

9-1 Introduction to Polar Coordinates

Objective(s):

- Convert between polar and rectangular coordinates.

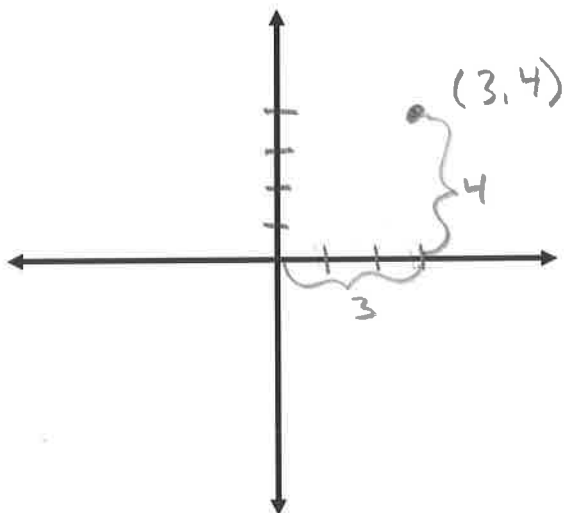
Warm-up:

Name two other angles that are co-terminal with -60° . Then, convert those angles to radians.

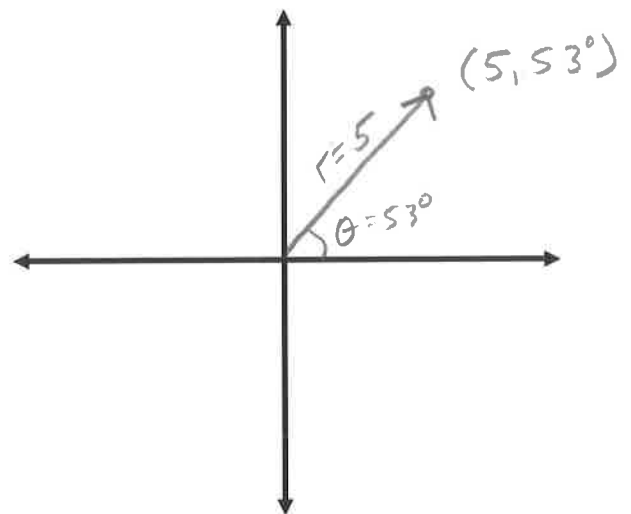
$$-60^\circ + 360^\circ = 300^\circ \quad \leftarrow \frac{5\pi}{3}$$

$$-60^\circ - 360^\circ = -420^\circ \quad \leftarrow \left(-\frac{6\pi}{3} - \frac{\pi}{3} = -\frac{7\pi}{3} \right)$$

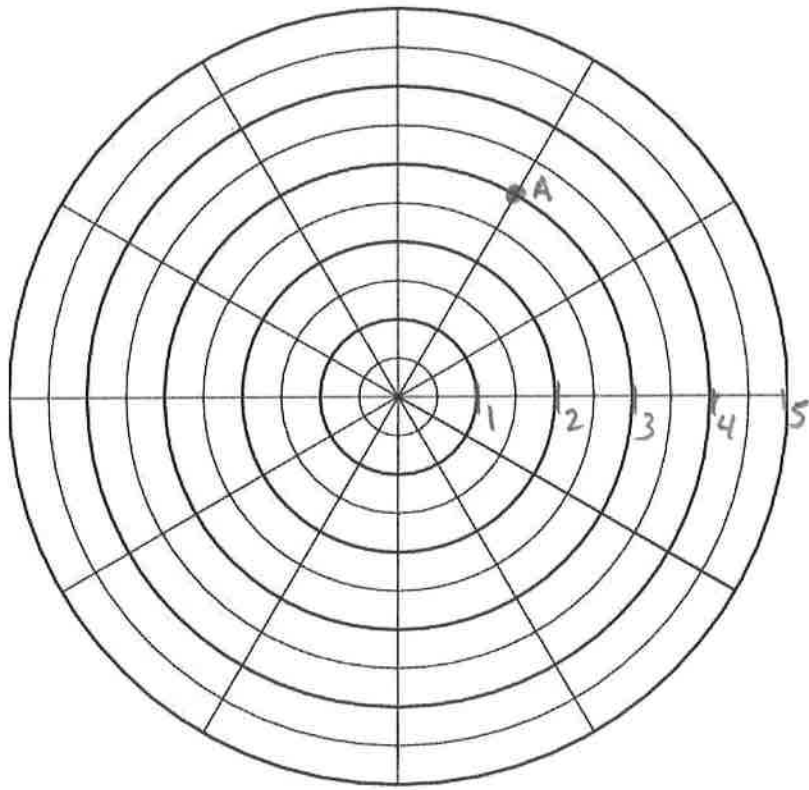
Rectangular Coordinates



Polar Coordinates



Ex 1: Naming a point in Polar



The coordinates for A can be stated in many ways, here are a few:

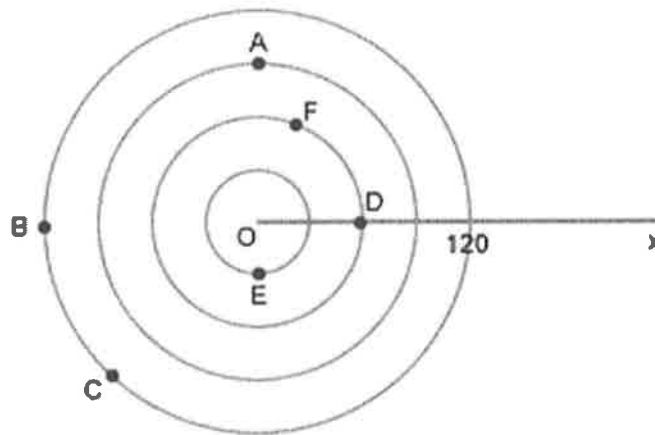
$(3, 60^\circ)$ $(3, \frac{\pi}{3})$

$(3, -300^\circ)$ $(3, -\frac{5\pi}{3})$

$(-3, 240^\circ)$ $(-3, \frac{4\pi}{3})$

$(-3, -120^\circ)$ $(-3, -\frac{2\pi}{3})$

Can you match the points to their coordinates?



