THE 47th PROBLEM OF EUCLID OR PYTHAGOREAN THEOREM

There are parts of our ritual that have great importance. But despite hearing them many times, we still have only an imperfect understanding of their significance.

I believe this is particularly the case with the 47th problem of Euclid which is in the Degree of Master Mason. It probably gets less attention, and certainly less understanding, than all of the symbols and geometric allusions in the Masonic Catechism combined. Yet, it contains as much food for thought, and contains as great a truth as any of the other symbols.

All that our ritual states is that:

"The *47th problem of Euclid was an invention of our ancient friend and brother Pythagoras, who, in his travels through Asia, Africa, and Europe, was initiated into several orders of Priesthood, and raised to the sublime degree of Master Mason. This wise philosopher enriched his mind abundantly in a general knowledge of things, more especially in Geometry, or Masonry. On this subject he drew out many problems and theorems; and among the most distinguished he originated this, when in the joy of his heart, he exclaimed, EUREKA, meaning I HAVE FOUND*

IT; and upon the discovery, is said to have sacrificed a hecatomb."

Now a first point of clarification, and the reason this talk is titled: THE 47th PROBLEM OF EUCLID OR PYTHAGOREAN THEOREM, is that while it is generally believed in the mathematic community that Pythagoras "invented" - or discovered - this problem, it was Euclid who mathematically proved this proposition.

But what is its great importance? Simply put the 47th problem is at the root – not only of all Geometry – but of most applied mathematics; certainly all that is essential in surveying, engineering, and astronomy, and in that wide expanse of problems concerned with finding one unknown from two known factors.

At the close of his first book, Euclid states the 47th problem – and its correlative 48th – as follows:

(47th) In every right angle triangle the square of the hypotenuse is equal to the sum of the square of the two sides. ($A^2 \times B^2 = C^2$)

(48th) If the square described on one of the sides of a triangle be equal to the squares described on the other sides,

then the angle contained by these two sides Is a right angle.

This sounds more complicated than it is, so let’s talk about it in plain English. As Masons we all know what a square is because our ritual teaches that a square is a right angle – or the forth part of a circle – or an angle of ninety degrees. And for the benefit of those who may have forgotten, the "hypotenuse" of a right triangle is the triangle's longest side; the side opposite the right angle. Another way of thinking about it is that it is the line that cuts a square into two triangles.

So let us consider that the familiar Masonic square has one arm 6 inches long, and one arm 8 inches long.

If a square is erected on the 6-inch arm, that square will contain square inches to the number of 6 times 6, or 36 square inches.

If the square is erected on the 8-inch arm it will contain square inches to the number of 8 times 8, or 64.

The sum of 36 and 64 is 100 square inches.

According to the 47th problem, the square, which can be erected on the hypotenuse, or line joining the 6 and 8-inch arms of the square, should contain exactly 100 inches. The only square root that can contain 100 square inches has 10-inch sides - since 10, and no other number is the square root of 100. A2 + B2 = C2.

This is "provable", mathematically, but it is also demonstrated with an actual square. You need only lay off a line 6 inches long, at right angles to a line 8 inches long, connect the free ends by a line (the hypotenuse) and measure that line to be convinced - it is indeed, 10 inches long.

And, of course, this works whether, instead of inches, we use any other unit of measurement – feet, meters, miles, or even light years.

Ok, so what? Well, it may surprise some of you to know that this theorem has a very practical everyday use in the building trades, in surveying and even astronomy.

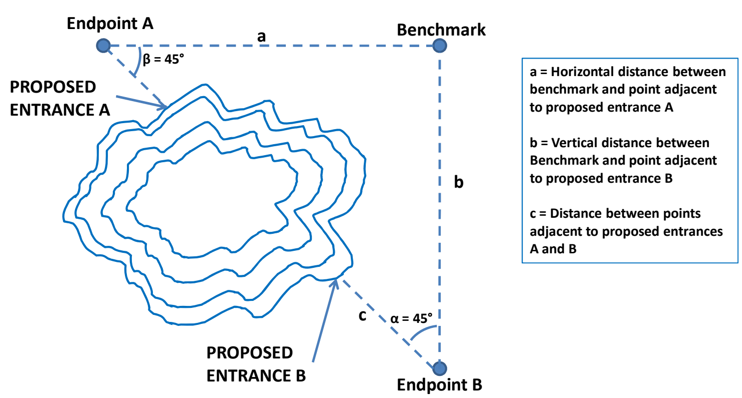
Without any other instruments than three pieces of cord and three stakes, one can lay out a right angle for a foundation, or the fence of a field, with remarkable accuracy.

For example, having placed a stake, with a six feet cord attached, at the point where the corner is to be, and knowing the direction which one wall is to extend, a second stake is placed at the end of the six-foot cord. The other two cords 8 and 10 feet long, respectively, are then stretched from the first two stakes to the point where the ends of the two cords meet, and a stake is placed there which marks the direction of the other side of the building. The angle made by the cords at that corner <u>must</u> be a right angle. The triangle formed has sides 6, 8, and 10 feet in length and the corner right angle is opposite the 10 foot hypotenuse.

The engineer, who tunnels from either side through a mountain, uses it to get his two shafts to meet in the center. Claudius Crozet used it to drill his railroad tunnel through Afton Mountain and it is recorded that he was off by only a few inches.

TOP VIEW OF A MOUNTAIN

(Pass Diagram Around)



The surveyor, who wants to know how high a mountain may be, ascertains the answer through the 47th problem.

The navigator traveling the trackless seas uses the 47th problem in determining his latitude, his longitude, and his true time.

