Lecture 2: Exercise 6

Explanation

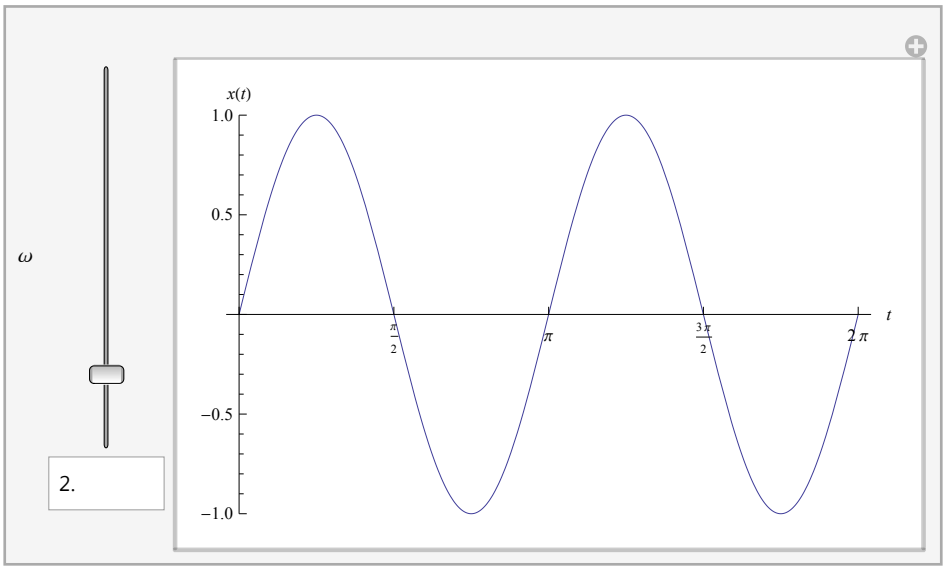
Here we have an actual physics problem. The task is to find the time it takes for an oscillator to complete one cycle. But what is a cycle? How long does it take to get back to some specific point that it was at before? This problem is more than just getting an answer to a physical problem. It is a great example of the process of discovery. You begin by examining cases, and then you make a generalization from those cases.

Hint

Make a plot of how many complete oscillations there are at a given frequency in some time, say 2 π. Then think about the relationship between frequency and time.

Answer

Here is a program that demonstrates the principes at work here. It plots the oscillation and you can manipulate the slider to change the frequency. The frequency is displayed in the box.



So how long does it take in t to cross one cycle, or, how do we find ω given t? How long does it take to cross one cycle when $\omega = 1$? 2π.
And when $\omega = 2$? π
And when $\omega = 1/2$? 4π
Does that suggest a formula?
In order to get π from an ω of 2 and $t = 2\pi$, we have,

$$\text{period} = \frac{2\pi}{\omega}.$$

This makes sense because frequency is the number of cycles per unit time. Thus we are dividing by the time. So it makes sense that if we want to find the time we need to divide by the frequency. Since we are completing a cycle, essentially a circle, thus we go around 2π in angular distance, se we have the angular distance divided by the frequency.