PROFESSOR: Two goals really-- one is to introduce students to an area of mathematics that really isn't covered much in the high school curriculum. I think there's a lot of fascinating problems in combinatorics and probability that kids don't see much when they're in their earlier studies, and they're extremely relevant. I guess there's sort of three main reasons I give students at the first day of the course as to why combinatorics is an interesting subject.

The first is something that I guess has always been true, but we've only really become aware of it in the last 50 years-- is the universe is sort of fundamentally discrete and digital, whether you're talking about quarks inside atoms, or electrons in orbits around atoms, or the way molecules are built, or the DNA in our cells. All of these things are made up of discrete structures, and to understand how they work and how they interact, we need to be able to understand how these pieces fit together. So whether you're a physicist trying to understand subatomic particle collisions or a chemist trying to understand the patterns in the periodic table, combinatorics and combinations of objects are an important part of that process.

Building on that, and one of the major themes of the course, is probability theory, and sort of any question about probability is really two questions about counting-- sort of how many things could possibly happen, and how many of those things correspond to what you're interested in? And if I were to pick out one piece of mathematics that I think everybody should know, whether they're interested in math or not, it would be sort of a basic understanding of probability theory. I mean, we spent a lot of time making kids memorize the quadratic formula, and learn trig ratios, and various other miscellaneous material that they are probably not that likely to use in their everyday life if they don't end up going into mathematics.

But probability theory is pretty fundamental to the decisions we make everyday in our lives, especially big decisions like how we invest our money, or decisions about our health, or other decisions that have a big impact on how we live. And a lot of people either never learn probability or are very confused by it, and I think that's an important skill for people to learn.

And then sort of the third thing, for the people who are interested in mathematics and combinatorics-- which tends to be the people who come to MIT to take these courses-- is to expose them to some interesting and challenging problems that, I guess, open up some areas of the mathematical universe that they may not have known existed. A lot of the students that I see are, you know, kids who were at the top of their class or who were bored in their math classes. They know everything that's in the textbook, and I had much the same experience when I was in high school.

And it's pretty easy to go through-- there's sort of a linear progression of math courses. You know, take algebra, geometry, trigonometry, calculus-- and view it as sort of a linear sequence, and think that eventually you'll get to the end of that sequence and know what there is to know. But in fact, it's a much broader subject, and there's a huge amount of material out there that is very accessible to high school students but is never incorporated in the curriculum. I didn't really learn any serious combinatorics until I was a sophomore or even a junior at MIT, but I found the subject fascinating. And I think it's very accessible and useful to younger students.