

The Architecture of Unity: Mathematical and Spiritual Symbolism of Nine-Fold Geometry in the Bahá'í Lotus Temple

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Abstract—The Bahá'í Lotus Temple in New Delhi is one of the most inspiring examples of how mathematics and spirituality can work together to express unity. This paper explains, in simple mathematical language, how the temple's nine-fold geometry—based on nine equal sides and nine entrances—creates both physical balance and a feeling of peace. Using ideas familiar to secondary-school mathematics, such as symmetry, circles, and angles, the paper shows that when shapes are arranged evenly, they form patterns that people naturally find beautiful and calming [2].

The number nine holds special meaning in the Bahá'í Faith, representing completeness and the idea that all people and religions are connected [5]. By combining simple geometry with this spiritual idea, the temple becomes more than a building—it becomes a lesson about equality. The research introduces the concept of a *Unity Center*, the exact middle point of the design, where all entrances and curved paths meet. Around this center, light and sound are distributed almost equally, which can be explained using basic ideas of symmetry and proportion.

In this way, mathematics becomes a bridge between science and faith. It helps students see that geometry is not only about numbers and measurements but also about harmony, fairness, and the beauty of balance in both architecture and life.

Bahá'í Faith, Lotus Temple, sacred geometry, nine-fold symmetry, symmetry in nature, equality through design, Unity Center, mathematics and spirituality, harmony, peace in architecture.

I. INTRODUCTION

Mathematics and spirituality may seem very different, yet both search for truth and order. Mathematics explores how numbers and shapes relate, while spirituality explores how people and the universe connect. When these two meet, learning becomes not only logical but also beautiful. The Bahá'í Lotus Temple in New Delhi is a living

example of this meeting. It shows that a building made from mathematical design can also teach lessons about peace and equality.

The Lotus Temple is shaped like a white lotus flower rising from water. It has nine sides, nine doors, and nine pools, all arranged in perfect balance. For students studying geometry, these shapes can be understood using simple rules of circles and angles. The temple is built so that if you rotate its plan by an angle of 40° , it looks exactly the same. This property is called *rotational symmetry* [3]. It means that the design repeats itself nine times around one center, just as petals repeat around the center of a flower. In mathematics, such symmetry belongs to a special group called the dihedral group D_9 , which describes all rotations and reflections that keep a nine-sided figure unchanged.

From a spiritual point of view, this rotation represents fairness. Every direction—north, south, east, or west—has an entrance. No one is more important than another. People coming from different paths all reach the same inner hall. This idea matches the Bahá'í teaching that all religions and people are part of one human family [5]. Thus, the temple's symmetry is not only a mathematical design but also a moral message: when all sides are equal, peace and unity appear.

1.1 Mathematics as a Universal Language

Students often study geometry as lines, angles, and measurements, but it can also be viewed as a language of patterns. Every circle, triangle, or polygon tells a story about balance. For example, when we divide a circle into equal parts, we create harmony that is pleasant to the eyes. Architects use this property to design buildings that feel stable and calm. The Lotus Temple applies these same rules. Its

base can be drawn by dividing a circle into nine equal sectors:

$$\text{Central angle of each sector} = \frac{360^\circ}{9} = 40^\circ.$$

Each 40° sector leads to one entrance. The total makes nine equal openings arranged like petals. The distance from the center to each door is the same, forming a perfect nonagon. Such equality in length and angle ensures that when visitors move around, they feel oriented and centered.

1.2 The Number Nine and Its Meaning

In arithmetic, nine is the largest single-digit number. When multiplied or added, it shows an interesting property: its digits always add up again to nine. For example, $9 \times 7 = 63$ and $6 + 3 = 9$. This repetition teaches that unity continues even when numbers grow. In the Bahá'í Faith, the word “Bahá,” meaning “glory,” has a numerical value of nine in the Arabic *Abjad* system [4]. Because of this, nine is considered the number of completeness and oneness. The temple's nine doors therefore represent all faiths entering one house of prayer.

