Adv Alg

Name: _____
Date: _____Period___

**MODELING PERIODIC EVENTS**

*Sketch a picture and graph for each problem. Answer the questions.*

1. An object hangs from a spring in a stable (equilibrium) position, 10 feet from the ground. The spring is pulled 3 feet towards the ground and the object begins to oscillate (in a vertical direction), making one complete oscillation every 4 seconds. Force of gravity is omitted from this model.

   a) Write an equation that models the motion of this object (height above ground with respect to time).
   b) At what two times within one cycle is the spring 2 feet below the equilibrium position?
   c) Use the values from part "b" to find the next two times the object is in the same position.

2. You board a ferris wheel that is 1 foot off the ground. At the highest point of the ride, you are 99 feet above the ground. It takes 30 seconds for the ride to complete one full revolution. The ride starts at the 3 o'clock position.

   a) Write a trigonometric equation for your height above the ground at t seconds after the ride starts.
   b) Find at what two times within one cycle you are exactly at 90 feet off the ground.

3. A mass suspended from a spring is at its rest position (equilibrium) at 15 feet above the ground. The mass is pulled down a distance of 2 feet from its rest position. The mass is then released at time t=0 and allowed to oscillate. The mass returns to the low position after 1 second. Force of gravity is omitted from this model.

a) Find an equation that describes the motion of the mass.
b) Find at what two times within one cycle that the height of the mass is 1.5 feet above its rest position?
c) What are the heights above ground of the mass at .17 seconds and .82 seconds?

4. San Francisco Bay is an inlet of the Pacific Ocean. At a dock, the depth of water is 6 feet at low tide at 12 am and high tide is 74 feet, which occurs every 6 hours.

a) Find an equation that models the depth of water with respect to time.
b) At what two times, during the first cycle, is the depth of water 25 ft?
c) What is the depth of water at 8:30 am?

5. A ferris wheel has a diameter of 24 m and rotates every 16 seconds. The bottom of the wheel is 2 m above the ground. (the ride starts at the 6 o'clock position).

   a) Find an equation that models the height of a rider above ground with respect to time.
   b) How high above the ground are you after 18 s?
   c) Find the first four times when you are 17 m above the ground.

6. A ferris wheel has a diameter of 14 m and rotates every 20 seconds. The bottom of the wheel is 1 m above the ground (the ride starts at the 3 o'clock position).

a) Find an equation that models the height of a rider above ground with respect to time.
b) How high above the ground is the rider after 25 s?
c) Find the first four times when the rider is 15 m above the ground.

7. A mass on the end of a spring is at rest 200 cm above the ground. It is pulled down 85 cm and released at time $t$=0. It takes 12 seconds for the mass to return to the low position. Force of gravity is omitted in this model.

   a) Find an equation that models the height of the mass above ground with respect to time.
   b) Find the height of the mass after 5 seconds.
   c) Find the first four times the mass reaches a height of 240 cm.

8. The average number of daylight hours per day can be modeled by a sinusoidal function. A city gets a maximum of 18 hours of daylight in the middle of June and a minimum of 6 hours of daylight in the middle of December.

   a) Find an equation that models the average number of daylight hours per month.
   b) Find two months that the average number of daylight hours is 12.
   c) What are the average number of daylight hours in February and September?