

## 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.

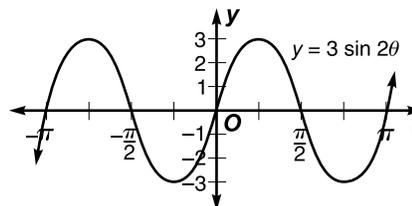
The definition of *period* states that the period of  $y = \cos k\theta$  is  $\frac{2\pi}{k}$ . Since  $-2 \cos \frac{\theta}{4}$  equals  $-2 \cos \left(\frac{1}{4}\theta\right)$ , the period is  $\frac{1}{4}$  or  $8\pi$ .

**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  $\pi$ .

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  $3\pi$ .

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.

$$|A| = 6.7$$

$$A = 6.7 \text{ or } -6.7$$

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

Now find the value of  $k$  when the period is  $3\pi$ .

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

$$k = \frac{2\pi}{3\pi} \text{ or } \frac{2}{3}$$

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

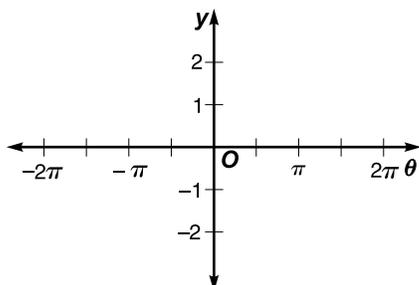
$$y = -6.7 \sin \frac{2}{3}\theta.$$

## Practice

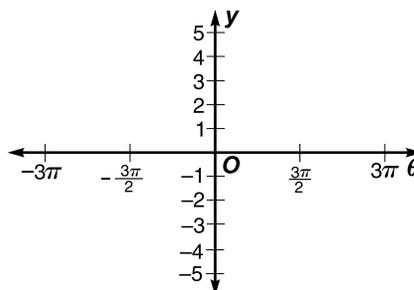
## Amplitude and Period of Sine and Cosine Functions

State the amplitude and period for each function. Then graph each function.

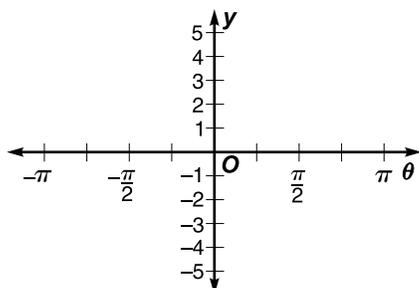
1.  $y = -2 \sin \theta$



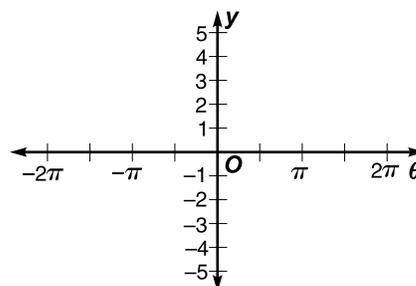
2.  $y = 4 \cos \frac{\theta}{3}$



3.  $y = 1.5 \cos 4\theta$



4.  $y = -\frac{2}{3} \sin \frac{\theta}{2}$



Write an equation of the sine function with each amplitude and period.

5. amplitude = 3, period =  $2\pi$

6. amplitude = 8.5, period =  $6\pi$

Write an equation of the cosine function with each amplitude and period.

7. amplitude = 0.5, period =  $0.2\pi$

8. amplitude =  $\frac{1}{5}$ , period =  $\frac{2}{5}\pi$

9. **Music** A piano tuner strikes a tuning fork for note A above middle C and sets in motion vibrations that can be modeled by the equation  $y = 0.001 \sin 880\pi t$ . Find the amplitude and period for the function.