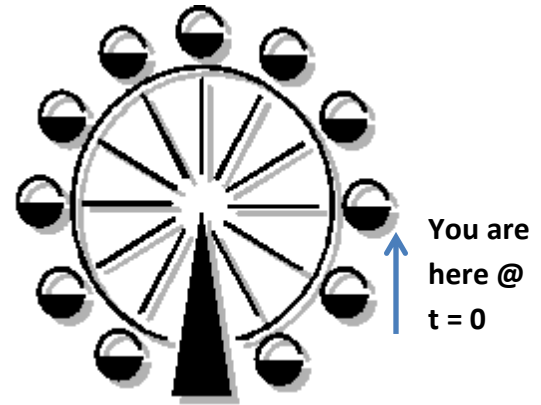Advanced Mathematical Decision-Making
Modeling a Ferris Wheel Project

As you ride the Ferris wheel, your distance from the ground varies sinusoidally with time. When the last seat is filled and the Ferris wheel starts, your seat is at the position shown in the figure at the right. Let *t* be the number of seconds that have elapsed since the Ferris wheel started. You find that it takes you 5 seconds to reach the top, 63 feet above the ground, and that the wheel makes a revolution once every 20 seconds. The diameter of the wheel is 58 feet. Use this information to answer the following questions.

You are here @ t = 0

1. At what time are you at the top of the Ferris wheel the first time? _____

2. At what time are you at the top of the Ferris wheel for the second time? _____

3. What is the lowest you go as the Ferris wheel turns and why is this greater than zero?

4. At what time are you at the bottom of the Ferris wheel for the first time? _____
(HINT: you'll be at the bottom exactly half way between your first and second time at the top).

5. Find the height that is exactly halfway between the lowest and highest point on your revolution. What is this height? At what two times will you reach this height during your first revolution?
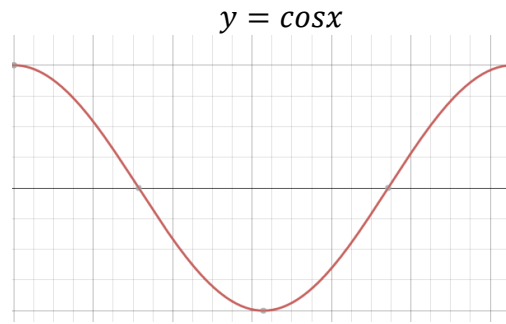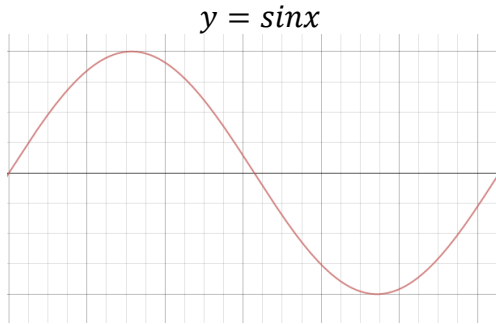
Height _____ First time _____ Second Time _____

6. Plot the highest, lowest, and middle points on the graph below with the appropriate times. Then connect your graph with a smooth curve.

Height (feet)

Time (sec)

7. We can write an equation for our graph using a sinusoidal function, such as $y = sinx$ or $y = cosx$ and some of the characteristics we know about its behavior.   The general form for such an equation is $y = Asin[B(x - C)] + D$ or $y = Acos[B(x - C)] + D$

Here are graphs of the two functions. Which looks more like the graph you drew in #6?

$y = sinx$	$y = cosx$

8. In the general equation, A represents the amplitude of the graph. This is the vertical distance from the middle to the top or the middle to the bottom of the graph. What is the distance from the middle to the top or to the bottom? (HINT: You found the middle height in #5.)

A = _____

9. In the general equation, B represents 2π divided by the period of the graph. The period is the horizontal distance from peak to peak or trough to trough. In other words, it is the distance needed for the graph to complete one cycle. Find the period. Then find B. Leave your answer in terms of π and simplify fractions.

Period _____   B = _____

10. In the general equation, C represents the horizontal shift, or the horizontal distance from zero to the beginning of your graph. (HINT: You found this in #1.)

C = _____

11. In the general equation, D represents the vertical shift, or the y-value of the "middle" of your graph. (HINT: You found this in #5.)

D = _____

12. Now you're ready to write the equation for the graph of this function. Fill in A, B, C, and D in the appropriate places. Then graph the function on a graphing calculator (use www.desmos.com for an online graphing calculator) and compare it to the sketch you drew in #5.

$$y = Acos[B(x - C)] + D$$

$$y = \underline{\quad\quad}cos[\underline{\quad\quad}(x - \underline{\quad\quad})] +\underline{\quad\quad}$$