Problem **18**

In this problem, we have a boat that's sitting on top of some waves that are traveling with a certain velocity and have a certain height and have a certain wavelength, we're given this wavelength, lambda equals to 15 meters. And we're also given the Y of t, which is the vertical displacement of the boat as a function of time, and it takes a cosine function shape. And we're asked to determine the height of these waves and the velocity these waves are traveling at with respect to the boat. So first, let's plot this function. So we're going to plot the function y as a function of time, right, and this is going to be a negative cosine curve. So we're going to oscillate between these two states, the top and the bottom. And this cosine curve is going to have an amplitude of 0.5 meters and this is in the negative and then here we have positive 0.5 meters. And we can see that this here will be our amplitude. And this here is the total height, h. But let's write this function down again, y of t is equal to negative 0.5 times cosine of 0.419 times t. And this cosine four has the following form amplitude times cosine of omega t plus five. So we have our amplitude, our frequency, and our phase, we're going to start with the amplitude. And from the amplitude, we can derive the height of the wave. So the amplitude is equal to negative 0.5 meters or just 0.5, because we take the absolute value of it. And we know that the height is equal to two times the amplitude. So the height is equal to two times 0.5 meters is equal to one meter. So our height is equal to one meter. And this is the first question first part of the question. Now, let's look at the frequency. So we know that omega is equal to 0.419 radians per second. And we know that velocity is equal to plan to f, we have lambda, but we don't know F, right? But we can derive that from omega because omega equals to two pi. So we know that the frequency f is going to be equal to omega over two pi, which is equal to 0.419 divided by two pi, which is equal to 0.0667 Hertz. And we can plug this into the vehicle. So named F equation, where v is going to be equal to 15 meters times the frequency is 0.0667 Hertz. And this is equal to one meter per second. So we know that the velocity of the wave is one meter per second in the i hat direction, because it's pointing towards the right. This is the second part of the question. The last part of the question has to do with the phase. So from we know that phi from what we're given phi is equal to zero radians. Therefore, there is no phase shift. And this is not part of the question because there is no phase shift, but essentially from the amplitude we derive the height of the wave and from the frequency we derive the velocity of the wave given a wave length