Video 3.5 Transcript - Trigonometric Equations

This video presentation is to demonstrate how to solve a trigonometric equation. To solve tangent of two x equal to one the first thing I would think of is the period of tangent. The period of tangent is pi. So, any multiples of pi will be my solution… from zero to two pi. So, we will start by thinking about tangent of what angle will equal to one, and the answer to that is pi over four because pi over four on the unit circle is equivalent to forty-five degrees, and forty-five degrees is square root of two over two comma square root of two over two. Since tangent is y over x, if I take my y divided by x that will equal to one. So, any multiples of pi, which is the period of a tangent, will be my solution. So, we will begin by stating that tangent of two x is equal to one, so that means that two x is equal to pi over four. Now, two x equal to pi over four - that's only one angle. We're looking for any multiples of pi as part of my solution, so we will write plus any multiples of pi which is n times pi, where n is any multiples of pi. To get x by itself I will divide all three terms by two; that will give me pi over eight plus n pi over two. If I start with n equal to zero, my x will be pi over eight plus zero times pi over two, and that will give me just pi over eight. Before I continue, let's think about my answer here: x equal to pi over eight. If I were to plug this angle back into my equation, which is tangent of two times pi over eight, would that equal to one? The answer is yes, because two and eight here can be reduced here (top and bottom), so that will give me tangent of pi over four equal to one, and tan of pi over four forty-five degrees is only in the first quadrant.

Since I'm looking for all the answers between zero to two pi, I will need to find my other solutions. So, to find other solutions, the next thing I will do is now let n equal to one, and that will give me x equal to pi over eight plus one times pi over two, and if I find the least common denominator… increase my numerator as well, my second angle here will be five pi over eight. So, if you think about it for a minute, take this five pi over eight, plug it back into my equation, tangent of two times five pi over eight. Two and eight cancel out leaving me with a four, which is tangent of five pi over four. Tangent of five pi over four is actually located in the third quadrant, which is equivalent to two hundred twenty-five. All right, so that's another solution.

Now I will let my n equal to two. X equal to pi over eight plus two pi over two, and that will be x equal to nine pi over eight. So, nine pi over eight is one of my solutions. Now, if I let n equal to three, that would be x equal to pi over eight plus three pi over two. Here I can find the least common denominator, increase my numerators… my answer will be thirteen pi over eight. Continue… n equal to four, x equal to pi over eight plus four pi over two. Now notice here four pi over two is equivalent to two pi already, so two pi plus any angle… that will actually be bigger than two pi. So, my answer here is seventeen pi over eight, which is much greater than two pi. So, here I will have to stop because I'm only looking for angles that's between zero and two pi. So, this angle is not part of my solutions. So, the solutions for x will be the pi over eight (where n equal to zero), five pi over eight (where n equal to one), nine pi over eight (where n equal to two), and my last answer will be thirteen pi over eight (where n equal to three). These four angles will be my solution for x, which means if I plug in all four angles into my function or my equation tan two x will then be equal to one.