6.2 Day 4 Word Problems with Sine and Cosine Worksheet

1. If the equilibrium point is $y = 0$, then $y = -4\cos(\frac{\pi}{6}t)$ models a buoy bobbing up and down in the water. Find the period of the function and the location of the buoy at $t = 10$.

   $\frac{2\pi}{\pi/6} = 12$ $(10, -2)$

2. The function $y = 25\sin(\frac{\pi}{6}t) + 60$, where t is in months and $t = 0$ corresponds to April 15, models the average high temperature in degrees Fahrenheit in Centerville.

   a. Find the period of the function. 12
   b. What does the period represent? 1 year
   c. What is the maximum high temperature? 85°
   d. When does the maximum occur? $\sin(\pi/6\,t) = 1$ $\pi/6\,t = \pi/2$ $t = 3$

3. The population of predators and prey in a closed ecological system tends to vary periodically over time. In a certain system, the population of owls O can be presented by $O = 30\sin\left(\frac{\pi}{10}t\right) + 150$, where t is the time in years since January 1, 2001.

   a. Find the maximum number of owls. 180
   b. When does the maximum occur? $\sin(\pi/10\,t) = 1$ $\pi/10\,t = \pi/2$ $t = 5$
   c. Find the minimum number of owls. 120
   d. When does the minimum occur? $\sin(\pi/10\,t) = -1$ $\pi/10\,t = 3\pi/2$ $t = 15$

4. A leaf floats on the water bobbing up and down. The distance between its highest and lowest point is 4 centimeters. It moves from its highest point down to its lowest point and back to its highest point every 10 seconds. Write a cosine function the models the movement of the leaf in relationship to the equilibrium point. amp = 2 $\frac{2\pi}{b} = 10$ $10b = 2\pi$ $b = \pi/5$

   $y = 2\cos(\pi/5\,t)$

5. A person's blood pressure oscillates between 160 and 60. If the heart beats once every second, write a sine function that models this person's blood pressure. midline = 110 amp = 50 $2\pi/b = 1$ $b = 2\pi$

   $y = 50\sin(2\pi t) + 110$

6. Kala is jumping rope, and the rope touches the ground every time she jumps. She jumps at the rate of 40 jumps per minute, and the distance from the ground to the midpoint of the rope at its highest point is 5 feet. At $t = 0$ the height of the midpoint is zero. midline 2.5 amp 2.5

   a. Write a function for the height of the midpoint of the rope above the ground after t seconds
   b. Find the height of the midpoint of the rope after 32 seconds.

   $2\pi/\tfrac{3}{2} = 4\pi/3$ starts on ground $\frac{40\text{ jumps}}{60\text{ sec}} = \frac{1\text{ jump}}{x}$

   $y = -2.5\cos(4\pi/3\,t) + 2.5$ $(32, 3.75)$ $x = 3/2$

7. Sam and Dan are being dared to ride the Ferris wheel The height h (in feet) above the ground at any time t (in seconds) can be modeled by: $h = 40\cos\left(\frac{\pi}{20}t + \frac{\pi}{2}\right) + 50$

   a. Find the amplitude and period. 40ft $\frac{2\pi}{\pi/20} = 40$ seconds
   b. The Ferris wheel turns for 160 seconds before it stops to let Sam and Dan get off. How many times will they go around? 4 times
   c. What are the minimum and maximum heights for Sam and Dan? max 90 ft min 10 ft.

8. Suppose a Ferris wheel has a radius of 20 feet and operates at a speed of 3 revolutions per minute. The bottom car is 4 feet above the ground. Write a model for the height of a person above the ground whose height when t = 0 is 44 feet.

   $y = 20\cos(\pi/10\,t) + 24$ $\frac{2\pi}{b} = 20$ $20b = 2\pi$ $b = \pi/10$

   need to make a cosine!