For students, this is an easy but powerful connection between mathematics and philosophy. The rule of digital sum becomes a symbol of spiritual unity: no matter how complex life becomes, its parts add back to one truth. The same law appears in the temple—many sides, one center.

1.3 Geometry in Daily Life

Geometry is not limited to textbooks; it appears everywhere in nature. Honeycombs form perfect hexagons; snowflakes show six-fold symmetry; flowers like the lotus show multiple petals arranged around a circle. The Lotus Temple takes inspiration from this natural geometry. Its nine petals are modeled by simple curved equations called *rose curves*:

$$r = a \sin(9\theta),$$

where r is the distance from the center, θ is the angle, and a controls the size. For every rotation of 40° , the same shape repeats. This simple equation produces the graceful form of the temple's plan. Explaining this to high-school students helps them see that mathematics can create art. It also encourages them to connect learning with observation: just as the petals of a flower follow a

pattern, so does the structure of the universe.

1.4 Light, Sound, and Balance

Inside the temple, sunlight enters through openings between the petals and spreads softly across the hall. Because of the symmetric design, light intensity remains almost the same everywhere. In physics terms, this happens because the angles of incidence and reflection are equal around all sides. The same balance applies to sound: when someone speaks or sings near the center, their voice spreads evenly in all directions. The hall acts like a naturally perfect echo chamber where no direction dominates. Simple geometry explains this equality. If the walls are placed at equal distances and angles, waves of light and sound reach every point nearly together, reducing shadows and echoes.

This harmony of light and sound symbolizes equality among people. Just as brightness and voice are shared evenly, kindness and respect should also be distributed without preference. The mathematics of symmetry thus becomes a model for moral symmetry.

1.5 Learning Through Beauty

For young learners, the Lotus Temple shows that mathematics is not dry or abstract—it is creative and spiritual. Drawing a nine-sided figure, dividing a circle, or exploring reflection and rotation helps students appreciate patterns found in nature and art. The temple's geometry teaches that understanding structure leads to understanding purpose. When students see how equations describe real shapes, they realize that mathematics is a way to describe beauty logically.

Teachers can use this temple as an example in lessons on polygons, angles, or rotational symmetry. By connecting formulae to a real monument, students develop both technical skill and appreciation for cultural heritage. They also learn that geometry is a universal language linking science, design, and spirituality.

1.6 Purpose of This Paper

The main aim of this paper is to explain how simple mathematical ideas can describe the deep harmony of the Bahá'í Lotus Temple. The study will:

- Introduce the concept of nine-fold symmetry in

plain language.

- Show how rotational and reflective symmetry create equality in design.
- Demonstrate, with easy equations, how light and sound balance around a center.
- Relate these patterns to Bahá'í teachings about unity and equality among people.

By combining geometry with moral understanding, the paper hopes to help young minds see mathematics as more than calculation. It becomes a tool to recognize fairness in the world.

1.7 Organization of the Paper

The following sections explore this idea step by step. Section 2 explains how sacred geometry has developed through history and why the number nine is spiritually important. Section 3 discusses philosophical meanings of unity. Section 4 presents a simple mathematical model using school-level equations. Section 5 gives results of light, sound, and symmetry analysis. Section 6 offers reflection on what these findings mean for science and faith. Finally, the paper concludes with thoughts on how geometry can guide both design and daily life.

Overall, this introduction invites students to see that mathematics is a reflection of truth. Just as every radius in a circle connects to the same center, every branch of knowledge connects to the same purpose—to bring order, peace, and understanding to the human spirit.

II. HISTORICAL AND SPIRITUAL BACKGROUND

The study of geometry began long before modern mathematics existed. Ancient people looked at the stars, seashells, and flowers and discovered that nature followed rules of shape and number. Egyptians used triangles to build pyramids; Indians planned temples using squares and circles; Greeks developed proofs to explain harmony in figures. They all believed that mathematics was not only useful but sacred—a way to understand the language of creation [1].

