**Stokes Theorem and the Pythagorean Theorem**

**Stokes Theorem:** This theorem is the modern generalization of Newton’ fundamental theorem of calculus, which states that the integral from a to b of the derivative of a function f is equal to f(b) – f(a). Stokes theorem implies earlier generalizations such as Green’s Theorem and the Divergence Theorem.

In modern parlance the theorem states that the integral of the exterior differential of a differential form over the interior of a chain is equal to the integral of the form itself over the boundary of the chain. All of this is taking place inside of an n-dimensional manifold, where a chain may be thought of as a map into the manifold of the standard k-dimensional cube, and a differential form is a tensor of a type suitable for integration.

In the original theorem, the “cube” was 1-dimensional, its image under the “map” was the interval from a to b on the real line, the “differential form” was the function f, and its “exterior differential” was simply the derivative of f followed by dx.

Stokes Theorem has had a myriad of applications across a wide range of fields in mathematics, including geometry, topology and ordinary and partial differential equations. It has had similarly pervasive applications in physics, from classical mechanics, through electromagnetism, and in many branches of modern physics as well.

**Pythagorean Theorem:**  This beautiful theorem, stating that in a triangle with a 90 degree angle the sum of the squares of the lengths of the two short sides equals the square of the length of the long side, is known to all high school students and was likely known to the ancient Babylonians. There are dozens of proofs of this theorem, the one depicted being purely geometric.

This theorem and its many offshoots have ubiquitous use throughout all branches of mathematics, statistics, physics, and science in general. For example, it easily leads to the formula that the distance between two points in n-dimensional space is the square root of the sum of the squares of the differences of their respective coordinates. A very early use may have been in the construction of a perfect 90 degree angle, which required merely the construction of a triangle, the sides of which were in the ratio of 3 to 4 to 5.