**MAH Ch 7 WS 3**
**Word Problems**

**Do work on a separate sheet. Use graph paper when necessary.**

1. A leaf floats on the water bobbing up and down. The distance between its highest and lowest point is 4 cm. It moves from its highest point down to its lowest point and then back to its highest point every 10 seconds. Write a cosine function to model the movement of the leaf in relationship to its equilibrium point.

2. Use the data and graphs from the Ferris Wheel Problem to write an equation for the height of a seat as a function of time when
   a) The seat starts at the bottom of the wheel
   b) The seat starts at the top of the wheel.
   c) Use your equations to find the height of the wheel (in both cases) after 384 seconds.

3. A wheel of a cart has diameter 30cm. The cart is moving at a speed of 1.4055 miles per hour.
   a) Determine the speed in cm/sec ( 2.54 cm= 1 in)
   b) Determine rotations per second.
   c) Sketch a graph for the height in cm of a point on the outer edge of the wheel that starts on the ground at time=0 sec as a function of time in sec.
   d) Write an equation for the height in cm of a point on the outer edge of the wheel that starts on the ground at time=0 sec as a function of time in sec.
   e) Use your equation to find the height of the point at 2.3 seconds and 2.6 seconds.

4. Draw a sketch of a graph and write a sine function to model the oscillation of tides in Savannah, Georgia if the equilibrium point is 4.24 feet, the amplitude is 3.55 feet, the phase shift is -4.68 hours, and the period is 12.40 hours.

5. There has been an earthquake in Alaska. A tidal wave caused by this earthquake is heading toward Carmel, CA. The water level at shore first goes down from its normal level then rises an equal distance above its normal level; the water then returns to normal. Assume the depth of the water varies sinusoidally with time as the wave passes. Suppose the wave has a period of 20 minutes and amplitude of 12 meters; the normal depth at the dock in Carmel is 15 meters.
   a) Sketch a graph of the depth of the water at the dock as a function of time
   b) Write an equation for your graph
   c) Find the water height at the dock at 5 minutes 20 seconds and at 12 minutes and 15 seconds.

6. The mean average temperature in Buffalo, New York is 47.5°. The temperature fluctuates 23.5° above and below the mean temperature. If t = 1 represents January, the phase shift of the sine function is 4.
   a) Write a model for the average monthly temperature in Buffalo.
   b) Use your model to predict the average temperature in March.
   c) Use your model to predict the average temperature in August.

7. Below is a table of average monthly temperatures at Wellington Airport from 1971-2000
Your task is to create a model of the data to predict the times during the year that a location would be pleasant to visit. This may be when the average monthly temperature is over 14°C.

| **Month** | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **°C** | 17.8 | 17.9 | 16.6 | 14.4 | 12.0 | 10.2 | 9.5 | 9.9 | 11.3 | 12.9 | 14.5 | 16.4 |

a) Graph this data.
b) Write a trigonometric equation using the cosine function that best models this situation.
c) Rewrite the equation using the sine function.
d) In which hemisphere do you think Wellington Airport is located?

8. Below is a table of average monthly temperatures in Thousand Oaks, CA

| Month | Jan | Feb | March | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp | 69 | 70 | 73 | 78 | 83 | 88 | 95 | 97 | 93 | 84 | 75 | 68 |

a) Graph this data.
b) Write a trigonometric equation using the cosine function that best models this situation.
c) Rewrite the equation using the sine function.

9. The table below contains the times that the sun rises and sets in the middle of each month in New York City.

| Month | Sunrise AM | Sunset PM |
|---|---|---|
| Jan | 7:19 | 4:47 |
| Feb | 6:56 | 5:24 |
| March | 6:16 | 5:57 |
| Apr | 5:25 | 6:29 |
| May | 4:44 | 7:01 |
| June | 4:24 | 7:26 |
| July | 4:33 | 7:28 |
| Aug | 5:01 | 7:01 |
| Sept | 5:31 | 6:14 |
| Oct | 6:01 | 5:24 |
| Nov | 6:36 | 4:43 |
| Dec | 7:08 | 4:28 |

Suppose the number 1 represents the middle of January, the number 2 represents the middle of February, etc.

a) Find the amount of daylight hours for the middle of each month
b) Determine the amplitude, period, vertical shift, and phase shift for a sinusoidal function that models the daylight hours.
c) Write a function to model the daylight hours

10. Geraldine rides her bicycle along a flat road at night. Ian can clearly see a reflector on the spoke of her wheel rotating. He measures the height of the reflector above the ground at different times using a video.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Time* (t s) | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| *Height* (H cm) | 19 | 17 | 38 | 62 | 68 | 50 | 24 | 15 | 31 |

a) Graph the data
b) Write a trig function to model the data
c) Find the diameter of Geraldine's wheel
d) Determine the speed that Geraldine was traveling on her bike.