6-4

Study Guide

Amplitude and Period of Sine and Cosine Functions

The **amplitude** of the functions $y = A \sin \theta$ and $y = A \cos \theta$ is the absolute value of A, or $|A|$. The period of the functions $y = \sin k\theta$ and $y = \cos k\theta$ is $\frac{2\pi}{k}$, where $k > 0$.

Example 1 **State the amplitude and period for the function $y = -2 \cos \frac{\theta}{4}$.**

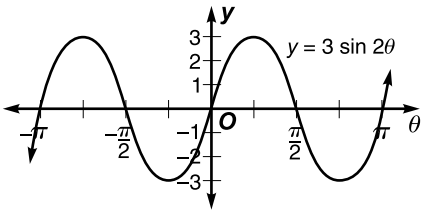
The definition of *amplitude* states that the amplitude of $y = A \cos \theta$ is $|A|$. Therefore, the amplitude of $y = -2 \cos \frac{\theta}{4}$ is $|-2|$, or 2.

The definition of *period* states that the period of $y = \cos k\theta$ is $\frac{2\pi}{k}$. Since $-2 \cos \frac{\theta}{4}$ equals $-2 \cos \left(\frac{1}{4}\theta\right)$, the period is $\frac{1}{4}$ or 8π.

Example 2 **State the amplitude and period for the function $y = 3 \sin 2\theta$. Then graph the function.**

Since $A = 3$, the amplitude is $|3|$ or 3.
Since $k = 2$, the period is $\frac{2\pi}{2}$ or π.

Use the amplitude and period above and the basic shape of the sine function to graph the equation.



Example 3 **Write an equation of the sine function with amplitude 6.7 and period 3π.**

The form of the equation will be $y = A \sin k\theta$. First find the possible values of A for an amplitude of 6.7.

$|A| = 6.7$
$A = 6.7$ or -6.7

Since there are two values of A, two possible equations exist.

Now find the value of k when the period is 3π.

$\frac{2\pi}{k} = 3\pi$ *The period of the sine function is* $\frac{2\pi}{k}$.
$k = \frac{2\pi}{3\pi}$ or $\frac{2}{3}$

The possible equations are $y = 6.7 \sin \frac{2}{3}\theta$ or $y = -6.7 \sin \frac{2}{3}\theta$.