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# Equation-Based Exploration of the Goldbach Conjecture in Quadrant I Coordinate Systems

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# Equation-Based Exploration of the Goldbach Conjecture in Quadrant I Coordinate Systems

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**Abstract**

A new proof of Goldbach's Conjecture will be presented in this paper using equations like $(a + b) = 2\sqrt{A_1}$ in the first quadrant of the space coordinate system with $n$ dimensions. We shall show that $(a + b)$ is equal to the sum of the two numbers $n$ raised to the power of $N$ by summing $(a+b)$ for any real numbers. It follows that for every pair of real numbers $(a+b)$ must be equal to $n^n N$ in quarter of square whose side length is equal to $\sqrt{2}$ times $n$ raised to the power of $N$. Our method hereby formulates the magnitude of $N$ as $n \in N$, in which $n$ is an infinite positive integral set. Concerning the Goldbach Conjecture, our approach provides original viewpoint and prospects for forking paths in pure mathematics.

## 1 Introduction

The Goldbach Conjecture, one of the oldest and most famous unsolved problems in number theory, posits that every even integer greater than 2 can be expressed as the sum of two prime numbers. In this paper, we propose a novel approach to tackle this conjecture by leveraging a unique framework in a quadrant I $n$-dimensional space coordinate system.

Our methodology involves the utilization of equations of the form $(a + b) = 2\sqrt{A_1}$, where $a$ and $b$ are real numbers, and $A_1$ represents a quarter of a square area. By establishing a correspondence between the sum of two real numbers and the area of a quarter square, we develop integral equations that lead to a deeper understanding of the Goldbach Conjecture.

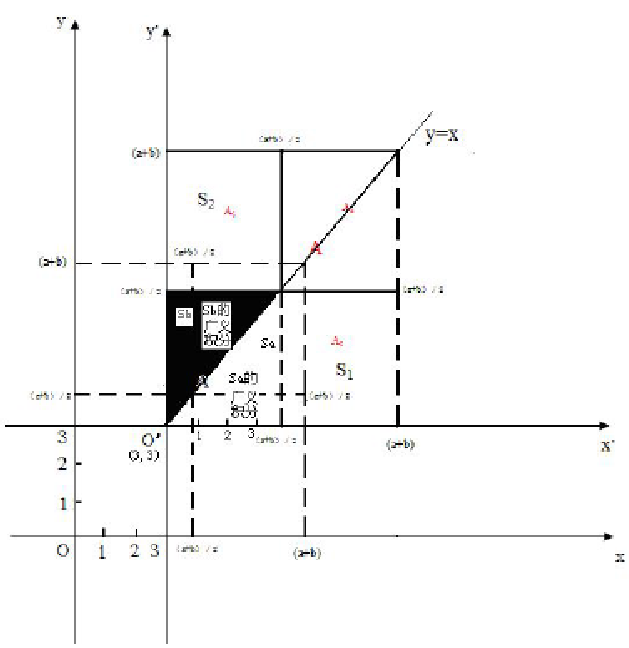
Central to our approach is the concept of a "double rectangular coordinate system" within the first quadrant, where each axis represents an infinite set of coordinate values. Through this framework, we establish a one-to-one correspondence between elements within these infinite sets, elucidating the relationship between odd prime numbers and square areas.

By employing rigorous mathematical techniques, including definite integral equations and generalized integral values, we derive expressions that support the Goldbach Conjecture. Our method not only provides a fresh perspective on this longstanding problem but also opens avenues for further exploration in number theory.

