

EQ :

Simple Harmonic Motion Models: $f(t) = A\sin[B(t - C)] + D$ $f(t) = A\cos[B(t - C)] + D$

Terms:

$|A| =$ _____ Maximum _____ from point of _____

Equilibrium --- object is at _____; _____ point

Period --- _____ it takes to complete one cycle $B = \frac{2\pi}{\text{_____}}$

Ex. 1 A buoy marking a channel in the harbor bobs up and down as the waves move past. Suppose the buoy moves a total of 6 feet from its high point to its low point and returns to its high point every 10 seconds. Assuming that at $t = 0$ the buoy is at its high point and the middle height of the buoy's path is $d = 0$, write an equation to describe its motion.

Should the equation be in terms of sine or cosine?

Ex. 2 A weight on a spring bounces a maximum of 8 inches above and below its equilibrium (zero) point. The time for one complete cycle is 2 seconds. Write an equation to describe the motion of this weight, assume the weight is at equilibrium when $t = 0$.

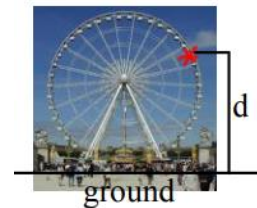
Should the equation be in terms of sine or cosine?

Ex. 3 In a particular harbor, high and low tides occur each 12 hours.

Find $f(t) = A\cos[B(t - C)] + D$ where $h(t)$ is the water level, in feet, t hours after midnight given the following:

- High tide is 10 ft and low tide which occurs at 6 am, is 2 ft
- High tide is 12 ft and low tide, which occurs at 4 am, is 6 ft.
- The average water level is 5 ft and high tide is 10 ft, which occurs at 7 pm.

Ex. 4 You have probably noticed that as you ride a 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 3 quiddles (a new measure of time) to reach the top, 43 above the ground, and that the wheel makes a revolution once every 8 quiddles. The diameter of the wheel is 40 ft. Your mission, should you choose to accept it, is to do the following:



- Sketch a graph of this sinusoid.
- What is the lowest you go as the Ferris wheel turns? Why is this number greater than 0?
- Write the function that models this sinusoid.
- Predict your height above ground at 6 quiddles, 4.33 quiddles, 9 quiddles, and 0 quiddles.
- How far from the ground were you when the last seat was filled?

➤ Assignment: Worksheet Harmonic Motion