The astronomer who calculates the distance of the sun, the moon, the planets - and who fixes "the duration of times and seasons, years and cycles," depends upon the 47th problem for his results.

So you can see why our ritual states that “On this subject he drew out many problems and theorems; and among the most distinguished he originated this….” Euclid’s famous 47th problem is distinguished because its resulting calculations show us how to predict eclipses, specify the height and times of tides, survey land, dig shafts and tunnels, and build roads and bridges.

Although the candidate learns of the 47th Problem of Euclid in the Degree of Master Mason, the importance of Geometry in general is explained in the Degree of Fellowcraft. Here the candidate is told that:

"By Geometry we may curiously trace nature through her various windings to her most concealed recesses; by It we may discover the power, the wisdom, and the goodness of the Grand Architect of the universe, and view with delight the proportions which connect this vast machine."

"By it we may discover how the planets move in their orbits, and demonstrate their various revolutions; by it we account for the return of seasons and the variety of scenes which each season displays to the discerning eye. Numberless worlds are around us all framed by the same Divine Artist which roll through the vast expanse and are all conducted by the same unerring law of nature."

Then in the Degree of Master Mason, with the 47th problem, we tell how man reaches deeper into Geometry to produce the science of astronomy and learn more about the further the universe. With it, he measures the most enormous distances. With it, he describes the whole framework and handiwork of nature. With it, he calculates the orbits and the positions of those "numberless worlds around us." But most important of all, with it, he better understands God’s great work and reduces the chaos of ignorance to the law and order of intelligent appreciation of the universe.

Thus, it is that while operative Masonry was focused on the practical nature of the science of Geometry, speculative Masonry and the ritual of the Degrees of Fellowcraft and Master Mason are concerned with the philosophical and aesthetic implications of Geometry – its moral calculations and spiritual symmetry inherent in those calculations.

Our Degrees instruct us that the process and results of Geometry prove that the science and its practical applications in Masonry are of a divine and moral nature, and that by its study we are enabled not only to prove the wonderful properties of nature but to demonstrate the more important truths of morality.

In Freemasonry, we are less concerned whether men remember much about the Geometric science which they studied in school, and less concerned with its uses in engineering, surveying and astronomy, but we very interested, indeed, in applying the symbols of mathematics and geometry to build moral character. And it is for this reason that the symbolism of this "invention of our friend and brother" becomes one of the most impressive – and one of the most important – of the emblems of Freemasonry, since it is a symbol of the power, the wisdom, and the goodness of the Great Architect of the universe.

So it is for very good reason that the Fellowcrafts' lecture calls our attention to the study of the seven liberal arts and sciences, especially the science of Geometry – or the basis of Masonry. And then in the Master Masons lecture, Geometry, in the form of the 47th Problem of Euclid, draws the close and vital connection between it and one of the greatest of Freemasonry's teachings – the knowledge of the All Seeing Eye.

No wonder our letter "G" stands for both the sacred name of Deity and Geometry! It shows us there is a plan for the universe – and we are a part of it!

From the symbolism of the simple square worn by the Worshipful Master through the other symbols in our Degrees, we are taught to make our life count, to be true to our obligations as Master Masons; to live virtuously and honorably; and to have faith in God, hope in immortality, and charity toward all mankind.

Thank you.

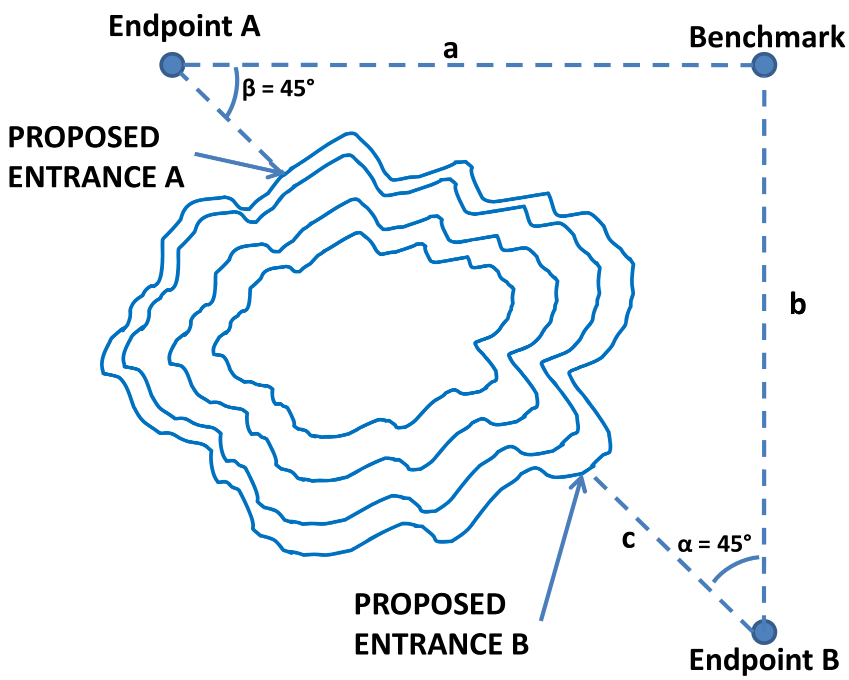
Written by RW William Talbott “Terry” Ellison, Jr.

References from:

1) The Complete Idiot’s Guide to Freemasonry by: S. Brent Morris

2) Coils Masonic Encyclopedia

TOP VIEW OF A MOUNTAIN



a = Horizontal distance between benchmark and point adjacent to proposed entrance A

b = Vertical distance between Benchmark and point adjacent to proposed entrance B

c = Distance between points adjacent to proposed entrances A and B