MATH 171 Activity #14: Inverse Trig Functions	Homework:	9.4:	7, 9, 11, 13, 41, 43
		9.5:	5, 7, 48-51 all

Last time, we learned how to modify the sinusoidal functions $y = A \sin B(t - h) + k$ and $y = A \cos B(t - h) + k$ to model situations. Today we'll learn how to solve trigonometric equations.

- Situation: A rabbit population in a national park rises and falls each year. It is at its minimum of 5000 rabbits in January. By July, as the weather warms up and foods grows more abundant, the population triples in size. By the following January, the population again falls to 5000 rabbits, completing the annual cycle. A trigonometric function models the size of the rabbit population as a function of time.
- 1. Sketch a graph of this function over the interval [0, 24]. Determine the amplitude and period of this function. What sinusoidal function will you use to model this situation?

2. Determine the sinusoidal function that models the situation.

3. Use graphical methods to find when the rabbit population is equal to 12,000.

4. We'll now learn how to solve this equation analytically. Simplify the equation: $-5000\cos\left(\frac{\pi}{6}t\right) + 10,000 = 12,000$.

5. If we want to solve this equation, we'll need to use an inverse function. We know not all functions have inverses. How do we determine which functions have inverses? Does the cosine function have an inverse?

The **inverse cosine function** is written as $y = \cos^{-1} x$ or $y = \arccos x$.

It means that $x = \cos y$ for $0 \le y \le \pi$

6. Graph arccosine functions on your calculator over the interval [-1, 1]. What are the domain and range of the function? Sketch the graph below.

7. Solve the equation you simplified in #4 using the arccosine function. How many solutions did you get?

(a) $\cos^{-1}(0)$

(a) $\arccos(1)$

(a) $\cos(\cos^{-1}(0))$

The inverse sine function is written as $y = \sin^{-1} x$ or $y = \arcsin x$. It means that $x = \sin y$ for $\frac{-\pi}{2} \le y \le \frac{\pi}{2}$ The inverse tangent function is written as $y = \tan^{-1} x$ or $y = \arctan x$. It means that $x = \tan y$ for $\frac{-\pi}{2} \le y \le \frac{\pi}{2}$

9. Your height on a ferris wheel is given by $h(t) = 250 + 250 \sin\left(\frac{\pi}{10}t - \frac{\pi}{2}\right)$. How much time do you spend above 400 feet if your ride lasts 20 minutes?