2.1 Ancient Roots of Sacred Geometry

Pythagoras, the Greek philosopher, taught that “all things are number.” His students discovered that

simple ratios such as 2:3 or 3:4 could create beautiful musical sounds. They also found the same ratios in buildings and in nature. When a temple was built using these ratios, people felt peace because the structure echoed natural harmony. In India, the *vastu-purusha mandala* used equal squares to represent balance between earth and sky. In Persia and Arabia, artists used star-shaped patterns to remind worshippers of infinity. Every civilization gave numbers and shapes moral meaning—circles for eternity, triangles for stability, and squares for order. These early builders might not have used algebra, but they understood that geometry connects the human mind to the rhythm of the universe. When students today draw polygons or calculate angles, they continue that ancient conversation between logic and beauty.

2.2 The Bahá'í Vision of Unity

The Bahá'í Faith, founded by Bahá'u'lláh in the nineteenth century, continued this tradition of joining science and spirituality. The central teaching of the Faith is the unity of humankind—that all religions, races, and nations are branches of one family [4]. To express this idea in architecture, Bahá'í Houses of Worship were designed with one simple rule: nine sides and one center.

In the Arabic *Abjad* numerical system, each letter has a number. The letters of the word “Bahá” (meaning “glory”) add up to nine. Because nine is the largest single-digit number, it stands for completeness. When we count beyond nine, we return to one again. This is like the spiritual journey of humanity—after many stages of growth, we come back to the same truth. Every Bahá'í temple therefore uses the number nine as a symbol of unity and fulfillment [5].

2.3 Geometry of Nine

For a student of mathematics, the rule of nine is fascinating. Multiplying any number by nine produces digits that add up to nine again—for example, $9 \times 4 = 36$ and $3 + 6 = 9$. This repeating pattern shows that nine keeps balance within change. The same idea appears in the architecture of Bahá'í temples. When a nonagon (a nine-sided figure) is drawn inside a circle, each vertex lies at an equal distance from the center and at

equal angles of 40° apart. Such symmetry means that turning the shape by 40° leaves it unchanged. This property is called rotational symmetry and belongs to a mathematical group known as D_9 [3]. Students can easily explore this by using a compass and protractor to divide a circle into nine equal sectors.

This geometric rule is not only elegant—it also teaches fairness. Every side of the temple corresponds to one entrance, welcoming people from all directions equally. In spiritual language, it means that every faith and every person can approach God without discrimination. Mathematics thus becomes a moral teacher: equality in angles mirrors equality among hearts.

2.4 From Ancient Harmony to Modern Design

When architect Fariborz Sahba began designing the Bahá'í House of Worship in New Delhi in the 1970s, he wanted a form that would speak both to science and to spirit. The lotus flower, common in Indian art, became his inspiration. The lotus grows from muddy water yet remains pure and beautiful—symbolizing purity rising from diversity. The temple's structure consists of twenty-seven marble "petals" arranged in groups of three, forming nine sides around a central hall. The base follows the equation of a nine-petaled rose curve:

$$r = a \sin(9\theta),$$

where r is the distance from the center and θ is the angle. Students can plot this equation using simple graphing software and see how a single formula can produce the elegant shape of a lotus. The building thus turns algebra into art.

Under each group of petals lies a pool of water. The reflections make the building appear to float, creating both physical cooling and spiritual calm. This use of symmetry and reflection connects architecture with natural science: when light and water interact at equal angles, beauty and balance appear naturally.

2.5 Light, Sound, and Equality

Inside the Lotus Temple, light enters through narrow gaps between the marble petals. Because every gap has the same width and angle, sunlight spreads evenly. At noon, the interior brightness differs by less than five percent between the center and the edges

[6]. Sound behaves in the same way. The curved walls reflect voices smoothly so that a person standing at the center can be heard equally in every direction [7]. Even without microphones, the hall carries words clearly—showing that geometry can design fairness into experience.

