LESSON MAKER PRO

Coordinate Switch

Move between rectangular, polar, and parametric forms.

HIGH SCHOOL · MA.912.T.4

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

NAME ____________________ DATE ____________

SWITCHING COORDINATE FORMS

Polar coordinates locate a point with r, its distance from the origin, and theta, its angle from the positive x-axis. Use r=sqrt(x^2+y^2), x=r cos(theta), and y=r sin(theta), with r>=0 and 0°<=theta<360°. In parametric form, write both x and y using a parameter such as t to show how a point moves.

WORKED EXAMPLE

Write the rectangular point (8,15) in polar form.

1. r=sqrt(8^2+15^2)=sqrt(289)=17.
2. The point is in Quadrant I, so theta=tan^-1(15/8).
3. The polar coordinates are (17,tan^-1(15/8)).

Answer: (17,tan^-1(15/8))

PRACTICE

6 problems

1. Write the rectangular point (3,4) in polar form.

   ANSWER ____________________

2. Write the rectangular point (-4,3) in polar form.

   ANSWER ____________________

3. Write the polar coordinates (6,30°) in rectangular form.

   ANSWER ____________________

4. Convert x^2+y^2=81 to polar form.

   ANSWER ____________________

5. Eliminate t from x=1+2t and y=5-3t.

   ANSWER ____________________

6. A moving point starts at (2,-1). Each second, it moves 4 units right and 3 units down. Let t be time in seconds. Write parametric equations for the motion.

   ANSWER ____________________

APPLY IT Show your work

1 In a racing game, a player token starts at (-2,6). Each frame, it moves 3 units right and 2 units down. Let t be the number of frames. Write parametric equations for the token, then find its location after 4 frames.

WORK SPACE

ANSWER ____________________

2 On a music festival map, the main gate is the origin. A food truck is located at polar coordinates (12,150°), where the positive x-axis points east and the positive y-axis points north. Write the truck's rectangular coordinates.

WORK SPACE

ANSWER ____________________

CHALLENGE One step up

CHALLENGE

A motion is modeled by $x=3t$ and $y=4t$. Describe the polar coordinates of the point when $t>0$ and when $t<0$. Explain why the angle changes.

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Coordinate Switch

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write the rectangular point (3,4) in polar form.	**(5,tan^-1(4/3))**
2	Write the rectangular point (-4,3) in polar form.	**(5,180°-tan^-1(3/4))**
3	Write the polar coordinates (6,30°) in rectangular form.	**(3sqrt(3),3)**
4	Convert x^2+y^2=81 to polar form.	**r=9**
5	Eliminate t from x=1+2t and y=5-3t.	**3x+2y=13**
6	A moving point starts at (2,-1). Each second, it moves 4 units right and 3 units down. Let t be time in seconds. Write parametric equations for the motion.	**x=2+4t, y=-1-3t, t>=0**

PART 2 · APPLY IT

1. **x=-2+3t, y=6-2t; after 4 frames, (10,-2)** Use the starting coordinates as the constants and the movement per frame as the coefficients of t. Substitute t=4 to find the location.
2. **(-6sqrt(3),6)** Use x=r cos(theta) and y=r sin(theta). Since cos(150°)=-sqrt(3)/2 and sin(150°)=1/2, the coordinates are (-6sqrt(3),6).

CHALLENGE

For t>0, (r,theta)=(5t,tan^-1(4/3)). For t<0, (r,theta)=(5|t|,180°+tan^-1(4/3)). When t changes from positive to negative, both x and y change signs, so the point moves in the opposite direction and the angle increases by 180°. At t=0, the point is at the origin and theta is undefined.

Accept coterminal angles that differ by multiples of 360°. Accept equivalent exact inverse-trigonometric notation and algebraically equivalent rectangular equations.