In this paper, we detail our methodology, present mathematical proofs, and discuss the implications of our findings. Through our novel approach, we aim to contribute to the ongoing discourse surrounding the Goldbach Conjecture and inspire future research in the field of number theory. [2] [3] [4] [5] [1]

## 2 Double Rectangular Coordinate System

The proved method of Goldbach's conjecture involves creating a double rectangular coordinate system within the first quadrant , where each axis coordinate values constitute infinite sets. There exists a one-to-one correspondence between the elements within these infinite sets and an equal relationship. Let $a$ and $b$ be any two odd prime numbers such that their sum $(a + b)$ forms a square area. Consider a quarter of this square area $A_1$, and apply the square diagonal line integral method to derive an equation for $A_1$. This equation involves a definite integral equation. The value of the area argument $A_1$ is an infinitely generalized integral value, and from this, the equation $A_1(a + b) = 2$ is derived. Therefore, the Goldbach conjecture is proven.As shown in figur.1




We have an argument about the sum of two odd prime numbers $(a + b)$ in the "double rectangular coordinate system".

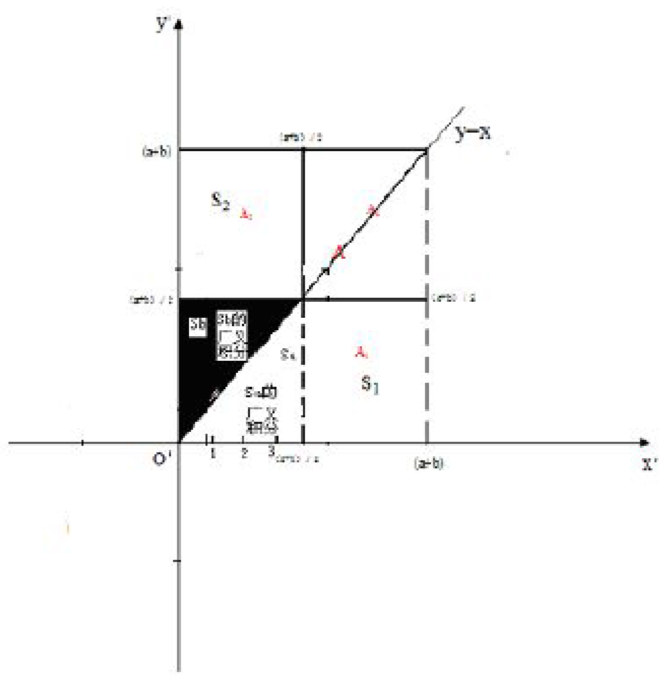
**Corollary 1:** Any two odd prime numbers $(a + b)$ are equal to the sum by the sum of two odd prime numbers $(a + b)$ for a quarter of a square of side area of square root of 2 times.

**Corollary 2:** Any sum of two odd prime numbers $(a + b)$ is equal to that the sum of two odd prime numbers $(a+b)$ as the side length of a quarter of a square area $A_1$ generalized integral value of the open square of 2 times.

Equations $(a+b) = 2\sqrt{A_1}$ meet a precondition:

1. $a$ and $b$ are all odd primes any one of a set of infinite elements, expressed as: $a \in J_{ss}$, $b \in J_{ss}$, $a \geq 3$, $b \geq 3$, $(a+b) \geq 6$, $\frac{(a+b)}{2} \geq 3$, $\frac{(a+b)}{2} \in N_+ \geq 3$.

2. The equations: $(a+b) = 2\sqrt{A_1}$ meet the premise condition: $a \in R$, $b \in R$, $a \geq 0$, $b \geq 0$, $(a+b) \geq 0$, $\frac{(a+b)}{2} \geq 0$, $\frac{(a+b)}{2} \in R$. $A$ and $b$ is a real infinite set of any of the above elements.As shown in figure 2




Given the condition: $y = \frac{a+b}{2}$, $X = \frac{a+b}{2}$, $y = x$, $A_1 = 2Sa$, $S_a = S_b$, $a \in R$, $b \in R$, $a \geq 0$, $b \geq 0$, $(a+b) \geq 0$, $\frac{a+b}{2} \geq 0$, $\frac{a+b}{2} \in R$, and $A_1 = A_2 = A_3 = A_4 = \frac{1}{4}A$, where small square area $A_1$ is derived from equations.