For high-school learners, these physical effects can be linked to basic science: equal angles of reflection cause equal distribution of light and sound. Thus, the spiritual message of equality becomes measurable physics.

2.6 The Nine-Fold Message

Every part of the temple—the petals, doors, and pools—repeats the number nine. This repetition does not create boredom; instead, it builds rhythm and order. The same principle works in music, where repeating patterns produce harmony. The Bahá'í Temple transforms repetition into meditation. As visitors walk through its nine paths toward the center, they symbolically travel from diversity to unity. The geometry gently guides thought inward, from many to one.

For students, the lesson is clear: mathematics is not separate from human values. When equations create symmetry, they also create peace. When numbers balance, they teach justice. The Lotus Temple stands as an example of how mathematical design can carry moral meaning visible to everyone.

2.7 Continuity of a Universal Tradition

Although the Bahá'í Temple is modern, it belongs to a long chain of sacred geometry. The golden ratio seen in the Parthenon, the concentric layouts of Islamic gardens, and the radial plans of Buddhist stupas all express the same idea: balance leads to beauty. The Bahá'í design adds a new dimension by opening its doors to all faiths. In that sense, it is geometry serving global citizenship. Mathematics becomes a language of unity understood in every culture [9].

The combination of tradition and innovation shows students that knowledge evolves. Ancient geometry discovered laws of form; modern science verifies them; spirituality gives them purpose. By studying the Lotus Temple, learners can see how mathematics connects history, architecture, and ethics into one continuous pattern.

The historical and spiritual background of the Bahá'í Lotus Temple demonstrates that geometry is far more than drawing figures on paper. It is a bridge between thought and faith, between logic and love. From the pyramids to the lotus, the same principle shines: when proportions are balanced and numbers cooperate, beauty and peace emerge. The number nine, both mathematically perfect and spiritually complete, links the temple to an ancient understanding that truth is one and harmony is universal.

By exploring such examples, high-school students can learn to appreciate mathematics as a creative and moral art—a tool not only for solving problems but also for building understanding among people. The Bahá'í Lotus Temple, with its nine-fold geometry, invites every learner to see that the world itself is built upon mathematical unity.

III. PHILOSOPHICAL FOUNDATIONS OF UNITY

Philosophy asks deep questions about why things exist and how they relate. Mathematics answers many of those questions through order and pattern. When both work together, we begin to understand that the same logic guiding equations also guides human life. The Bahá'í Lotus Temple demonstrates this truth through its nine-fold geometry—a pattern that is easy to draw yet full of meaning. In this section, the idea of unity is explained as a bridge between mathematics, ethics, and spirituality [9, 1].

3.1 Unity in Number and Thought

The first and simplest number is one. Every other number is built by repeating one, yet the original value never disappears. Philosophers such as Pythagoras and Plotinus believed this showed that all creation begins from a single source [2]. Mathematically, if we call that source 1, then 2, 3, 4, ... are only multiples of it. Spiritually, if we call the source “Truth,” then all religions and sciences are reflections of that same truth in different forms. The Bahá'í Faith teaches the same idea: that the world is many in appearance but one in essence. In the Lotus Temple, nine sides grow from one center. Each entrance is different in direction but equal in distance. This equality of measure becomes a lesson in equality of heart. When visitors walk

toward the center, they unknowingly perform a small mathematical ritual—moving from diversity back to unity.

3.2 Symmetry as Fairness

Symmetry means that one side mirrors another. In geometry, a figure is symmetric if folding it along an axis produces matching halves. In ethics, fairness means giving equal importance to everyone. The Bahá'í temple links these two ideas beautifully. Because it has nine entrances placed 40° apart, any person entering from any side experiences the same view and distance to the center. There is no “front” or “back.” Mathematically, this is rotational symmetry of order 9, described by the group D_9 [3]. Spiritually, it is social equality expressed through design.

Students can test this with paper: draw a circle, mark nine equal points, and join them to the center. Each rotation fits perfectly. The activity shows that geometry can teach moral principles—when all sides are equal, conflict disappears.

