

**Math Analysis**  
**Unit 3-Writing Equations From Data WS**

1. As you ride a Ferris wheel, the height that you are above the ground varies periodically. Consider the height of the center of the wheel to be the equilibrium point. Suppose the diameter of a Ferris Wheel is 42 feet and travels at a rate of 3 revolutions per minute. At the highest point, a seat on the Ferris wheel is 46 feet above the ground.

- What is the lowest height of a seat?
- What is the equation of the midline?
- What is the period of the function?
- Write a sine equation to model the height of a seat that was at the equilibrium point heading upward when the ride began.
- According to the model, when will the seat reach the highest point for the first time?
- According to the model, what is the height of the seat after 10 seconds?

2. If the equilibrium point is  $y = 0$ , then  $y = -5\cos\left(\frac{\pi}{6}t\right)$  models a buoy bobbing up and down in the water.

- Describe the location of the buoy when  $t = 0$ .
- What is the maximum height of the buoy?
- Find the location of the buoy at  $t = 7$ .

3. A certain person's blood pressure oscillates between 140 and 80. If the heart beats once every second, write a sine function that models the person's blood pressure.

4. The initial behavior of the vibrations of the note E above middle C can be modeled by  $y = 0.5\sin 660t$

- What is the amplitude of this model?
- What is the period of this model?

5. In a region with hawks as predators and rodents as prey, the rodent population  $R$  varies according to the model

$R = 1200 + 300\sin\left(\frac{\pi}{2}t\right)$ , and the hawk population  $H$  varies according to the model  $H = 250 + 25\sin\left(\frac{\pi}{2}\left(t - \frac{1}{2}\right)\right)$ , with  $t$  measured in

years since January 1, 1970.

- What was the population of rodents on January 1, 1970?
- What was the population of hawks on January 1, 1970?
- What are the maximum populations of rodents and hawks? Do these maxima ever occur at the same time?
- On what date was the first maximum population of rodents achieved?
- What is the minimum population of hawks? On what date was the minimum population of hawks first achieved?
- According to the models, what was the population of rodents and hawks on January 1 of the present year?

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

7. The mean average temperature in Buffalo, New York, is  $47.5^\circ$ . The temperature fluctuates  $23.5^\circ$  above and below the mean temperature. If  $t = 1$  represents January, the phase shift of the sine function is 4.

- Write a model for the average monthly temperature in Buffalo.
- According to your model, what is the average temperature in March?
- According to your model, what is the average temperature in August?

8. The average monthly temperatures for Honolulu, Hawaii, are given below.

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
$73^\circ$	$73^\circ$	$74^\circ$	$76^\circ$	$78^\circ$	$79^\circ$	$81^\circ$	$81^\circ$	$81^\circ$	$80^\circ$	$77^\circ$	$74^\circ$

- Find the amplitude of a sinusoidal function that models the monthly temperatures.
- Find the vertical shift of a sinusoidal function that models the monthly temperatures.
- What is the period of a sinusoidal function that models the monthly temperatures?
- Write a sinusoidal function that models the monthly temperatures, using  $t = 1$  to represent January.
- According to your model, what is the average temperature in August? How does this compare to the actual average?
- According to your model, what is the average temperature in May? How does this compare to the actual average?