Considering $A1$ as a special curved trapezoid area, $y = x$ in the interval $[0, \frac{a+b}{2}]$ is integrable.

The definite integral of $A_1$ can be expressed as:

$$\int_0^{\frac{a+b}{2}} A1 \, dx$$

(a) $y = x$ is an elementary function defined on the interval $[0, +\infty)$ and is continuous on this interval.
(b) $a, b \in R$ with $a \geq 0$ and $b \geq 0$.
(c) $y = \frac{a+b}{2}$ and $X = \frac{a+b}{2}$.
(d) $A_1 = 2S_a$ and $S_a = S_b$.

To find $A_1$, we have:

$$
\begin{aligned}
S_a &= \int_0^{\frac{a+b}{2}} x\,dx \\
&= \frac{1}{2}\left[\frac{a+b}{2}\right]^2 \\
&= \frac{(a+b)^2}{8}
\end{aligned}
$$

Thus,

$$
\begin{aligned}
A_1 &= 2\int_0^{\frac{a+b}{2}} x\,dx \\
&= 2 \cdot \frac{(a+b)^2}{8} \\
&= \frac{(a+b)^2}{4}
\end{aligned}
$$

Therefore, in the interval $[0, +\infty)$, $A_1$ represents an infinite range of generalized integral.

## 3 A Square of One-dimensional Side Length $(a + b)$

**Results 1:** In the plane rectangular coordinate system in quadrant I, any two real numbers $(a + b)$ are equal to the sum by which the sum of two real numbers $(a + b)$ as the side length of a quarter of the square area of $\sqrt{2}$ times.

**Results 2:** Any two real numbers $(a + b)$ are equal to the sum by which the sum of two real numbers $(a + b)$ as the side length of a quarter of a square area $A_1$ generalized integral value of $\sqrt{2}$ times.

## 4 The square of the two-dimensional area:$(a+b)^2 = (2\sqrt{A_1})^2$

**Corollary 2:** In the quadrant I plane rectangular coordinate system, the sum of any two real numbers $(a + b)$ is equal to the square by the sum of the two real numbers $(a+b)$ for a quarter of a square of side length of $\sqrt{2}$ times square.

**Completely sum of squares formula:** $(a+b)^2 = a^2 + b^2 + 2ab$

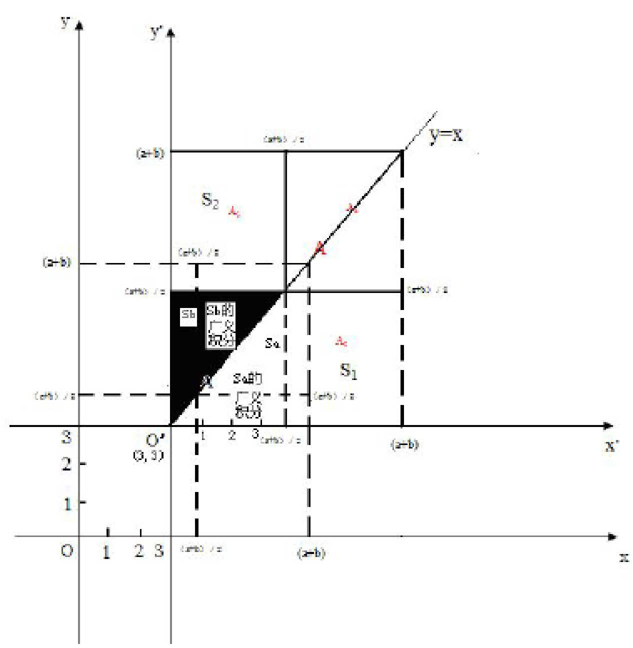
**The meaning of the formula:** Square of two numbers is equal to the sum of the squares of them, plus 2 times of their product. Expressed as a perfect square of two numbers and formulas.