3.3 The Center as Balance

Every symmetric figure has a center, a point that does not change even when the rest of the figure moves. The temple's Unity Center is that point. From it, every radius is equal, and all directions are fair. In mathematics, this is called a *centroid*. In philosophy, it represents stability. In spirituality, it is the place of stillness inside every human being where peace begins. Standing at the center of the Lotus Temple, one feels surrounded equally by space and light. This experience transforms a simple geometric point into a moment of meditation.

3.4 Number Nine and Harmony

Nine is not only a number but a symbol of completion. After counting from one to nine, we return to ten, which is one again on a higher level. The pattern repeats forever. This mirrors the Bahá'í idea of progressive revelation—that truth renews itself in every age [4]. Mathematically, nine is also special because its multiples keep returning to nine: $9 \times 5 = 45$ and $4 + 5 = 9$. It is as if the number contains its own echo of unity. When applied to architecture, this property ensures that the design always “returns” to balance.

In the temple, nine sides, nine doors, and nine pools

remind visitors of this cycle. Every step toward the center feels complete yet continuous—teaching that learning and spiritual growth never end.

3.5 Geometry as Meditation

Many traditions use geometric figures as aids to meditation. Buddhists draw mandalas; Hindus create yantras; mathematicians plot circles and spirals. Each pattern guides the mind from outer form to inner peace. The nine-petaled layout of the Lotus Temple acts in the same way. If the boundary of the building is plotted by the simple equation

$$r = a \sin(9\theta),$$

the result is a graceful lotus shape. Students who trace this curve see how repeating a single formula creates beauty. Thinking quietly while drawing or programming this pattern can feel calming—an exercise in focus and appreciation. Thus geometry, usually seen as calculation, becomes a form of mindfulness.

3.6 Science and Faith as Complementary

Modern life often separates science from religion, but the Bahá'í writings teach that they are “two wings of one bird.” Science discovers the laws of creation; religion gives those laws purpose. The Lotus Temple shows this harmony. Engineers used measurements and materials to make the structure safe and bright, while spiritual vision gave the design its meaning. Both worked together. The same approach can help students: understanding formulas explains how things work; understanding values explains why they matter.

The equal spread of sunlight through the nine openings can be described with basic physics: when light rays strike a surface at equal angles, reflection is uniform [6]. Yet behind this rule stands a spiritual idea—that divine light shines equally on everyone. In this way, even simple school experiments about reflection or symmetry can be connected to lessons about equality.

3.7 Unity in the Mind and Community

Psychology shows that humans prefer symmetry because it reduces confusion in the brain. Balanced patterns are easier to process and make people feel safe. When students enter a symmetric hall, their attention naturally settles at the center. The same

happens in society: when relationships are balanced and fair, communities feel peaceful. The temple therefore acts like a classroom for the world, teaching cooperation through experience. As Bahá'u'lláh wrote, “Let your vision be world-embracing.” Mathematical balance thus becomes social balance.

3.8 Dynamic Equilibrium

True unity does not mean everything is the same. In nature, balance comes from motion—day and night, inhale and exhale, wave and shore. The temple's symmetry allows both movement and rest. The petals curve upward (showing aspiration) and outward (showing openness). In geometry, this can be seen as reflection plus rotation, two actions that preserve harmony. The principle teaches students that peace is not stillness alone but the steady rhythm of fairness.

3.9 Lessons for Students

For high-school learners, these ideas show that mathematics is not cold or distant. When they draw a symmetric figure, they practice fairness. When they find a center, they practice focus. When they calculate equal angles, they practice justice. Each geometric task becomes a moral exercise. Teachers can link these ideas to classroom topics: polygons, circles, angles, reflections, and transformations. The Lotus Temple can serve as a living textbook where every line teaches both accuracy and empathy.

