LESSON MAKER PRO

Locate the Point

Switch between two ways to describe a position.

HIGH SCHOOL · G.GPE.C.9

G.GPE.C.9 "Convert between polar and rectangular coordinates."

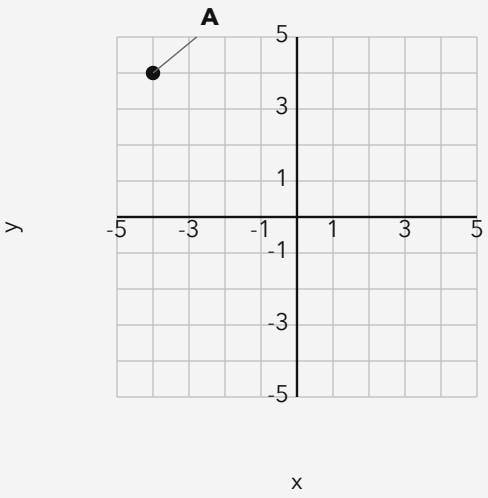
NAME _____ DATE _____

TWO COORDINATE SYSTEMS

Rectangular coordinates give a point as (x, y). Polar coordinates give its distance r from the origin and its angle θ, measured counterclockwise from the positive x-axis. Use $x = r\cos\theta$ and $y = r\sin\theta$; to convert back, use $r = \sqrt{(x^2 + y^2)}$ and find θ from the point's quadrant.

WORKED EXAMPLE

Point A is at (-4, 4). Find its polar coordinates with $r \geq 0$ and $0° \leq \theta < 360°$.



1. $r = \sqrt{((-4)^2 + 4^2)} = 4\sqrt{2}$.
2. A is in Quadrant II. Its reference angle is 45°.
3. $\theta = 180° - 45° = 135°$.

Answer: $(r, \theta) = (4\sqrt{2}, 135°)$

PRACTICE 4 problems

1 Convert (r, θ) = (6, 30°) to rectangular coordinates.

ANSWER _____

2 Convert (r, θ) = (10, 120°) to rectangular coordinates.

ANSWER _____

3 Convert $(x, y) = (-\sqrt{3}, 1)$ to polar coordinates. Use $r \geq 0$ and $0° \leq \theta < 360°$.

ANSWER _____

4 Convert $(x, y) = (0, -9)$ to polar coordinates. Use $r \geq 0$ and $0° \leq \theta < 360°$.

ANSWER _____

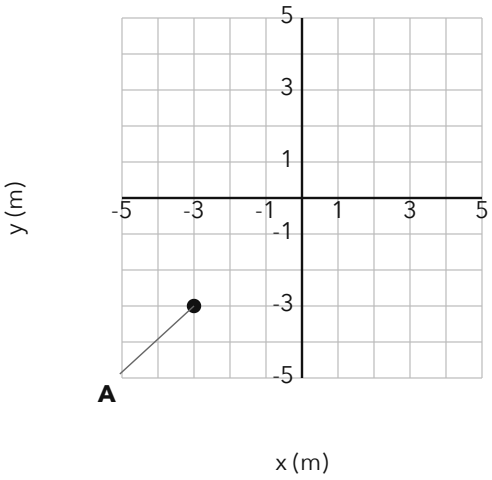
APPLY IT Show your work

1 At a concert, a spotlight is 12 meters from center stage at an angle of 60° counterclockwise from the positive x-axis. What are its rectangular coordinates in meters?

WORK SPACE

ANSWER _____

2 In a game, A marks your character on a coordinate grid. Each unit is 1 meter. Give A's polar coordinates with $r \geq 0$ and $0° \leq \theta < 360°$.



ANSWER _____

CHALLENGE One step up

A point has polar coordinates (-8, 30°). Find its rectangular coordinates and a polar form of the same point with a positive radius.

WORK SPACE AND ANSWER

ANSWER KEY

Locate the Point

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Convert (r, θ) = (6, 30°) to rectangular coordinates.	**(x, y) = (3√3, 3)**
2	Convert (r, θ) = (10, 120°) to rectangular coordinates.	**(x, y) = (-5, 5√3)**
3	Convert (x, y) = (-√3, 1) to polar coordinates. Use r ≥ 0 and 0° ≤ θ < 360°.	**(r, θ) = (2, 150°)**
4	Convert (x, y) = (0, -9) to polar coordinates. Use r ≥ 0 and 0° ≤ θ < 360°.	**(r, θ) = (9, 270°)**

PART 2 · APPLY IT

1. **(6, 6√3) meters** Use x = 12 cos 60° = 6 and y = 12 sin 60° = 6√3.
2. **(r, θ) = (3√2 meters, 225°)** A is at (-3, -3), so r = √(9 + 9) = 3√2 meters. Its reference angle is 45° in Quadrant III, so θ = 225°.

CHALLENGE

Rectangular: (-4√3, -4). Positive-radius polar form: (8, 210°).

Accept equivalent exact radical forms. Polar answers must use the stated angle range where one is given.