TAKE IT TO THE MAT

A NEWSLETTER ADDRESSING THE FINER POINTS OF MATHEMATICS INSTRUCTION

Regional Professional Development Program
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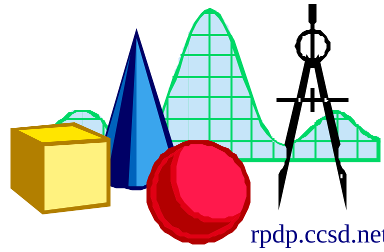

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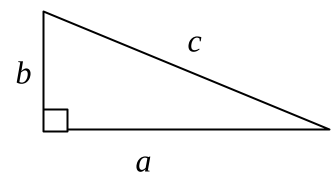
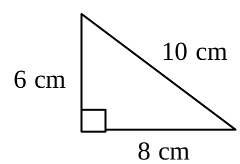
Over the past few months, several teachers have asked about properties of triangles, particularly the *Theorem of Pythagoras*. While it is not part of the Nevada Standards until seventh grade, it is desirable to know where students are going as they enter middle school and how it relates to what they learned in elementary school. This issue of *Take It to the MAT* looks at the Pythagorean Theorem and some of its connections to elementary school mathematics.

Pythagoras was a Greek scholar in the 6^{th} century B.C. While the Babylonians, Hindus, and Egyptians knew the right triangle relationship that bears his name hundreds of years before, Pythagoras is credited with the first proof of it. The relationship states: *the sum of the squares of the lengths of the legs of a* ***right triangle*** *is equal to the square of the length of the hypotenuse.*

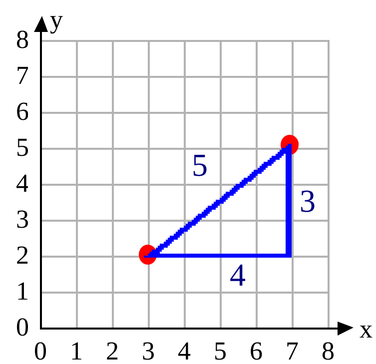


The *legs* of a right triangle are the two shorter sides that form the right angle. The *hypotenuse* is the longest side that is opposite the right angle. The most common way to label the sides of the right triangle is to label the legs *a* and *b*, and the hypotenuse *c*. Thus, the Pythagorean Theorem can be written in the familiar form $a^2 + b^2 = c^2$. There are many marvelous proofs of why this works, but we will not go into them here.

One elementary connection that we can make is to square numbers. Those values that lie along the diagonal of the multiplication table are very useful when studying right triangles. We're not aiming for 5^{th} graders to use exponents, but we do want them to know that $6 \times 6 = 36$, $8 \times 8 = 64$, and $10 \times 10 = 100$. Actually, all the squares up to 144 are part of what we want kids to memorize, but certain squares are more interesting than others: 9, 16, 25, 36, 64, and 100. Why are they so special? Take a second and think about it.



Did you notice that 9 + 16 = 25 and that 36 + 64 = 100? So there are cases where the sum of two squares equals a third square. Sounds like the Pythagorean Theorem. If a right triangle had legs of 6 cm and 8 cm, its hypotenuse is 10 cm.



Another neat elementary connection is to coordinate geometry. Fifth graders may be asked to locate the points (3, 2) and (7, 5) on a coordinate grid, perhaps as part of a mapping exercise. The next question is, "How far are these points apart?" One could measure the distance with a ruler and compare it to the scale of the grid. Or, one could use the Pythagorean Theorem. Notice that we can make a right triangle using the two points as the ends of the hypotenuse. The horizontal distance is 4 units; the vertical distance is 3 units. Since $(3 \times 3) + (4 \times 4) = (5 \times 5)$, the distance between the points is 5 units. This is later developed in algebra into the *distance formula*.

Even though the Pythagorean Theorem is not a topic in elementary school mathematics, some of the groundwork for applying it is laid there.