

Student Workbook

Polar Coordinates

Name: _____

Date: _____

Period: _____

Learning Target: I can convert points and equations between polar and rectangular coordinates, and find alternate representations of a polar point.

Vocabulary

Term	Meaning
Polar Coordinates	A point given as (r, θ): r is the distance from the origin (pole), θ is the angle from the polar axis.
Pole	The origin in the polar coordinate system.

Key Concept: Polar → Rectangular

$x = r\cos\theta, y = r\sin\theta$

EXAMPLE 1
Convert $(4, \pi/3)$ to rectangular.

$x = 4\cos(\pi/3) = \rule{1cm}{0.4pt}$ $y = 4\sin(\pi/3) = \rule{1cm}{0.4pt}$

Key Concept: Rectangular → Polar

$r = \sqrt{x^2+y^2}, \theta = \text{reference angle adjusted for quadrant}$

EXAMPLE 2
Convert $(3, 4)$ to polar.

$r = \sqrt{9+16} = \rule{1cm}{0.4pt}$ $\theta = \arctan(4/3) \approx \rule{1cm}{0.4pt}$

COMMON MISTAKE
 $\arctan(y/x)$ only gives an angle in $(-90^\circ, 90^\circ)$! Always check which quadrant the point (x,y) is actually in, and adjust θ accordingly.

Key Concept: Multiple Representations

EXAMPLE 3

Find two other ways to represent $(5, \pi/4)$.

Add 2π : $(5, \underline{\hspace{2cm}})$ Use negative r (add π to θ): $(-5, \underline{\hspace{2cm}})$

Key Concept: Converting Equations

EXAMPLE 4

Convert $x^2 + y^2 = 16$ to polar form.

$r^2 = 16 \rightarrow r = \underline{\hspace{2cm}}$

EXAMPLE 5

Convert $r = 6\cos\theta$ to rectangular form (multiply both sides by r first).

$r^2 = 6r\cos\theta \rightarrow x^2 + y^2 = \underline{\hspace{2cm}}$

Guided Practice — Part A: Polar $\rightarrow$ Rectangular

A1 Convert $(6, \pi/6)$ to rectangular.

A2 Convert $(8, 2\pi/3)$ to rectangular.

Guided Practice — Part B: Rectangular $\rightarrow$ Polar

B1 Convert $(5, 5)$ to polar.

B2 Convert $(-3, 3\sqrt{3})$ to polar.

Guided Practice — Part C: Alternate Representations

- C1** Find two other representations of $(4, \pi/3)$.

- C2** Find two other representations of $(-2, \pi/4)$.

Guided Practice — Part D: Converting Equations

- D1** Convert $x^2 + y^2 = 9$ to polar form.

- D2** Convert $r = 4\sin\theta$ to rectangular form.

BEFORE YOU MOVE ON

Check with a partner: when converting rectangular to polar, did you verify your angle matches the correct quadrant of the original point?