3.3/3.4: Trig Equations and Sinusoidal Functions

Tips:

- Sinusoidal Functions are those which are general graph transformations of $\sin(x)$. Spelled out more explicitly, this says any function of the form

$$f(x) = A\sin\left(\frac{2\pi}{P}(x-h)\right) + k$$

  is a sinusoidal function.

- When solving an equation $f(x) = \#$ involving $\sin, \cos$, or $\tan$:

  1. dentify a fundamental domain,
  2. find the fundamental solutions
  3. translate each of those solutions by the period.

  (This is exactly what we did in section 1.6, only now we apply it to the specific case of sin and cos.)

1. Show that $\cos(\theta)$ is a sinusoidal function.

2. What is the period of the function $\sin\left(\frac{\pi}{7}x\right)$?

3. Sketch the graph of $g(x) = 3\sin(\frac{\pi}{12}(x-5)) + 4$. Be sure to include at least one period.

4. Find a sinusoidal function with the following attributes:

   - an amplitude of 13
   - a midline of $y = 3$
   - a period of 7
   - $f(\frac{33}{4}) = -10$.

5. Solve the equation $\tan(\theta) = -2.5$.

6. The height of a windmill blade is modeled by the function

$$H(t) = 40\sin(80\pi(t + \frac{1}{320})) + 60$$

   where height is in meters and time in minutes. Find all values of t such that the blade is at a height of 50 meters.

7. A ferris wheel has a radius of 50 ft and its highest point is 125 ft off the ground. It takes the ferris wheel 3 minutes to complete one full rotation. Suppose that the carriage makes an angle of $-\frac{\pi}{3}$ with the horizontal when it starts. Find the height $f(t)$ of the carriage as a function of time in minutes since the wheel started turning.