

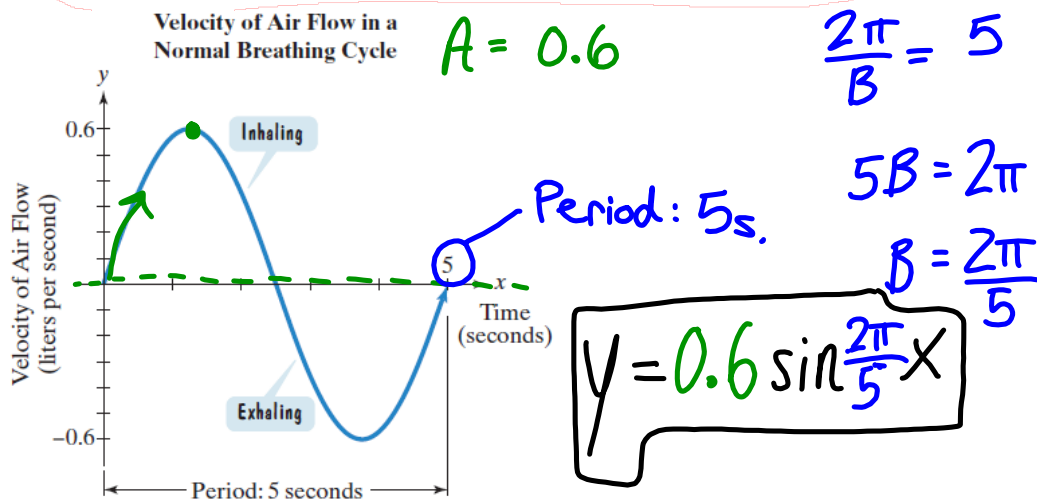
## 4.3 - Graphing Sin/Cos Trig. Functions - Day 5

### Using Sin / Cos Functions to Model Real-Life Situations

**Ex1.)**

#### A Trigonometric Breath of Life

The graph in **Figure 4.76** shows one complete normal breathing cycle. The cycle consists of inhaling and exhaling. It takes place every 5 seconds. Velocity of air flow is positive when we inhale and negative when we exhale. It is measured in liters per second. If  $y$  represents velocity of air flow after  $x$  seconds, find a function of the form  $y = A \sin Bx$  that models air flow in a normal breathing cycle.



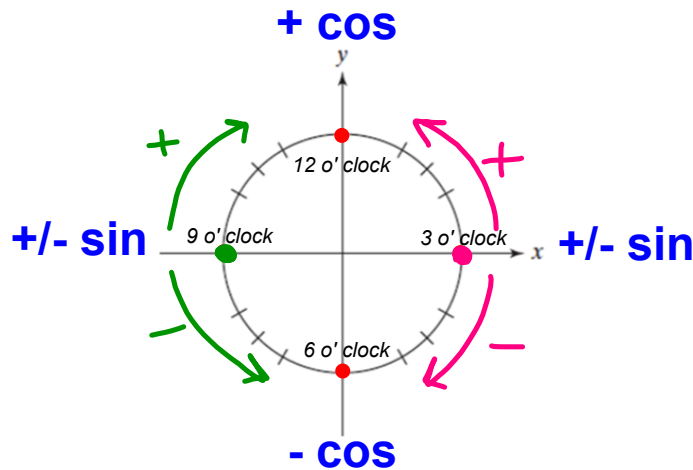
$$y = A \sin/\cos Bx + K$$

**A** = **amplitude** of the situation. Can be found by finding the difference between the max and min, then dividing by two. Often times it is the **radius** of a "wheel-problem."

**B** involves remembering that the **Period** = time for 1 revolution. Find  $B$ , by setting the period given equal to  $\frac{2\pi}{B}$  then solve for **B**.

**K** = the **distance the center (midline) is above zero** (the ground in "wheel-problems"). Easily found by adding the distance given to the amplitude.

## When to use Sin, Cos, -Sin, or -Cos ???



- Starts at 12 o'clock position (the top) use: +cos
- Starts at 6 o'clock position (the bottom) use: -cos
- Starts at 3 o'clock position (the right) with counterclockwise rotation use: +sin  
with clockwise rotation use: -sin
- Starts at 9 o'clock position (the left) with counterclockwise rotation use: -sin  
with clockwise rotation use: +sin

**Ex.2)** A Ferris wheel has a diameter of 50 feet and the bottom of the wheel is 4 feet above the ground. The wheel rotates at a constant speed, and takes 40 seconds to complete one revolution. Write the equation that models the height,  $h$ , of the Ferris wheel in terms of  $t$ , time in seconds, and assuming it starts at the bottom.

radius = 25 ft. = A

period = 40s =  $\frac{2\pi}{B}$

$40B = 2\pi$      $B =$

$B = \frac{2\pi}{40} = \frac{\pi}{20}$

$K = 29$  ft.

$h = -25 \cos \frac{\pi}{20} t + 29$

**You Try!**

**Ex.3)** A Ferris wheel has a diameter of 80 feet and the bottom of the wheel is 3 feet above the ground. The wheel rotates at a constant speed, and takes 5 minutes to complete six revolutions. Write the equation that models the height,  $h$ , of the Ferris wheel in terms of  $t$ , time in seconds, and assuming it starts at the bottom.



$$5 \text{ min} \rightarrow \frac{300 \text{ s.}}{6 \text{ revs}} = \text{Period} = 50 \text{ s}$$

$$\frac{2\pi}{B} = 50$$

$$50B = 2\pi$$

$$B = \frac{2\pi}{50} = \frac{\pi}{25}$$

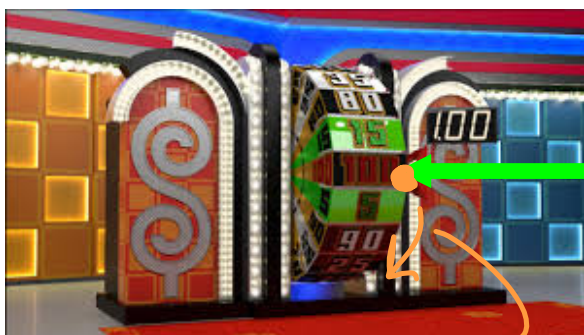
$$A = 40 \text{ ft}$$

$$K = 43 \text{ ft}$$

$\sim -\cos$

$$h = -40 \cos \frac{\pi}{25} t + 43$$

**Ex.4)** The wheel from The Price is Right is 8 feet in diameter and rotates clock-wise. The center axle of the wheel is 5 feet from the ground. Assume the \$1.00 is in line with the arrow (*like the picture*) and you spin the wheel downwards with two revolutions over 6 seconds. Write the equation that models the height,  $h$ , of the wheel in terms of  $t$ , time in seconds.



$$A = 4 \text{ ft.}$$

$$K = 5 \text{ ft.}$$

Starts here

$$\frac{6 \text{ s.}}{2 \text{ rev}} = 3 \text{ s.} = \text{Period}$$

$$\frac{2\pi}{B} = 3$$

$$3B = 2\pi$$

$$B = \frac{2\pi}{3}$$

$\sim -\sin$

$$h = -4 \sin \frac{2\pi}{3} t + 5$$