LESSON MAKER PRO

Change the Coordinates

Turn polar and parametric paths into rectangular equations.

HIGH SCHOOL · PC.F.E.32.b

PC.F.E.32.b "Convert parametric and polar equations to rectangular form."

NAME _____ DATE _____

THE BIG IDEA

To convert a polar equation, use $x=r\cos\theta$, $y=r\sin\theta$, and $r^2=x^2+y^2$. To convert parametric equations, solve one equation for the parameter and substitute into the other. Keep any restrictions needed to describe exactly the original points.

WORKED EXAMPLE

Convert $r=7\cos\theta$ to rectangular form.

1. Multiply both sides by r: $r^2=7r\cos\theta$.
2. Substitute $r^2=x^2+y^2$ and $r\cos\theta=x$: $x^2+y^2=7x$.

Answer: $x^2+y^2=7x$

PRACTICE 6 problems

1 Convert $r=4\sin\theta$ to rectangular form.

ANSWER _____

2 Convert $r=5$ to rectangular form.

ANSWER _____

3 Convert $r\cos\theta=3$ to rectangular form.

ANSWER _____

4 Eliminate t from $x=2t+1$ and $y=3t-4$.

ANSWER _____

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

ANSWER _____

6 Eliminate t from $x=4\cos t$ and $y=9\sin t$, where $0\le t<2\pi$.

ANSWER _____

APPLY IT Show your work

1 A student films a drone. After t seconds, its horizontal position is $x=5t$ meters and its height is $y=12t+2$ meters, where $t\geq 0$. Write a rectangular equation for its path and state the restriction on x.

WORK SPACE

ANSWER _____

2 A drone show planner marks the boundary of a circular viewing area on a polar map with $r=6\sin\theta$. Write a rectangular equation for the boundary.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A game character follows $x=3t-2$ and $y=t^2+1$, where $t\geq 0$. Write a rectangular equation for the path, state the restriction on x, and explain why it is needed.

WORK SPACE AND ANSWER

Change the Coordinates

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Convert $r=4\sin\theta$ to rectangular form.	**$x^2+y^2=4y$**
2	Convert $r=5$ to rectangular form.	**$x^2+y^2=25$**
3	Convert $r\cos\theta=3$ to rectangular form.	**$x=3$**
4	Eliminate t from $x=2t+1$ and $y=3t-4$.	**$2y=3x-11$**
5	Eliminate t from $x=t^2+2$ and $y=t-1$.	**$x=(y+1)^2+2$**
6	Eliminate t from $x=4\cos t$ and $y=9\sin t$, where $0\le t<2\pi$.	**$x^2/16+y^2/81=1$**

PART 2 · APPLY IT

1. **$y=(12/5)x+2$, with $x\ge0$** From $x=5t$, $t=x/5$. Substitute into $y=12t+2$; since $t\ge0$, $x\ge0$.
2. **$x^2+y^2=6y$** Multiply by r to get $r^2=6r\sin\theta$. Substitute $r^2=x^2+y^2$ and $r\sin\theta=y$.

CHALLENGE

The path is $y=(x+2)^2/9+1$, with $x\ge-2$. Since $t\ge0$ and $x=3t-2$, the character never reaches a point with $x<-2$.

Accept algebraically equivalent rectangular equations. For the restricted paths, require the x restriction as well as the equation.