

Practice

Polar and Rectangular Coordinates

Find the rectangular coordinates of each point with the given polar coordinates.

1. $(6, 120^\circ)$
 $(-3, 3\sqrt{3})$

2. $(-4, 45^\circ)$
 $(-2\sqrt{2}, -2\sqrt{2})$

3. $(4, \frac{\pi}{6})$
 $(2\sqrt{3}, 2)$

4. $(0, \frac{13\pi}{3})$
 $(0, 0)$

Find the polar coordinates of each point with the given rectangular coordinates. Use $0 \leq \theta < 2\pi$ and $r \geq 0$.

5. $(2, 2)$
 $(2\sqrt{2}, \frac{\pi}{4})$

6. $(2, -3)$
 $(3.61, 5.30)$

7. $(-3, \sqrt{3})$
 $(2\sqrt{3}, \frac{5\pi}{6})$

8. $(-5, -8)$
 $(9.43, 4.15)$

Write each polar equation in rectangular form.

9. $r = 4$
 $x^2 + y^2 = 16$

10. $r \cos \theta = 5$
 $x = 5$

Write each rectangular equation in polar form.

11. $x^2 + y^2 = 9$
 $r = \pm 3$

12. $y = 3$
 $r \sin \theta = 3$ or
 $r = 3 \csc \theta$

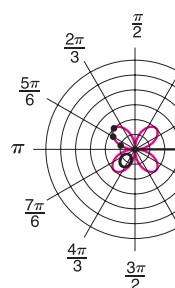
13. **Surveying** A surveyor records the polar coordinates of the location of a landmark as $(40, 62^\circ)$. What are the rectangular coordinates?
 $(18.78, 35.32)$

Polar Rose

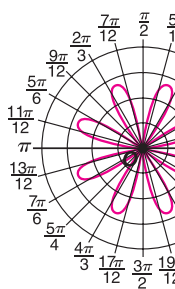
The polar equation $r = a \sin n\theta$ or $r = a \cos n\theta$ is called a polar rose. When $n = 1$, the rose is a circle.

Sketch the graphs of the polar equations.

1. $r = 2 \sin 2\theta$



3. $r = -2 \sin 4\theta$



5. The graph of the polar equation $r = a \sin n\theta$ or $r = a \cos n\theta$ is called a polar rose. The results from Example 13 are shown below.
- The distance from the origin to the tip of a petal is a .
 - If n is an odd number, the rose has n petals.
 - If n is an even number, the rose has $2n$ petals.
6. Write $r = 2 \sin 3\theta$ in rectangular form.
7. The total area of a polar rose $r = a \sin 3\theta$ is given by the formula $A = \frac{1}{2} a^2 n$.
- Find the area of the rose $r = 2 \sin 3\theta$.
 - Write the equation of a polar rose with area $A = 12$ and $n = 3$.

Sample a