D
(60, 0)

E
(30, 270)

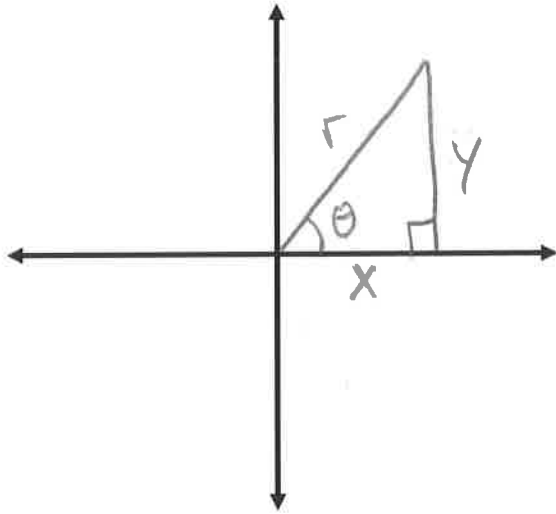
C
(120, 225)

A
(90, 90)

F
(60, 60)

B
(120, 180)

From Polar to Rectangular



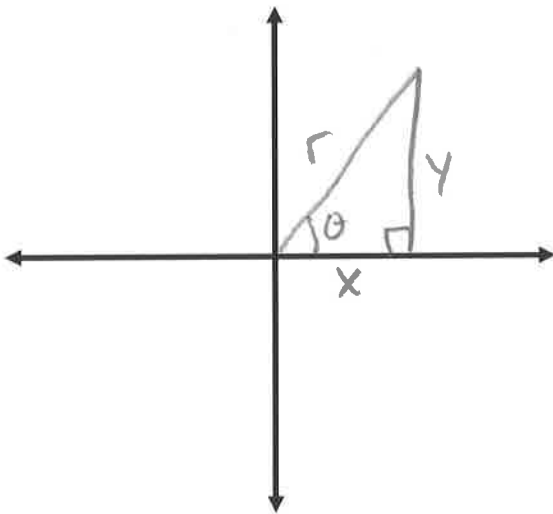
$$\cos \theta = \frac{x}{r}$$

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

$$x = r \cos \theta$$

$$y = r \sin \theta$$

From Rectangular to Polar



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

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

$$\tan \theta = \frac{y}{x}$$

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

Ex 2: Covert polar coordinates to rectangular coordinates.

A.) $(6, 120^\circ)$

$$x = 6 \cos 120^\circ$$

$$y = 6 \sin 120^\circ$$

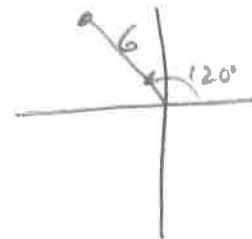
$$x = 6\left(-\frac{1}{2}\right)$$

$$y = 6\left(\frac{\sqrt{3}}{2}\right)$$

$$x = -3$$

$$y = 3\sqrt{3}$$

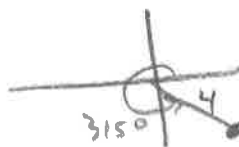
$$\boxed{(-3, 3\sqrt{3})}$$



B.) $(-4, 135^\circ)$

$$x = -4 \cos 135^\circ = -4 \left(-\frac{\sqrt{2}}{2}\right) = 2\sqrt{2}$$

$$y = -4 \sin 135^\circ = -4 \left(\frac{\sqrt{2}}{2}\right) = -2\sqrt{2}$$

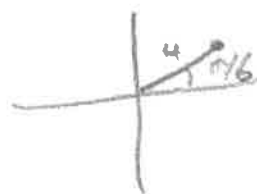


$$(2\sqrt{2}, -2\sqrt{2})$$

C.) $(4, \frac{\pi}{6})$

$$x = 4 \cos \frac{\pi}{6} = 4 \left(\frac{\sqrt{3}}{2}\right) = 2\sqrt{3}$$

$$y = 4 \sin \frac{\pi}{6} = 4 \left(\frac{1}{2}\right) = 2$$



$$(2\sqrt{3}, 2)$$

D.) $(0, \frac{13\pi}{3})$

$$(0, 0)$$

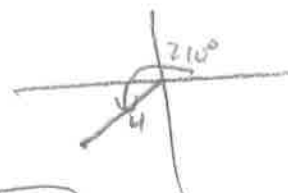
Check for understanding:

1. Convert to rectangular coordinates

$$(4, 210^\circ)$$

$$x = 4 \cos 210^\circ = 4 \left(-\frac{\sqrt{3}}{2}\right) = -2\sqrt{3}$$

$$y = 4 \sin 210^\circ = 4 \left(-\frac{1}{2}\right) = -2$$



$$(-2\sqrt{3}, -2)$$