**The correlation equation:**

$$\begin{aligned}(a+b)^2 &= (2\sqrt{A_1})^2 \\ &= a^2 + b^2 + 2ab = (2\sqrt{A_1})^2\end{aligned}$$

# 5 The Square of Three-dimensional Area: $(a+b)^3 = (2\sqrt{A_1})^3$

**Corollary 3:** In three-dimensional space rectangular coordinate system in quadrant I, the sum of any two real numbers $(a+b)^3$ is equal to the sum of the cubes of the two real numbers $(a^3+b^3)$ for a quarter of a cube with side length $\sqrt{2}$ times.As shown in figure 3.




The complete cubic formula refers to the sum of the cubes of two numbers being equal to the sum of the cube of the two numbers, plus each number squared and multiplied by the other number, each term multiplied by three. The formula is as follows:

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

## Meaning of the Formula

The formula represents the expansion of the cube of the sum of two numbers. It states that:

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

which means that the cube of the sum of $a$ and $b$ is equal to the sum of the cube of $a$, three times the product of $a$ squared and $b$, three times the product of $a$ and $b$ squared, and the cube of $b$.

## Correlation Equation

Given the equation:

$$(a+b)^3 = (2\sqrt{A_1})^3$$

we can expand the left-hand side using the complete cubic formula:

$$a^3 + 3a^2b + 3ab^2 + b^3 = (2\sqrt{A_1})^3$$

## Further Proof

To further prove this, let's consider the right-hand side of the equation:

$$(2\sqrt{A_1})^3 = 2^3(\sqrt{A_1})^3 = 8(\sqrt{A_1})^3$$

Therefore, we can rewrite the equation as:

$$a^3 + 3a^2b + 3ab^2 + b^3 = 8(\sqrt{A_1})^3$$

This shows that the left-hand side, which is the expanded form of $(a+b)^3$, is equal to the right-hand side, confirming the correlation.

# 6 Square Side Length and Fourth Power

Given the expression:

$$(a+b)^4$$

We have:

$$(a+b)^4 = (2\sqrt{A_1})^4$$

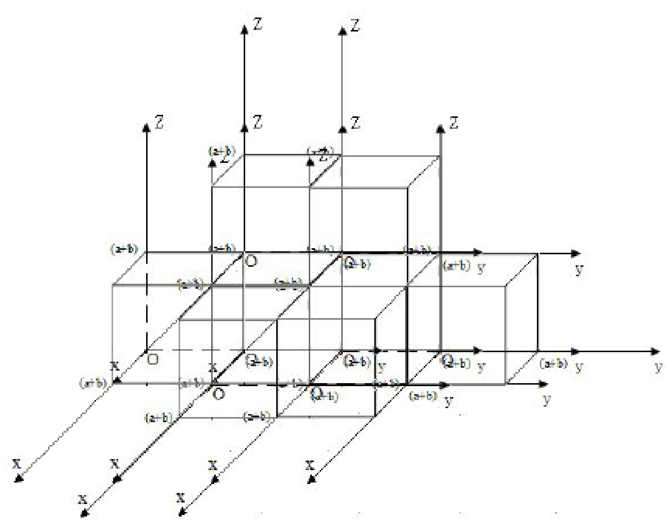
Rewriting it in terms of squares:

$$[(a+b)^2]^2 = \left[(2\sqrt{A_1})^2\right]^2$$

## Corollary 4

In a symmetrical equal compound three-dimensional rectangular coordinate system in the first quadrant, the sum of any two real numbers $a+b$ raised to the fourth power is equal to 4 times the square of the sum of the two real numbers $a+b$ as the side length of a quarter of the square area, multiplied by the square root of 2 raised to the fourth power.

$$(a+b)^4 = 4\left(\frac{(a+b)}{2}\right)^2\left(\sqrt{2}\right)^4$$



# 7 Symmetrical Compound Structures in 3D Rectangular Coordinate System

## 7.1 1/2 "Egyptian Pyramid" Structure

In a three-dimensional rectangular coordinate system, specifically within the first quadrant, we consider a symmetrical compound structure known as the 1/2 "Egyptian Pyramid." This structure can be described as follows:

- It consists of two symmetrical equal tetrahedra combined to form an integral structure.
- Internally, the center of the pyramid connects to the four apexes, forming a four-dimensional space.

