9-2 Graphs of Polar Equations

Use symmetry to graph each equation.

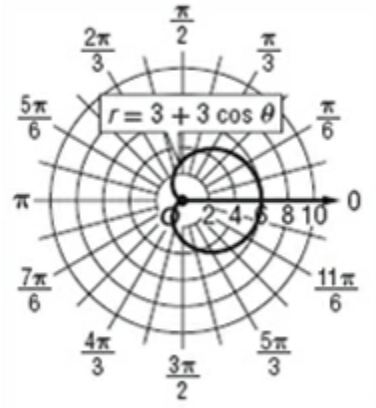
9. $r = 3 + 3 \cos \theta$

SOLUTION:

Because the polar equation is a function of the cosine function, it is symmetric with respect to the polar axis. Therefore, make a table and calculate the values of r on $[0, \pi]$.

θ	$r = 3 + 3 \cos \theta$
0	6
$\frac{\pi}{6}$	5.6
$\frac{\pi}{4}$	5.1
$\frac{\pi}{3}$	4.5
$\frac{\pi}{2}$	3
$\frac{2\pi}{3}$	1.5
$\frac{3\pi}{4}$	0.9
$\frac{5\pi}{6}$	0.4
π	0

Use these points and polar axis symmetry to graph the function.



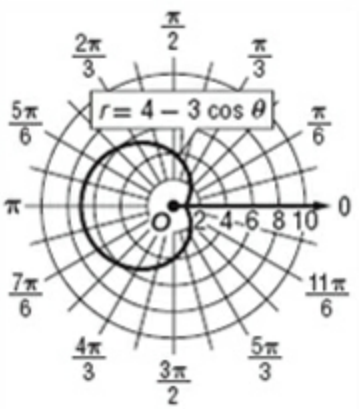
11. $r = 4 - 3 \cos \theta$

SOLUTION:

Because the polar equation is a function of the cosine function, it is symmetric with respect to the polar axis. Therefore, make a table and calculate the values of r on $[0, \pi]$.

θ	$r = 4 - 3 \cos \theta$
0	1
$\frac{\pi}{6}$	1.4
$\frac{\pi}{4}$	1.9
$\frac{\pi}{3}$	2.5
$\frac{\pi}{2}$	4
$\frac{2\pi}{3}$	5.5
$\frac{3\pi}{4}$	6.12
$\frac{5\pi}{6}$	6.6
π	7

Use these points and polar axis symmetry to graph the function.



Use symmetry, zeros, and maximum *r*-values to graph each function.

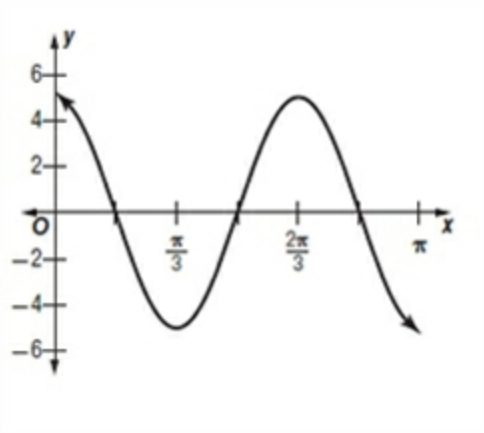
19. $r = 5 \cos 3\theta$

SOLUTION:

Because the polar equation is a function of the cosine function, it is symmetric with respect to the polar

axis.

Sketch the graph of the rectangular function $y = 5 \cos 3x$ on the interval $[0, \pi]$. From the graph, you can see that $|y| = 5$ when $x = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \text{and } \pi$ and $y = 0$ when $x = \frac{\pi}{6}, \frac{\pi}{2}, \text{and } \frac{5\pi}{6}$.



Interpreting these results in terms of the polar equation $r = 5 \cos 3\theta$, we can say that $|r|$ has a maximum value of 5 when $\theta = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \text{and } \pi$ and $r = 0$ when $\theta = \frac{\pi}{6}, \frac{\pi}{2} \text{and } \frac{5\pi}{6}$.

Since the function is symmetric with respect to the polar axis, make a table and calculate the values of r on $[0, \pi]$.

θ	$r = 5 \cos 3\theta$
0	5
$\frac{\pi}{12}$	3.5
$\frac{\pi}{6}$	0
$\frac{\pi}{4}$	−3.5
$\frac{\pi}{3}$	−5
$\frac{5\pi}{12}$	−3.5
$\frac{\pi}{2}$	0
$\frac{7\pi}{12}$	3.5
$\frac{2\pi}{3}$	5
$\frac{3\pi}{4}$	3.5
$\frac{5\pi}{6}$	0
$\frac{11\pi}{12}$	−3.5
π	−5

Use these and a few additional points to sketch the graph of the function.