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How Now, Pythagoras?

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You may think of the **Pythagorean theorem** as useful only to geeky college freshmen who want to calculate how many steps they are saving by walking across the grass. Recently I learned of a very practical use of this theorem in a very unexpected place.

A few years ago we built a house. Since one of the rooms was a sort of odd shape, we had a carpenter/cabinet-maker friend build us an entertainment center. Visiting his shop one day during the process of creation, I was surprised to learned that **he uses the Pythagorean theorem to make sure the corners of his cabinets are square**. Basically, he measures off a length along one side starting at the corner, say 3 inches, and then a length along the second side, say 4 inches. He marks both points. Then he cuts a piece of string of length:

$$\text{Square Root [(length along side1)}^2 + \text{(length along side2)}^2 \text{]}$$

in this case, 5 inches. He strings it between the 3 inch and 4 inch marks on the two sides he wants to join. When the string fits just right, he knows that he has a **perfect right angle** and can join the two pieces - and we have a nice, square cabinet! (In building a large stage set, one might use measurements like 3, 4, and 5 feet.)

Extension: Taking this a bit further, it is possible to **construct a very accurate joint having any angle.** You would use the **law of cosines**. Given the desired angle and lengths measured along the two pieces to be joined, the law of cosines can be used to calculate the proper length of string needed to set the pieces up in the proper geometry. The expression for the length of the piece of string is:

$$\begin{aligned}&\text{Square Root [(length along side1)}^2 + \text{(length along side2)}^2\\ &\qquad - 2 \text{ x (length along side1) x (length along side2) x (cosine A)]}\end{aligned}$$

where “A” is the desired angle between side1 and side2. (Note: When A is 90˚, the third term is 0, and we get back to Pythagoras’ formula.)

Applications: This could come in very handy in building high tech soapbox **race cars**, **puppet theaters**, or in wood shop. It could be especially helpful for teaching geometry concepts to students who learn by seeing/feeling.