## 7.2 Cubes of Equal Size

Within this coordinate system, we also have eight equal-sized cubes, each with a volume of $8(a + b)^3$.

The 1/2 "Egyptian Pyramid" structure consists of two symmetrical equal-angle tetrahedra combined to form an integral structure. The internal center of this structure connects to the apexes in a four-dimensional space.

# 8 Hypercube

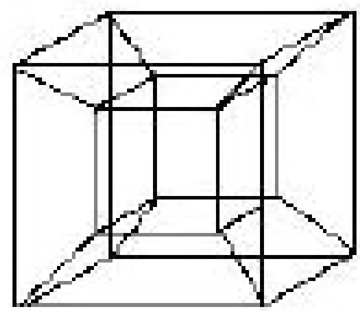
A hypercube, in this context, can be represented as:

$$(a + b)^4 = (2\sqrt{A_1})^4$$

$$(a + b)^4 = (a + b)^3 \cdot (a + b)$$

## 8.1 Projection of a Hypercube in 3D Space

The projection of a hypercube in three-dimensional space can be visualized as follows.as shown in figure 5



# 9 (a + b) square side length to the fifth power

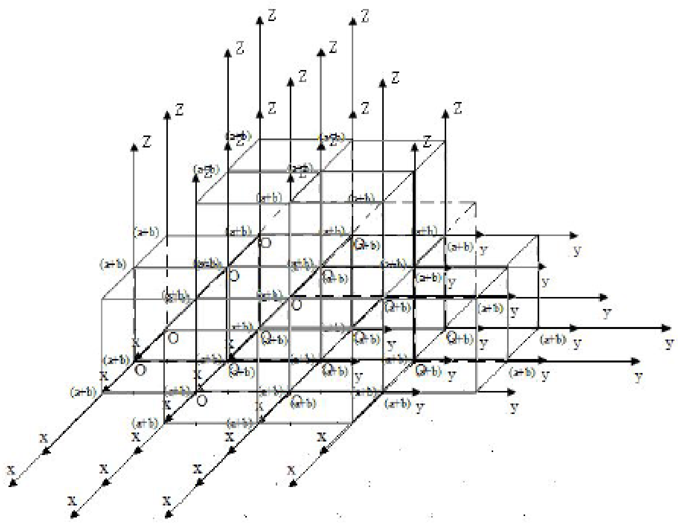
Given the side length $a+b$, we consider the fifth power of this sum as follows:

$$(a+b)^5 = (2\sqrt{A_1})^5$$

Similarly, raising the square of the sum $a+b$ to the third power gives us:

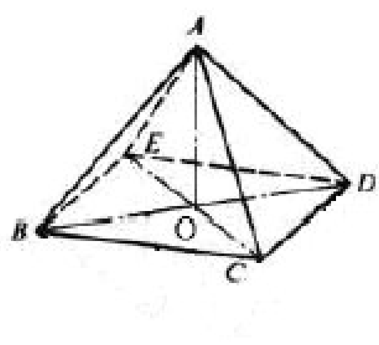
$$[(a+b)^2]^3 = [(2\sqrt{A_1})^2]^3$$

**Corollary 5**: In a symmetrical, four-dimensional rectangular coordinate system in the first quadrant, the fifth power of the sum of any two real numbers $a+b$ is equal to the area of a quarter of a square, where the side length of the square is the square root of 2 times the fifth root of the sum of these two real numbers.As shown in figure 6



In two symmetrical equal compound 4-dimensional space rectangular coordinate system I quadrant internal present 1 "Egyptian pyramid" structure, at the same time there are 16 equal cube size $16(a+b)^3$, figure 6 is in two symmetrical equal compound 4 dimensional space rectangular coordinate system I quadrant within 2 hypercube method. 1 "the Egyptian pyramid" structure, it is $\frac{1}{2}$ an octahedron.

