Polar Coordinates

Every polar coordinate can be represented 4 ways

(r, counter-clockwise angle)
(r, clockwise angle)
(- r, counter-clockwise angle)
(- r, clockwise angle)

Change from polar to rectangular coordinates

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

Change from rectangular to polar coordinates

$r = \pm\sqrt{x^2 + y^2}$
$\theta = \tan^{-1} y/x$

Change a rectangular equation to polar

1. Substitute $r \cos \theta$ for every x, $r \sin \theta$ for every y, and r^2 for every $x^2 + y^2$.
2. Rewrite the equation so that r is by itself.

Change a polar equation to rectangular

1. Cross-multiply to get rid of any fractional equations.
2. Substitute $x^2 + y^2$ for every r^2. Substitute x for every $r \cos \theta$ and y for every $r \sin \theta$.
3. If you only have r, get it by itself. You will have to change it to r^2. There are 2 ways to do this. Choose the method that gives the best results.
    a. Multiply both sides of the equation by r, or
    b. Square both sides of the equation

Section Exercises 12.1: Polar Coordinates

In Exercises 1 – 4, plot each point on a polar graph and find three additional polar coordinate representations of this point such that $-360° < \theta < 360°$.

1. $(2, 30°)$
2. $(3, 135°)$
3. $(-5, 90°)$
4. $(4, -60°)$

In Exercises 5 – 8, the polar coordinates are given. Find the rectangular coordinates for the same point. Round answers to the nearest tenth.

5. $(4, 90°)$
6. $(-1, 225°)$
7. $(4, 60°)$
8. $(\sqrt{2}, -135°)$

In Exercises 9 – 12, the rectangular coordinates of a point are given. In each case find two sets of polar coordinates for the same point such that $0 \leq \theta < 360$. Round answers to the nearest tenth.

9. $(1, 1)$
10. $(0, -5)$
11. $(-3, 4)$
12. $(5, 12)$

In Exercises 11 -13, find a polar equation of the graph having the given rectangular equation.

13. $x^2 + y^2 = 9$
14. $x^2 + y^2 - 6y = 0$
15. $4x + 7y - 2 = 0$

In Exercises 14 – 16, find a rectangular equation of the graph having the polar equation.

16. $r = 4 \cos \theta$
17. $r = \dfrac{1}{1 - \cos \theta}$
18. $r = \dfrac{6}{2 \cos \theta - 2 \sin \theta}$