = 180°
$\rho = \frac{\pi}{180}$ Rad

$\frac{225\pi}{180}$



① (8, 225°)
② (8, −135°)
③ (−8, 45°)
④ (−8, −315°)

① $(8, \frac{5\pi}{4})$
② $(8, -\frac{3\pi}{4})$
③ $(-8, \frac{\pi}{4})$
④ $(-8, -\frac{7\pi}{4})$



Check Your Understanding

4. Create a picture by plotting and connecting the following points.

(a) Join these points with a smooth curve.

$\left(8, \frac{\pi}{2}\right), \left(10, \frac{5\pi}{12}\right), \left(11, \frac{\pi}{3}\right), \left(-10, \frac{5\pi}{4}\right), \left(7, \frac{\pi}{6}\right), \left(3, -\frac{\pi}{2}\right), \left(7, -\frac{7\pi}{6}\right),$
$\left(10, \frac{3\pi}{4}\right), \left(-11, -\frac{\pi}{3}\right), \left(10, \frac{7\pi}{12}\right), \left(-8, \frac{3\pi}{2}\right)$

(b) Connect these points with straight lines in the order given.

$\left(10, \frac{7\pi}{2}\right), \left(-6, \frac{5\pi}{12}\right), \left(10, -\frac{8\pi}{3}\right)$

(c) Join these points with a smooth curve.

$\left(6, \frac{15\pi}{4}\right), \left(-6, \frac{14\pi}{3}\right), \left(6, -\frac{5\pi}{12}\right)$

(d) Join these points with a straight line.

$(6, 0), (-10, -5\pi)$

(e) Join these points with a smooth curve.

$(8, 245°), (8, 265°)$

(f) Join these points with a straight line.

$(-6, -240°), (10, -60°)$

(g) Join these points with a straight line.

$\left(6, \frac{23\pi}{6}\right), \left(10, -\frac{\pi}{6}\right)$

(h) Join these points with a smooth curve.

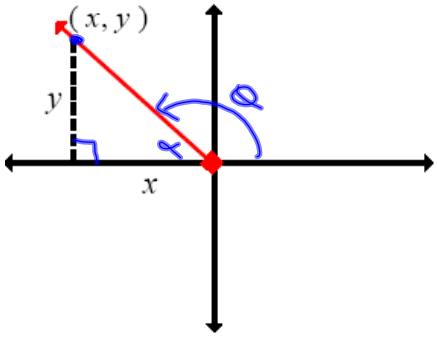
$(8, 690°), (8, 6\pi)$

(i) Connect these points with straight lines in the order given.

$\left(10, \frac{13\pi}{12}\right), \left(-6, \frac{\pi}{12}\right), \left(9, -\frac{5\pi}{6}\right), \left(6, \frac{13\pi}{4}\right), \left(-10, -\frac{7\pi}{4}\right)$

Converting Between Coordinate Systems

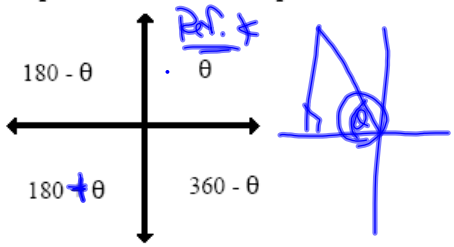
I. Rectangular ⇒ Polar
(x, y) (r, θ)



To get θ we know that...

$$\tan\theta = \left|\frac{y}{x}\right|$$

to get the reference angle then we put it into the quadrant where the point lies.

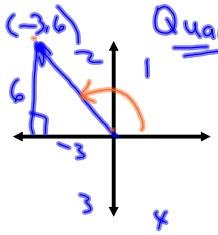


To get r we know that...

$$r = \sqrt{x^2 + y^2}$$

EXAMPLES...

#1. (-3, 6)



(r, θ)

Quad.: 2

$\tan\theta = \left|\frac{6}{-3}\right| = 2$

(Ref ∠: 63°) Q2

$r = \sqrt{9+36}$

$r = \sqrt{45}$

$r = 3\sqrt{5}$

$\theta = 180 - 63$

$= 117°$

180 - θ, θ, 180 + θ, 360 - θ

Always Positive!!

