**Unknown Leg Lengths**

**Section 1**

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| 00:00:01 | TEACHER: You've seen triangle problems where you're supposed |
| 00:00:03 | to find the unknown length of the hypotenuse. But what about this here, what about if the leg is unknown. How do we find that value? We need to be able to handle the situation or to understand right triangles. So how do you find the length of an unknown leg in a right triangle? |

**Section 2**

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| 00:00:00 | TEACHER: Let's take a look at the supplied problem together. |
| 00:00:03 | A tree is 50 feet tall. At one point during the day, the tree cast a shadow on the ground. The distance from the top of the tree to the furthest tip of the shadow is 80 feet. We want to know, what is the length of the shadow, or this distance down here? And we're going to round our answer |
| 00:00:27 | to the nearest hundredth. We're going to use the Pythagorean theorem, a squared plus b squared is equal to c squared. And we're looking for a, so we'll leave that as a. I have a value for b though, it's 50. And I have a value for c though, it is 80. So 50 squared is 2,500 and 80 squared is 6,400. Subtracting 2,500 from both sides, looking for a, I find |
| 00:01:01 | that a squared is 3,900. Now to solve for a, I have to take the square root of both sides. So a is the square root of 3,900. 3,900 is not a perfect square. So using a calculator and rounding to the nearest hundredth, I find that a is equal to the square root of 39, which is 62.45 feet. |

**Section 4**

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| 00:00:00 | TEACHER: Let's apply the Pythagorean Theorem to this |
| 00:00:02 | triangle to see if we can find the unknown side length a. I'm calling it a, you could have called it b. We can interchange the legs this way. This, then, will be my b value. So, let's use the Pythagorean Theorem to find the length of a. My a value is unknown, so I leave it at that way. The b, I said, was 22. |
| 00:00:27 | So I have 22 squared. I must have c-- yes, I do. It's 29. Now I'm all set up to find a. So what is 22 squared? So I have a squared plus 22 squared, which is 484, and that's equal to 29 squared, which is going to be 841. |
| 00:00:51 | Now let's subtract 484 from both sides. We're solving for a. On the left hand side it cancels out. On the right, it becomes 357. That's equal to a squared. So to solve this, I take the square root of both sides. a squared equals the square root of 357. I'm going to move our work right up here. |
| 00:01:20 | So the square root of a squared is a. And that is equal to the square root of 357. And I'm given units of meters so I have to put that in my final answer. 357 is not a perfect square. I want an exact value, so I'm going to leave in the square root sign. So the length of a is the square root of 357 meters. |

**Section 6**

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| 00:00:01 | TEACHER: Let's take a look at this triangle and see if we |
| 00:00:03 | can find the unknown side length. I'll be using the Pythagorean Theorem. And the unknown side length I'll call a you could have called b. The legs are interchangeable. But in this case, I called the unknown a, so this is going to have to be my b value. Now, what about this value here? |
| 00:00:23 | My c value is not a natural number. It is a square root of a number. We'll have to handle that, but it'll be no problem. Check it out. So my a value is unknown. My b value 6, so I substitute the 6 in for b. My c value is the square root of 62. So square root of 62-- |
| 00:00:44 | and I still have that square right there, right? So I have to square it. So let's do the math here. a is unknown. 6 squared is 36. Now, the square root of 62 squared-- if I start with a number and then take its square root, then I take that square root and I square it back. |
| 00:01:06 | I get the number I started with. The same thing happening here-- I start with 62, take the square root, and then square that. I end up at 62 again-- OK, simple. Let's solve for a. Subtract 36 from both sides. |
| 00:01:21 | On the left, it cancels. So a squared is 62 minus 36, which is 26. And I take the square root of both sides. And the square root of a squared is a. And I have an exact value of 26. 26 is not a perfect square. So I leave it like this. And my units are inches. |
| 00:01:51 | So a is the square root of 26 inches. |

**Section 8**

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| 00:00:00 | TEACHER: What do you want to be when you grow up? |
| 00:00:02 | Have you ever thought about working in construction? Well, suppose you have a bunch of ladders of different lengths, and you know how far these ladders had to be placed from the wall to safely climb up the wall. So we know this value, check. We know this value, check. But I want to know how useful my ladders are. What are the heights of the walls that I can |
| 00:00:27 | climb with my ladders? We don't know this. This is a leg problem in a right triangle. It's becoming increasingly clear that it is important to be able to answer the question, how do you find the length of an unknown leg of a right triangle? |

**Section 9**

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| 00:00:00 | TEACHER: Let's take a look at this real-world example. |
| 00:00:03 | How about the steps to solve real-world problems with the Pythagorean theorem? First, we create a diagram. We have one. Then we determine variable values. Well, I've been given this length, and I've been given this length, but not this length. We'll use the value b, OK? |
| 00:00:25 | Now, next, we want to substitute into the Pythagorean theorem. Well, the Pythagorean theorem is a squared plus b squared equals c squared. I've been given a, right here, 8. So let's substitute that. b is our unknown. Now, what about c? |
| 00:00:41 | I was given c as 18. So I substitute the 18 in for c, and I get 18 squared. Now, the last step will be to solve for the unknown variable b. And we will do that here. So once again, create a diagram? Check. Determine variable values? |
| 00:01:01 | Check. Substitute into the Pythagorean theorem? Check. And now, we just want to solve for the variable. So I have 8 squared plus b squared equals 18 squared. So 8 squared is 64, plus my unknown b squared. And 18 squared is 324. So to solve for b, now, I need to subtract |
| 00:01:29 | 64 from both sides. So let's do that. It cancels on the left. And on the right, I get 260. Now, I'm going to take the square root of both sides to finish solving for b. So square root of b squared is equal to square root of 260. And I'm going to move our work right here, OK? |
| 00:01:53 | So the square root of b squared is just b. And this is equal to the square root of 260. Now 260 is not a perfect square. So we're going to approximate with a calculator. So you would take out your calculator and type in the square root of 260. And you will find that b is approximately 16.12. Do I have a unit of measurement? |
| 00:02:23 | I do-- feet. So b is approximately 16.12 feet. And we're all through. |

**Section 12**

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| 00:00:00 | TEACHER: Let's take a look at right triangle leg length and |
| 00:00:03 | solve this applied problem together. A tree is 50 feet tall. At one point during the day, the tree casts a shadow on the ground. The distance from the top of the tree to the furthest tip of the shadow is 80 feet. What is the length of the shadow? We'll call that variable a. |
| 00:00:28 | We're going to find our answer using the Pythagorean Theorem. And we're going to round to the nearest hundredth. So I know the Pythagorean Theorem states that a squared plus b squared is equal to c squared. And I've been given values for c and a value for b as well. So we'll be solving for a, which is the length of our shadow. For b, our b will be 50, 50 feet. |
| 00:00:51 | And our c value will be 80 feet. So let's find 50 squared and 80 squared. So we have a squared plus 2,500 is equal to 6,400. Subtract 2,500 from both sides, and we find that a squared is equal to 3,900. Now to solve for a, we need to take the square root of both sides. So we're going to take the square root of a squared and |
| 00:01:24 | the square root of 3,900. The square root of a squared will just leave a behind. And 3,900 is not a perfect square. So let's get an approximate answer using a calculator. We'll need the square root of 3,900. So 3,900, the square root of that is 62.4499 on and on. And we are rounding to the nearest hundredth. So we're going to have 62.45. |
| 00:02:02 | So a, let's just write a is equal to square root of 3,900. And we'll write our final answer as a is approximately 62.45 feet. And that is the length of the shadow that the tree casts. |