LESSON MAKER PRO

Beyond the Grid

Move between rectangular, polar, and parametric equations.

HIGH SCHOOL · MA.912.T.4

MA.912.T.4 "Extend rectangular coordinates and equations to polar and parametric forms."

NAME _____ DATE _____

COORDINATE CONNECTIONS

For a polar point, use x = r cos(theta) and y = r sin(theta) to find rectangular coordinates. To change a rectangular equation to polar form, replace $x^2 + y^2$ with r^2. For parametric equations, solve one equation for t and substitute into the other equation to remove t.

WORKED EXAMPLE

Convert the polar point (6, 150 degrees) to rectangular coordinates.

1. Write x = 6 cos(150 degrees) and y = 6 sin(150 degrees).
2. Use cos(150 degrees) = -sqrt3/2 and sin(150 degrees) = 1/2.
3. Compute x = -3sqrt3 and y = 3.

Answer: (-3sqrt3, 3)

PRACTICE 6 problems

1 Convert the rectangular point (5, 5) to polar coordinates. Use 0 degrees <= theta < 360 degrees.

ANSWER _____

2 Convert the polar point (8, 30 degrees) to rectangular coordinates.

ANSWER _____

3 Convert the rectangular point (0, -7) to polar coordinates. Use 0 degrees <= theta < 360 degrees.

ANSWER _____

4 Convert the polar point (10, 120 degrees) to rectangular coordinates.

ANSWER _____

5 Convert the polar equation $r^2 = 81$ to a rectangular equation.

ANSWER _____

6 Eliminate t to write a rectangular equation for x = 2t - 1 and y = 5t + 4.

ANSWER _____

APPLY IT Show your work

1 A school robotics team uses a floor map with the starting marker at the origin. A robot is 14 meters from the marker at an angle of 135 degrees, measured counterclockwise from the positive x-axis. What are the robot's rectangular coordinates?

WORK SPACE

ANSWER

2 For a motion graphic in the school news video, a dot's position t seconds after the clip begins is $x = 4t + 2$ and $y = -2t + 9$. Write a rectangular equation relating x and y. Include the restriction implied by $t \geq 0$.

WORK SPACE

ANSWER

CHALLENGE One step up

Convert $x^2 + y^2 = 4x$ to polar form. Then explain in one sentence why the origin is included in your polar equation.

WORK SPACE AND ANSWER

Beyond the Grid

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Convert the rectangular point (5, 5) to polar coordinates. Use 0 degrees <= theta < 360 degrees.	**(5sqrt2, 45 degrees)**
2	Convert the polar point (8, 30 degrees) to rectangular coordinates.	**(4sqrt3, 4)**
3	Convert the rectangular point (0, -7) to polar coordinates. Use 0 degrees <= theta < 360 degrees.	**(7, 270 degrees)**
4	Convert the polar point (10, 120 degrees) to rectangular coordinates.	**(-5, 5sqrt3)**
5	Convert the polar equation $r^2 = 81$ to a rectangular equation.	**$x^2 + y^2 = 81$**
6	Eliminate t to write a rectangular equation for x = 2t - 1 and y = 5t + 4.	**y = (5/2)x + 13/2**

PART 2 · APPLY IT

1. **(-7sqrt2, 7sqrt2)** Use x = 14 cos(135 degrees) and y = 14 sin(135 degrees).
2. **y = -(1/2)x + 10, with x ≥ 2.** Solve x = 4t + 2 for t, then substitute t = (x - 2)/4 into the equation for y. Since t ≥ 0, x = 4t + 2 ≥ 2; the path is a ray, not the entire line.

CHALLENGE

r = 4 cos(theta). The origin is included because r = 0 works when theta = 90 degrees or theta = 270 degrees.

Accept equivalent exact forms and clearly labeled coordinates. In Practice 1 and 3, require 0 degrees <= theta < 360 degrees as stated. Coterminal angles outside that interval do not meet those directions; accept them only when a task specifies no angle interval. Equivalent negative-radius representations within the stated interval are also valid: (-5sqrt2, 225 degrees) for Practice 1 and (-7, 90 degrees) for Practice 3.