$(3\sqrt{5}, 117°)$

2. (-12, -5) → Q3

$r = \sqrt{144+25}$

$r = 13$

$\tan\theta = \frac{5}{12}$

Ref ∠ = 23°

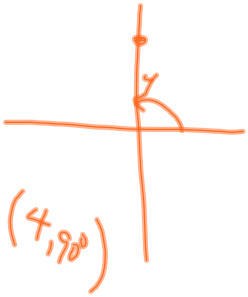
$\theta = 180 + 23$

$\theta = 203°$

$(13, 203°)$

$(13, -157)$

$(0, 4)$ ← Quadrantal

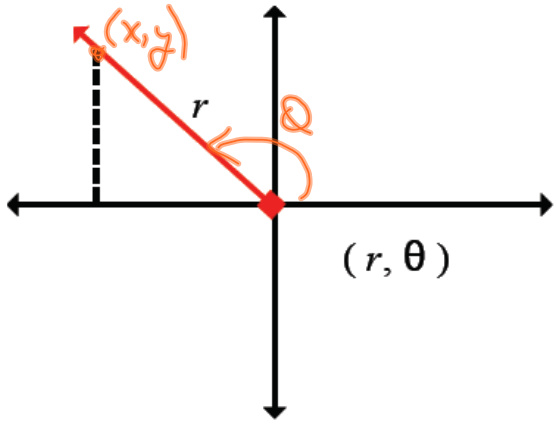


$(4, 90°)$

II. Polar ⇒ Rectangular

(r, θ) (x, y)

FORMULA!!!



$$\cos\theta = \frac{x}{r} \quad so \quad x = r\cos\theta$$

$$\sin\theta = \frac{y}{r} \quad so \quad y = r\sin\theta$$

Examples

#1. $(3, 150^o)$

3cos(150
-2.598076211
3sin(150
1.5

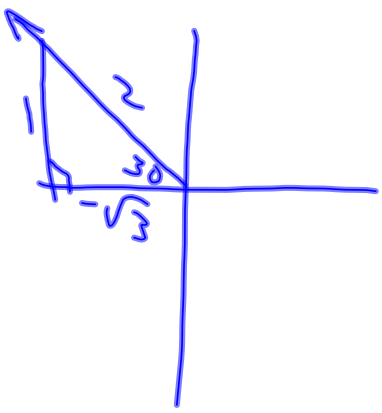
$x = 3\cos 150°$

$x = \frac{-3\sqrt{3}}{2}$ $3\left(\frac{-\sqrt{3}}{2}\right)$

$y = 3\sin 150°$

$y = 1.5$

150°



#2. $(-5, -440^o)$

$x = -5\cos(-440°)$

-5cos(-440)
-.8682408883

$x =$

$y = -5\sin(-440°)$

$y =$ -5sin(-440)
4.924038765

Bonus #1

$$|2x-1|-|x+5|=3$$

Case 1: (+,+) ⟶ If $2x-1>0$ & $x+5>0$

$2x>1$ $\quad x>-5$

$x>\frac{1}{2}$

$(2x-1)-(x+5)=3$

$x-6=3$

$x=9$ ⟶ okay ⟶ $\therefore x>\frac{1}{2}$

Case 2: (+,−) ⟶ If $2x-1>0$ & $x+5<0$

$x>\frac{1}{2}$ $\quad x<-5$ $\quad \emptyset$

$(2x-1)+(x+5)=3$

$3x+4=3$

$3x=-1$

$x=-\frac{1}{3}$

Case 3: (−,+) ⟶ If $2x-1<0$ & $x+5>0$

$2x<1$ $\quad x>-5$

$x<\frac{1}{2}$

$\therefore \{-5<x<\frac{1}{2}\}$

$-(2x-1)-(x+5)=3$

$-2x+1-x-5=3$

$-3x-4=3$

$-3x=7$

$x=-\frac{7}{3}$ ⟶ okay

Case 4: (−,−) ⟶ If $2x-1<0$ & $x+5<0$

$x<\frac{1}{2}$ $\quad x<-5$

$\therefore x<-5$

$-(2x-1)+(x+5)=3$

$-x+4=3$

$-x=-1$

$x=1$ ⟶ not <-5