PROFESSOR: There's one more property of this thing that is important, and it's something called the correspondence principle, which is another classical intuition. And it says that the wave function, and it addresses the question of what happens to the amplitude of the wave function. It says that the wave function should be larger in the regions where the particle spends more time. So in this problem, you have the particle going here. It's bouncing and it's going slowly here, it's going very fast here. So it spends more time here, spends a lot of time here, spends a lot of time here. So it should be better in these regions and smaller in the regions that spends little time.

So this was called the correspondence principle, which is a big name for a somewhat vague idea. But nevertheless, it's an interesting thing and it's true as well. So let me explain this a little more and get the key point about this. So we say, if you have a potential, you have x and x plus dx, so this is dx, the probability to be found in the x is equal to psi squared dx, and it's proportional to the time spent there. So we'll say that it's-- we'll write it in the following way. It's proportional to the fraction of time spent in dx. And that, we'll call little t over the period of the motion in this oscillation. The classical particle is doing, the period there.

That's the fraction of time it spends there. Up two factors of 2, maybe, because it spends going there and there for the whole period, it doesn't matter, it's anyway approximate. It's a classical intuition expressed as the correspondence principle. So this is equal to dx over v, over the velocity that positioned the [INAUDIBLE] velocity T. And this is there for dx. And the velocity is p over m, so the mass over period and the momentum.

So here we go. Here's the interesting thing. We found that the magnitude of the wave function should be proportional to 1 over p of x, or lambda over h bar of x. So then the key result is that the magnitude of the wave function goes like the square root of the position the [INAUDIBLE] de Broglie wavelength. So if here the de Broglie wavelength is becoming bigger because the momentum is becoming smaller, the logic here says that yes indeed, in here, the particle is spending more time here, so actually, I should be drawing it a little bigger.

So when I try to sketch a wave function in a potential, this is my best guess of how it would be. And you will be doing a lot of numerical experimentation with Mathematica and get that kind of insight. They position the [INAUDIBLE] de Broglie wavelength as you have, it is a function of the local kinetic energy. And that's what it gives for you.

OK so that is one key insight into the plot of the wave function. Without solving anything, you can estimate how the wave length goes, and probably to what degree the amplitude goes. What else do you know? There's the node theorem that we mentioned, again, in the case of the square well. The ground state, the bounce state, the ground state bounce state is a state without the node. The first excited state has one node, the next excited state has two nodes, the next, three nodes, and the number of nodes increase. With that information, it already becomes kind of plausible that you can sketch a general wave function.