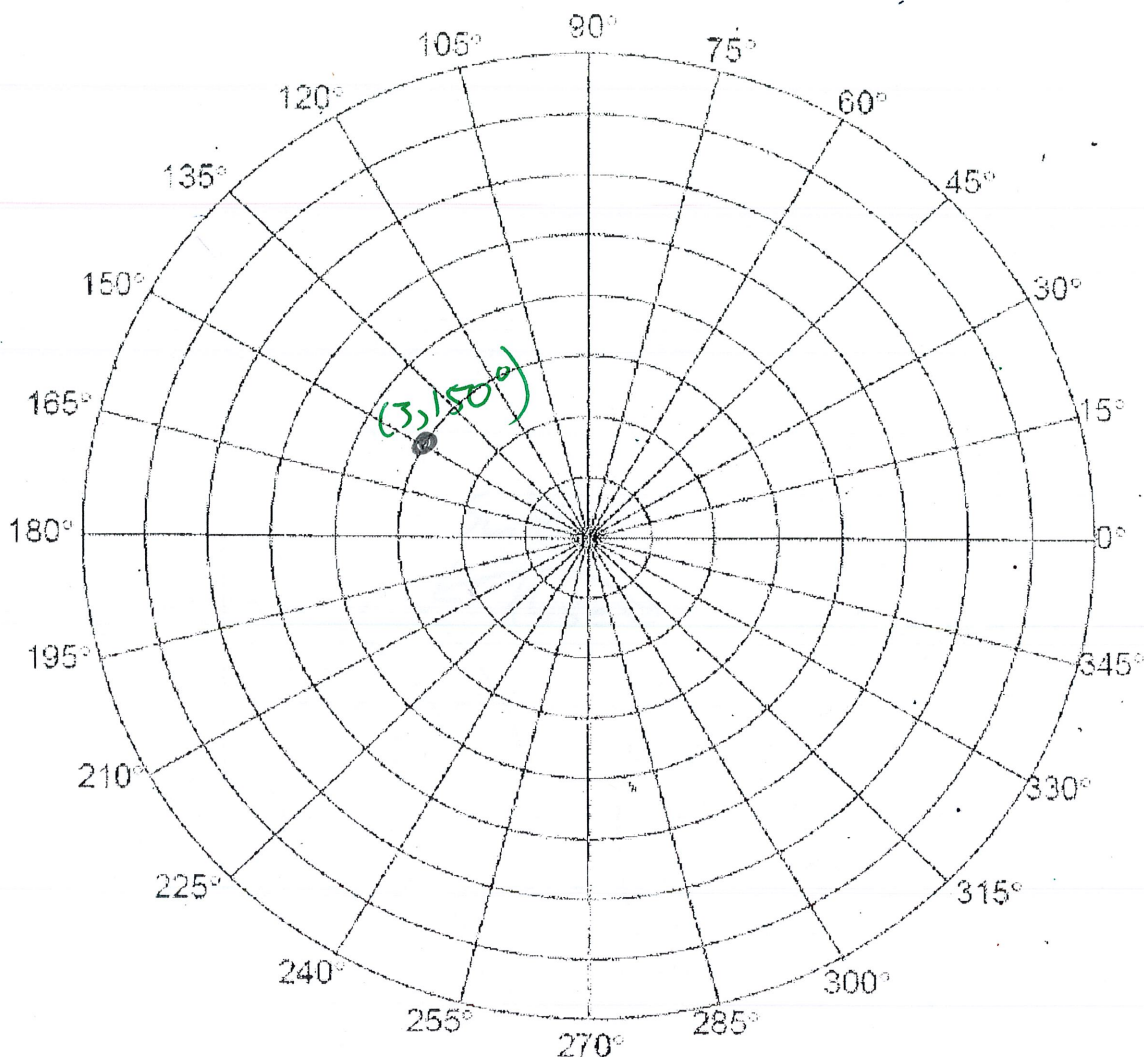


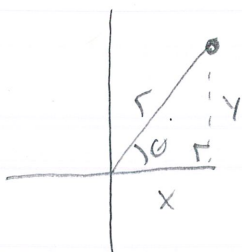
### Polar Coordinates



Polar Coordinate: A point represented by a radius and an angle  $(r, \theta)$ .  
 Formed by a fixed point and the pole (origin).

Ex:  $(3, 150^\circ)$

$$x^2 + y^2 = r^2 \rightarrow \text{circle (why not } x-h, y-k?)$$

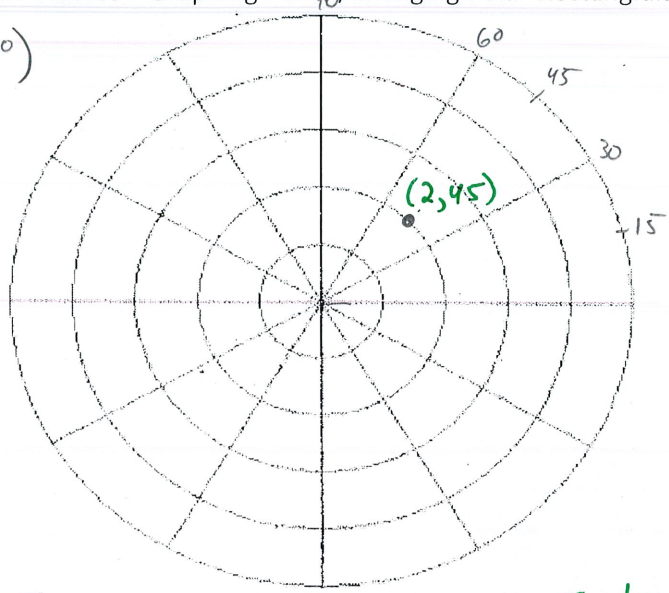


$$\begin{aligned} \cos \theta &= \frac{x}{r} \Rightarrow r \cos \theta = x \\ \sin \theta &= \frac{y}{r} \Rightarrow r \sin \theta = y \end{aligned} \quad \left. \vphantom{\begin{aligned} \cos \theta &= \frac{x}{r} \\ \sin \theta &= \frac{y}{r} \end{aligned}} \right\} \text{look familiar?}$$

$$\tan \theta = \frac{y}{x} \Rightarrow \theta = \tan^{-1}\left(\frac{y}{x}\right)$$

