THE GEOMETRY OF THE KING'S CHAMBER IN THE PYRAMID OF KHUFU AND THE NUMERICAL EQUALITY OF AREA AND PERIMETER IN RIGHT-ANGLED TRIANGLES

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April 10, 2026

Abstract

The article demonstrates the connection between the linear dimensions of the King's Chamber in the Great Pyramid of Khufu and the dimensions of a unique right-angled triangle, in which the numerical values of the area, the perimeter, and the square of the shorter leg are equal. All dimensions are given in meters.

1 Introduction

In one of our previous publications, we analyzed the geometric dimensions of the King's Chamber in the Pyramid of Khufu [1]. This analysis revealed a double mathematical equality within a right-angled triangle inscribed in the chamber's geometry: the numerical value of its area (formed by the chamber's width and length and expressed in meters), the value of its perimeter in the same units, and the area of the square of its shorter leg (Figure). A subsequent publication demonstrated the uniqueness of this particular right-angled triangle due to the identified double mathematical identity [2]. Furthermore, a prior study [3] established a connection between the geometry of the King's Chamber and the values of the smallest primitive Pythagorean triple — "3, 4, 5" (Figure). In that context, the "unit" value for this Pythagorean triple was specified as 2.618… meters (notably, the number 2.61803… is the square of the Golden Ratio, a dimensionless irrational constant). A specific correlation exists between these two triangles: the imaginary "shadow" of the larger triangle forms the visible outlines of the smaller one, with the area of the larger triangle being 1.5 times that of the smaller (Figure).

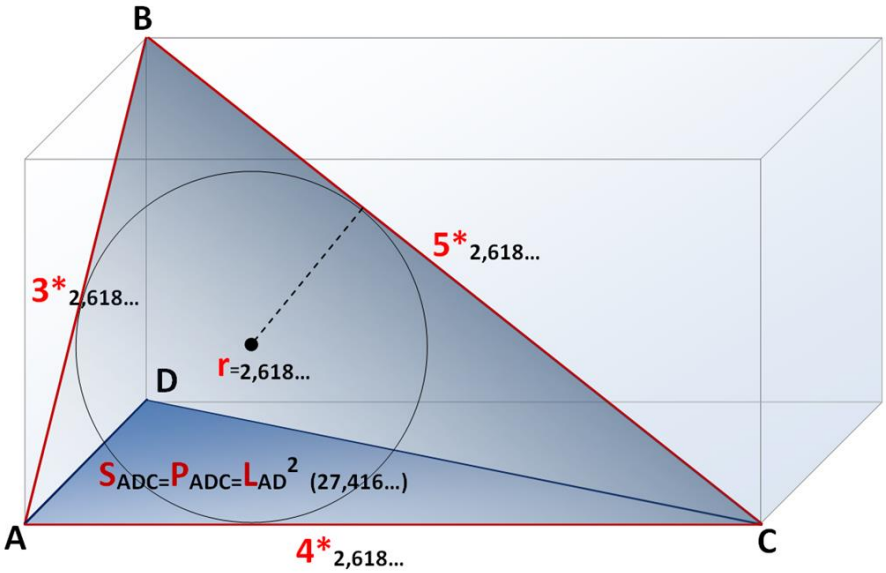

Figure – Schematic representation of the King's Chamber geometry in the Pyramid of Khufu, where: 2.618… is the square of the Golden Ratio (1.618…²), the shorter edge (AD) = 2 × 2.618… (5.236… m), and the height of the figure (DB) = √5 × 2.618… (5.854… m).

2 The main part

Based on the geometric analysis of the King's Chamber in the Pyramid of Khufu, the dimensions of a right-angled triangle inscribed within the geometry of this room have been interpreted (Figure 1). The figure illustrates two right-angled triangles inscribed within the geometry of the parallelepiped (the King's Chamber), where 2.618… is the square of the Golden Ratio ($1.618…^2$), the shorter edge (AD) equals 2 × 2.618… (5.236… m), and the height of the figure (DB) equals √5 × 2.618… (5.854… m). Notably, the right-angled triangle ADC possesses unique properties (making it singular in this regard): its numerical area of 27.416… is identical to the numerical values of both its perimeter and the square of its shorter leg.

Following the geometric analysis of the King's Chamber in the Pyramid of Khufu, a study was undertaken to identify potential right-angled triangles where the numerical values of the area and perimeter are equal.

The calculations revealed the following numerical equalities:

Right-angled triangles with irrational area and perimeter values:

- **1:1 ratio of legs:** The legs are equal to 6,8285… =√8+4 или =4+2√2, and the hypotenuse is 9,6568… =√32+4. The area and perimeter both equal 23,314 … = $(√8+2)^2$.
- **1:2 ratio of legs:** The area and perimeter equal 27,4163… = $(√5+3)^2$ or 14+6√5. The shorter leg is 5.236… = √27,4163…or =√5+3, the longer leg is twice the shorter one (10.472…), and the hypotenuse is 11,7082…=√45+5) (= 3+√5, 6+2√5, 5+3√5).
- **1:3 ratio of legs:** The area and perimeter equal (52+16√10)/3≈34.1988141876… . The shorter leg is = 4,7748517734… = (8+2·√10)/3, the longer leg is = 14,3245553203 … = 8+2·√10, and the hypotenuse is ≈ 15,0994070938… = (20+8·√10)/3.
- **1:4 ratio of legs:** The sides are a = 4,561552812808 … a = 5+√17/2, 18,24621125123 … b = 10+2·√17 (or 4 times the size of a smaller catheter), c = 18,807764064039… = 5·√17+17/2 both the area and the perimeter = 41,6155281280883… = 21+5·√17.
- **1:5 ratio of legs:** The sides are a = (12+2·√26)/5 ≈ 4,4396078054... , b =5 a=12+2·√26≈22,1980390272... , c =52+12·√26/5 ≈ 22,6376468326 ... , The area and perimeter are 124+24·√26/5 ≈ 49.2752936651 … .

and so on ... we get an infinite set of right-angled triangles with irrational values of the legs satisfying the condition with S=P;

In addition, there are two right—angled triangles (at S=P) with integer side values of 5, 12, 13 and 6, 8, 10, when the area and perimeter of the first is 30, and the second is 24.

3 Conclusion

According to the search results, it was revealed that among the infinite set of right triangles with irrational values of the legs, there is one unique one in which 2 conditions are fulfilled: the first is when the numerical value of the area is equal to the perimeter value, and the second condition is the square of the smaller leg. This is a triangle with sides — 5,236... (= √27,4163...) and – 10,472 ...

References

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