

1. Amanda was watching her little brother, Mike, play on a swing set. She decided that she would like to find his distance above the ground using a sinusoidal curve. Mike's height (in feet) at any time,  $x$  (in seconds), can be modeling by the equation  $f(x) = 4 \sin(\pi(x - 2)) + 5$

- Graph the function.
- What is Mike's maximum height? When does he reach this point for the first time?
- What is Mike's minimum height? When does he reach this point for the first time?
- How long will it take for Mike to travel from his maximum height to his minimum height?

2. While at the Puyallup Fair, you decide to ride the Ferris Wheel. Your distance above the ground (in feet) since you began moving varies sinusoidally with the time (in seconds) according to the equation

$$f(x) = 22 \cos\left(\frac{\pi}{6}(x - 5)\right) + 27$$

- Graph the function.
- What is the lowest point that you reach on the wheel? Highest point?
- How long will it take for you to travel all the way around the Ferris Wheel two times?

3. Sales of General Motors cars and trucks in 1996 followed a sinusoidal model for monthly sales  $m(t)$  of General Motors from a low of \$80 billion in April ( $t = 4$ ) to a high of \$96 billion in October ( $t = 10$ ).

- Find a sinusoidal equation for the monthly sales  $m(t)$  and graph it.
- What will the sales be in January of 1997?

4. The amount of air in a person's lungs varies sinusoidally with time when breathing normally. When full, Karen's lungs hold 3.5 liters of air. When "empty," her lungs only hold 0.5 liters of air. Her brother starts timing her breathing – after 2 seconds she has exhaled completely, then she completely inhales in 3 seconds.

- Find a sinusoidal equation for the amount of air in Karen's lungs at any time and graph it.
- Find the amount of air in Karen's lungs after 17 seconds.

5. The depth of water at my favorite surfing spot varies from 4 feet to 16 feet, depending on the time. Last Sunday, high tide occurred at 5:00am and the next high tide occurred at 7:00pm.

- Find a sinusoidal equation for the depth of water (in feet) of time  $t$  (in hours) since midnight on Sunday morning.
- When will the depth of the water be at its lowest point for the first time?
- What is the depth of the water on Monday at 4:00pm?

6. The height of a piston in a cylinder can be modeled by a sinusoidal function. A piston is at its lowest point in a cylinder, 8cm from the bottom, at  $t = 1$  seconds. The piston is at its highest point, 38 cm from the bottom, at  $t = 9$  seconds.

- Find a sinusoidal equation for the height of the piston, in cm, at any given time  $t$  and graph it.
- How long does it take the piston to reach 23 cm from the bottom for the third time?
- Find the height of the piston 45 seconds after the engine has started.