Student: Arfaz Hossain **Date:** 04/20/22	**Instructor:** Muhammad Awais **Course:** Math 101 A04 Spring 2022	**Assignment:** Practice Questions for Sections 11.4 & 11.5 [Not f

Graph the curves $r = 6 + 12\cos\theta$ and $r = 6 + 12\sin\theta$.

First, establish what symmetries $r = 6 + 12\cos\theta$ has. The curve is symmetric about the x-axis if, when the point (r,θ) lies on the graph, the point $(r,-\theta)$ or $(-r,\pi-\theta)$ lies on the graph.

Test to see if the curve is symmetric about the x-axis. In the equation $r = 6 + 12\cos\theta$ substitute $(r,-\theta)$ or $(-r,\pi-\theta)$ for (r,θ) and see if the resulting equation is equivalent to the original one. It is helpful to make use of the identities $\cos(-\theta) = \cos(\theta)$ and $\cos(\pi-\theta) = -\cos(\theta)$. The equation does not change, so the curve is symmetric about the x-axis.

The curve is symmetric about the y-axis if, when the point (r,θ) lies on the graph, the point $(r,\pi-\theta)$ or $(-r,-\theta)$ lies on the graph.

Test to see if the curve is symmetric about the y-axis. In the equation $r = 6 + 12\cos\theta$ substitute $(r,\pi-\theta)$ or $(-r,-\theta)$ for (r,θ) and see if the resulting equation is equivalent to the original one. It is helpful to make use of the identities $\cos(\pi-\theta) = -\cos(\theta)$ and $\cos(-\theta) = \cos(\theta)$. The equation changes, so the curve is not symmetric about the y-axis.

The curve is symmetric about the origin if, when the point (r,θ) lies on the graph, the point $(-r,\theta)$ or $(r,\theta+\pi)$ lies on the graph.

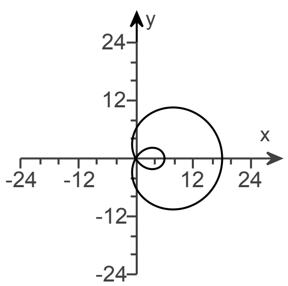
Test to see if the curve is symmetric about the origin. In the equation $r = 6 + 12\cos\theta$ substitute $(-r,\theta)$ or $(r,\theta+\pi)$ for (r,θ) and see if the resulting equation is equivalent to the original one. It is helpful to make use of the identity $\cos(\theta+\pi) = -\cos(\theta)$. The equation changes, so the curve is not symmetric about the origin.

Now that the symmetry about the x-axis has been established, it is possible to graph the curve by finding r for θ values ranging from 0 to π, and then reflect the plot about the x-axis to get the whole graph.

For each value of θ, find the corresponding value of $r = 6 + 12\cos\theta$. Round to the nearest hundredth.

θ	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π
r	18	16.39	14.48	12	6	0	-2.48	-4.39	-6

Use these values to sketch the curve $r = 6 + 12\cos\theta$.



Next, establish what symmetries $r = 6 + 12\sin\theta$ has. Test to see if the curve is symmetric about the x-axis. The curve is symmetric about the x-axis if, when the point (r,θ) lies on the graph, the point $(r,-\theta)$ or $(-r,\pi-\theta)$ lies on the graph.

Test to see if the curve is symmetric about the x-axis. In the equation $r = 6 + 12\sin\theta$ substitute $(r,-\theta)$ or $(-r,\pi-\theta)$ for (r,θ) and see if the resulting equation is equivalent to the original one. It is helpful to make use of the identities $\sin(-\theta) = \sin(\theta)$ and $\sin(\pi-\theta) = \sin(\theta)$. The equation changes, so the curve is not symmetric about the x-axis.

The curve is symmetric about the y-axis if, when the point (r,θ) lies on the graph, the point $(r,\pi-\theta)$ or $(-r,-\theta)$ lies on the graph.

Test to see if the curve is symmetric about the y-axis. In the equation $r = 6 + 12\sin\theta$ substitute $(r,\pi-\theta)$ or $(-r,-\theta)$ for (r,θ) and see if the resulting equation is equivalent to the original one. It is helpful to make use of the identities $\sin(\pi-\theta) = \sin(\theta)$ and $\sin(-\theta) = \sin(\theta)$. The equation does not change, so the curve is symmetric about the y-axis.

The curve is symmetric about the origin if, when the point (r,θ) lies on the graph, the point $(-r,\theta)$ or $(r,\theta+\pi)$ lies on the graph.

Test to see if the curve is symmetric about the origin. In the equation $r = 6 + 12\,\mathbf{sin}\;\theta$ substitute $(-r,\theta)$ or $(r,\theta+\pi)$ for (r,θ) and see if the resulting equation is equivalent to the original one. It is helpful to make use of the identity $\mathbf{sin}\,(\theta+\pi) = -\,\mathbf{sin}\,(\theta)$. The equation changes, so the curve is not symmetric about the origin.

Now that the symmetry about the y-axis has been established it is possible graph the curve by finding r for θ values ranging from $-\frac{\pi}{2}$ to $\frac{\pi}{2}$, and then reflect the plot about the y-axis to get the whole graph.

For each value of θ, enter the corresponding value of $r = 6 + 12\,\mathbf{sin}\;\theta$. Round to the nearest hundredth.

$\boldsymbol{\theta}$	$-\frac{\pi}{2}$	$-\frac{\pi}{3}$	$-\frac{\pi}{4}$	$-\frac{\pi}{6}$	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
r	-6	-4.39	-2.48	0	6	12	14.48	16.39	18

Use these values to sketch the curve $r = 6 + 12\,\mathbf{sin}\;\theta$.