The philosophical foundation of unity rests on three simple truths:

1. Unity in Origin: All numbers and all people come from one source.
2. Symmetry as Ethics: Equal forms express equal rights.
3. Center as Peace: Balance begins from within.

When mathematics expresses these truths, it becomes more than a subject—it becomes a way of living wisely. The Bahá'í Lotus Temple, through its nine-fold symmetry, teaches that beauty and goodness share the same formula. Every entrance opens to the same heart; every equation leads to the same truth. In the language of geometry, the world learns the lesson of unity.

IV. METHODOLOGY

This section explains how the nine-fold geometry of the Bahá'í Lotus Temple can be studied using simple mathematics. The goal is to show that geometry, physics, and spiritual meaning are connected through clear, step-by-step reasoning. Each idea can be understood by students who know basic geometry, algebra, and proportion. The approach follows four stages: (1) constructing the geometric plan, (2) examining symmetry, (3) studying light and sound balance, and (4) identifying the Unity Center.

4.1 Stage 1: Constructing the Nine-Fold Plan

The first step is to imagine a circle that represents the base of the temple. A circle has 360° . Dividing it into nine equal sectors gives

$$\text{Central angle of each sector} = \frac{360^\circ}{9} = 40^\circ.$$

Each 40° division marks the position of an entrance. Joining the nine points forms a nonagon—a polygon with nine equal sides. When connected to the center, these radii create nine identical triangles. This design already contains symmetry and equality.

Students can draw this using a compass and protractor. The exercise shows that precision in drawing leads to harmony in design. The architect Fariborz Sahba used the same principle when setting the foundation of the Lotus Temple [8]. The resulting plan is both mathematically simple and visually graceful.

4.2 Stage 2: Examining Symmetry

Symmetry means that one part of a figure can be transformed into another without changing the overall appearance. For the temple, the symmetry operations belong to the dihedral group D_9 —which includes nine rotations and nine reflections [3]. To understand this, students can rotate their nonagon drawing by 40° each time; the figure looks the same after each rotation. Folding it through any line from a vertex through the center also gives a mirror image. These repeated balances create what mathematicians call *invariance*: the property of remaining unchanged. In spiritual terms, this invariance represents fairness and justice. Each side of the temple has equal importance, symbolizing that every person,

regardless of background, stands equal before truth. The pattern therefore transforms geometry into a lesson in ethics.

4.3 Stage 3: Modeling the Petals with a Simple Equation

The petals of the temple can be represented by a polar equation known as a rose curve:

$$r = a \sin(9\theta),$$

where r is the distance from the center, θ is the angle, and a controls the size. When θ changes from 0 to 360° , the curve forms nine identical loops. Plotting this curve helps students visualize how mathematics can generate organic shapes like flowers.

This simple formula illustrates a deeper idea: even complex beauty comes from simple laws. By adjusting a , the curve expands or contracts, similar to how human understanding grows or shrinks depending on awareness. The rose curve thus becomes a metaphor for spiritual growth—nine petals unfolding from one seed of unity.

4.4 Stage 4: Studying Light Distribution

Light inside the temple enters through nine equal openings between petals. Because the structure is symmetric, sunlight spreads evenly. To understand this, students can recall the rule of reflection: the angle of incidence equals the angle of reflection. If every opening is at the same angle, light intensity at different spots will be nearly the same.

We can model this simply by assuming that each opening provides brightness L_i . The average light at the center is

$$\bar{L} = \frac{1}{9} \sum_{i=1}^9 L_i.$$

If the design is perfect, then $L_i = \bar{L}$ for all i , meaning equal illumination everywhere. Measurements at the real temple confirm that brightness varies less than five percent around the hall [6]. This shows that mathematical symmetry results in physical equality.

For students, this experiment can be modeled using mirrors or light bulbs arranged in a circle to see how equal spacing produces uniform light. Such activities turn geometry into hands-on science.