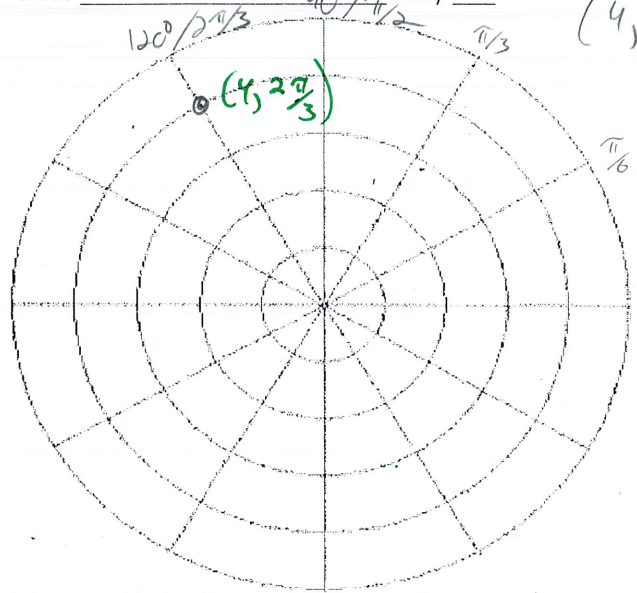
when deni add 180°

$(2, 45^\circ)$



$120^\circ / 2\pi/3$     $90^\circ / \pi/2$     $\pi/3$

$(4, 2\pi/3)$

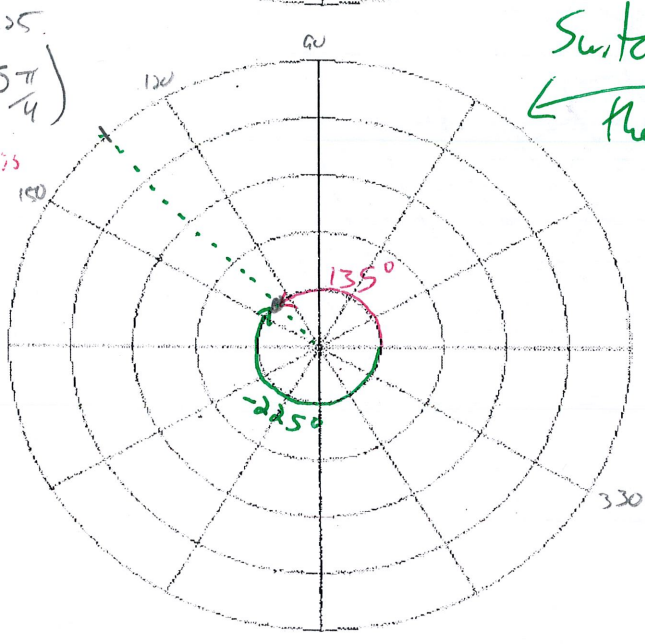


work in radians, then convert

$(1, -5\pi/4)$

what else is it?

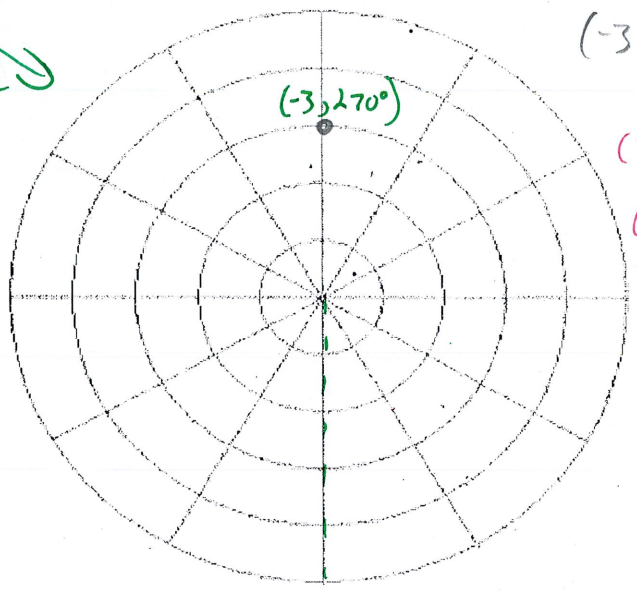
$(1, 3\pi/4)$   
 $135^\circ$



Switch Phase

$(-3, 270^\circ)$

or  
 $(3, 90^\circ)$  ✱  
 $(3, -270^\circ)$   
 $(3, \pi/2)$   
etc.



$270^\circ$

Convert Polar  $(r, \theta) \Rightarrow$  rectangular  $(x, y)$

$(3, 50^\circ) \rightarrow (x, y)$

$(r \cos \theta, r \sin \theta)$

$(3 \cos 50^\circ, 3 \sin 50^\circ)$

$(1.93, 2.30)$

Convert rectangular  $\Rightarrow$  polar

$(-2, 5) \rightarrow (r, \theta)$

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

$r = \sqrt{x^2 + y^2} = \sqrt{(-2)^2 + 5^2} \approx 5.39$

$\theta = \tan^{-1}(\frac{y}{x}) = \tan^{-1}(\frac{5}{-2}) + 180 = 111.80^\circ$

$(5.39, 111.80^\circ)$