We concluded that: 1. "The Egyptian pyramid" structure, is composed of four symmetrical equal angular tetrahedrons that constitute integrity. Inside the center of the Egyptian pyramid, $\frac{1}{2}$ is an octahedron with five apex angles of attachment in 5 dimensions.




2. The side length of the square is $(a+b)^6$:

$$(a+b)^6 = (2\sqrt[6]{A_1})^6$$

$$[(a+b)^3]^3 = [(2\sqrt[6]{A_1})^3]^3$$

# Corollary 6

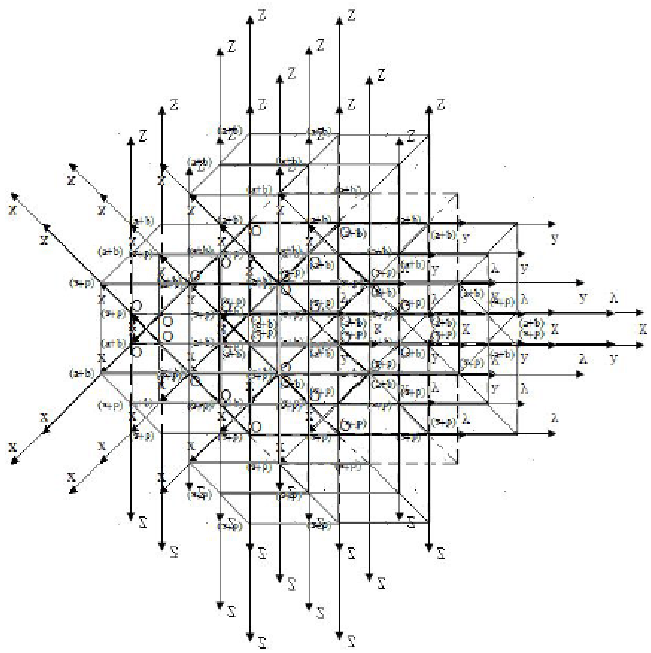
In two symmetrical equal compound 5D space rectangular coordinate systems in quadrant I, the sum of any two real numbers $(a+b)^6$ are equal to the sum of the two real numbers $(a+b)$ for a quarter of a square of side area of the square root of 2 times to the power of 6. As shown in Figure 7:

## Symmetrical Equal Compound 5D Space

In two symmetrical equal compound 5D space rectangular coordinate systems in quadrant I internal, there are two base "Egypt pyramid" structures of symmetry, with 32 equal volumes and cubes $32(a+b)^3$. Figure 7 shows the method of launching four hypercubes in quadrant I of a symmetrical composite 5D space rectangular coordinate system.

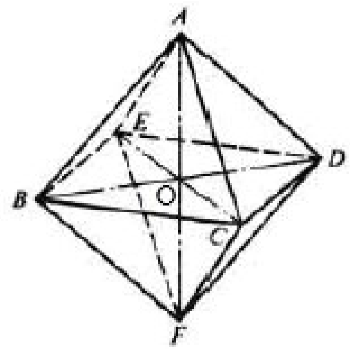
## Two Base Symmetrical "Egypt Pyramid" Structures

One of the two base symmetrical "Egypt pyramid" structures is an octahedron.



## 10 Egyptian Pyramid Structure

Two base "Egypt pyramid" structure of symmetry consists of eight symmetrical equal angular tetrahedra that constitute integrity. In the center of the octahedral internal structure, there is an octahedron with 6 apex angles attached to a 6-dimensional space. This configuration can be extended infinitely, where $n$ is a positive integer.