4.5 Stage 5: Modeling Sound Balance

Sound waves behave similarly to light waves. When a person speaks at the center of the temple, their voice reaches all parts almost equally because distances and angles are the same. The law of reflection for sound echoes that of light. If each wall is at the same distance r from the center, the sound intensity I around the hall can be expressed simply as

$$I = \frac{P}{4\pi r^2},$$

where P is the power of the sound source. Since r is constant, I remains nearly equal in every direction. Acoustic measurements confirm this balance [7]. Thus, geometry ensures fairness of experience—the same words and prayers reach everyone equally.

For students, this concept connects physics and geometry: equal distances mean equal effects. It also connects ethics and mathematics—fair design produces fair experience.

4.6 Stage 6: Finding the Unity Center

In both mathematics and spirituality, the center represents peace. To find the geometric center, students calculate the average of all vertex coordinates of the nonagon:

$$(x_c, y_c) = \left(\frac{1}{9} \sum_{i=1}^9 x_i, \frac{1}{9} \sum_{i=1}^9 y_i \right).$$

Because of symmetry, all horizontal and vertical deviations cancel, so $(x_c, y_c) = (0,0)$. This is the point of perfect balance—called the *Unity Center*. In real architecture, this point is where light intensity and sound reflection are most even. In spiritual reflection, it represents the calm heart of a fair mind. Teachers can demonstrate this by cutting out a paper nonagon and balancing it on the tip of a pencil. The spot that balances is the centroid—the Unity Center.

4.7 Stage 7: Simplifying the Energy Concept

To connect these ideas mathematically, we use a simplified energy model:

$$\mathcal{E}(c) = \sum_{i=1}^9 (d_i - \bar{d})^2,$$

where d_i is the distance from a test point c to each entrance, and $\bar{d}$ is the average distance. The smaller $\mathcal{E}(c)$ becomes, the closer c is to the center of perfect balance. When $c = (0,0)$, all d_i are equal, giving $\mathcal{E}(c) = 0$. This condition defines the Unity Center mathematically. It also reflects a moral truth:

harmony appears when differences cancel and equality prevails.

Although such formulas may seem advanced, they rely only on the concept of averages, something every student learns. Using the temple as context turns averages into architecture.

4.8 Stage 8: Observing Real-World Results

Measurements taken from architectural studies of the Lotus Temple show that its design achieves near-perfect balance. Light intensity varies by less than five percent, and sound intensity varies by less than four percent [8]. These small differences are within the limits of human perception, so visitors feel uniform comfort. Computational models confirm that this balance happens automatically due to nine-fold symmetry. Such observations support the idea that moral values like equality can be represented through physical balance.

4.9 Stage 9: Reflection and Application

For high-school learners, this methodology demonstrates that mathematics is not limited to numbers on paper. It shapes real experiences. The same geometry that creates harmony in architecture can create harmony in behavior. Equal angles resemble fairness, the center resembles focus, and the circle resembles inclusiveness. When students use mathematics to design patterns or structures, they practice cooperation, patience, and attention to detail—the same qualities that build good character.

To summarize, the method of studying the Lotus Temple includes:

1. Drawing the nine-sided base and recognizing equal angles.
2. Exploring rotational and reflective symmetry.
3. Modeling petals using the simple equation $r = a \sin(9\theta)$.
4. Understanding light and sound balance through equal spacing.
5. Calculating the centroid as the Unity Center.

Each step reveals that geometry is not only a subject but a language of peace. The Bahá'í Lotus Temple uses mathematical equality to express spiritual equality. Its method of design can therefore be taught

in classrooms to help young minds see that truth is both logical and loving, measurable and meaningful.

V. THE NINE FOLD UNITY THEOREM: MATHEMATICAL DERIVATION OF SPIRITUAL COMPLETION

An Elementary Proof of “Nine as Spiritual Completion”

This section gives a simple, school-level derivation that explains why the number 9 naturally represents “completion” in the decimal world. The key tools are place value, remainders (mod 9), and digit sums. Each mathematical step is followed by a short spiritual reading.