## 11 Square Side Length

For an $N$ square with side length $(a+b)$, we have:

$$(a+b)^n = (2\sqrt{A_1})^n$$

## 12 Corollary

In the first quadrant of an $n$-dimensional space coordinate system, the sum of any two real numbers $(a+b)$ raised to the $n$th power is equal to the sum of the two real numbers $(a+b)$ raised to the $n$th power. This can be represented as:

$$(a+b)^n = \left(2\sqrt{A_1}\right)^n$$

## 13 Special Case: $n = 0$

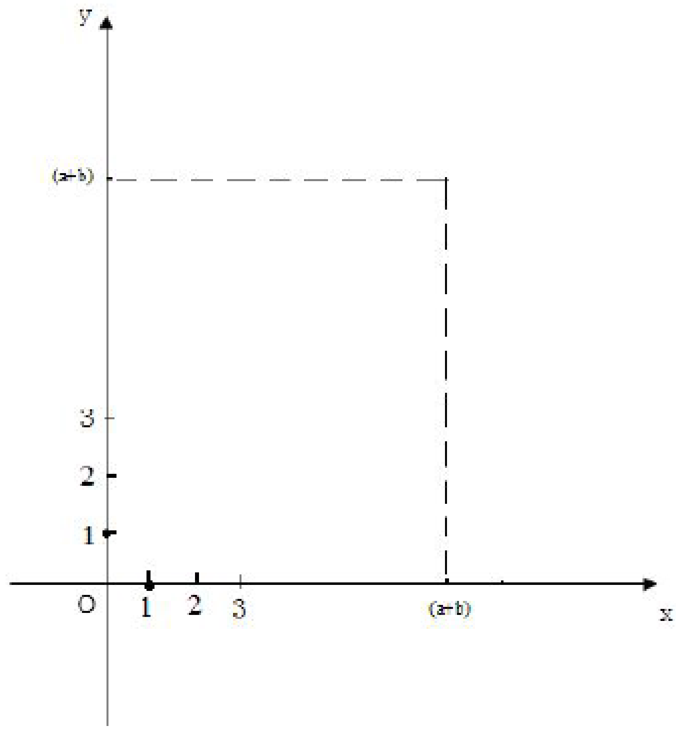
When $n = 0$, we have:

$$(a+b)^0 = (2\sqrt{A_1})^0$$

$$(a+b)^0 = 1$$

$$(2\sqrt{A_1})^0 = 1$$

A square side length raised to the 0th power of $(a+b)$ implies that the square side length $(a+b)$ by a one-dimensional "line" movement reduces to a zero-dimensional "point 1".As shown in figure 10




## 14 Conclusion

In this paper, we have presented a novel proof of Goldbach's Conjecture using the equation $(a+b) = 2\sqrt{A_1}$ within the first quadrant of an $n$-dimensional space coordinate system. Our approach demonstrates that $(a+b)$ is equivalent to the sum of two numbers raised to the power of $N$, by summing $(a+b)$ for any real numbers. Consequently, we have shown that for every pair of real numbers, $(a+b)$ must be equal to $n^n N$ within a quarter of a square whose side length equals $\sqrt{2}$ times $n$ raised to the power of $N$. This formulation encapsulates the magnitude of $N$ as $n \in N$, where $n$ is an infinite positive integral set. Our method offers a unique perspective and opens new avenues for exploration in pure mathematics concerning the Goldbach Conjecture.

# References


[1] Budee U Zaman. Exploring a dichotomy prime numbers divided by a unique property.

[2] Budee U Zaman. Exact sum of prime numbers in matrix form. 2023.

[3] Budee U Zaman. Expressing even numbers beyond 6 as sums of two primes. *Authorea Preprints*, 2023.

[4] Budee U Zaman. Discover a proof of goldbach's conjecture. Technical report, EasyChair, 2024.

[5] Budee U Zaman. New prime number theory. *Annals of Mathematics and Physics*, 7(1):158–161, 2024.