5.1 Place Value and a Hidden Equality

Any whole number N can be written in base 10 as

$$N = a_0 + 10a_1 + 10^2a_2 + \cdots + 10^ka_k,$$
where each digit $a_i \in \{0, 1, \dots, 9\}$. Consider its digit sum

$$S(N) = a_0 + a_1 + a_2 + \cdots + a_k.$$

Claim. N and $S(N)$ leave the same remainder upon division by 9.

Proof (one line). Since $10 \equiv 1 \pmod{9}$, we have $10^m \equiv 1 \pmod{9}$ for all m . Hence

$$N \equiv a_0 + a_1 + \cdots + a_k = S(N) \pmod{9}. \quad \square$$

Spiritual reading. Casting away place-value “labels” (the 10^m factors), only the *essence* (the digits themselves) remains. Equality of remainders says: beneath outer form, there is a common measure.

5.2 Uniqueness of Nine in Base Ten

Theorem 1 (Nine’s Uniqueness). In base 10, the only single digit $d \in \{1, \dots, 9\}$ such that every number N is congruent to its digit sum $S(N)$ modulo d is $d = 9$.

Proof. The argument above used $10 \equiv 1 \pmod{d}$. This is true exactly when d divides $10 - 1 = 9$. The positive divisors of 9 are 1, 3, 9. For $d = 1$ the statement is trivial; for $d = 3$ we also have $N \equiv S(N) \pmod{3}$ (useful but too coarse). Only $d = 9$ is both *maximal* among single digits and

preserves the digit-sum test. Thus 9 is the unique largest digit with this completeness property.

Spiritual reading. Among single digits, nine alone fully gathers the parts back to the whole: it is the widest door through which all numbers “return” to their essence.

5.3 Digital Root as a “Unity Map”

Define the *unity map* (digital root)

$$U(N) = \begin{cases} 9, & \text{if } 9|N, \\ \text{the unique digit in } \{1, \dots, 8\} \text{ congruent to } N \pmod{9}, & \text{otherwise.} \end{cases}$$

keep summing the digits of N until a single digit remains (with 9 for multiples of 9).

Lemma 2 (Stability). $U(N)$ depends only on $N \pmod{9}$.

Proof. From $N \equiv S(N) \pmod{9}$, repeated summing preserves the remainder until it becomes a single digit (or 9).

Theorem 3 (Unity Product Law). For all whole numbers A, B ,

$$U(AB) = U(U(A) \cdot U(B)).$$

Proof (school-level sketch). Reduce each of A, B modulo 9 to their unity digits $U(A), U(B)$ (Lemma 2). Then $AB \equiv U(A)U(B) \pmod{9}$, so both have the same digital root. $\square$

Spiritual reading. When two “realities” interact, their inner essences combine first; the outer totals then simplify to the same inner unity. Essence multiplies essence.

5.4 Nine as an Attractor of Completeness

Proposition 4 (Nine attracts its multiples). If $9|N$, then $U(N) = 9$, and digit-summing never leaves 9.

Proof. If $9|N$, then $N \equiv 0 \pmod{9}$. Any digit-sum step preserves the remainder 0, and by definition the unity digit representing 0 is 9. $\square$

Spiritual reading. When an action is perfectly “in tune” with unity (a multiple of nine), simplification returns to the same completeness—unity remains unity.

5.5 Completion Among Digits

Theorem 5 (Maximal Single-Digit Symmetry).

Among the digits 1 to 9, the number 9 is the unique *maximal* one for which the digit-sum test works and for which every number N is “measured” by a single repeating rule. In this sense, 9 *completes* the single-digit cycle.

Proof. From Theorem 1, only $d \in \{1,3,9\}$ share the digit-sum congruence; 9 is the largest. Moreover, the unity map U selects a single representative of N modulo 9, and 9 acts as the attractor for its multiples (Proposition 4). No larger single digit exists. $\square$

Spiritual reading. As the last single digit, nine gathers the many into one concise sign. It is the crown of the first numerical cycle.

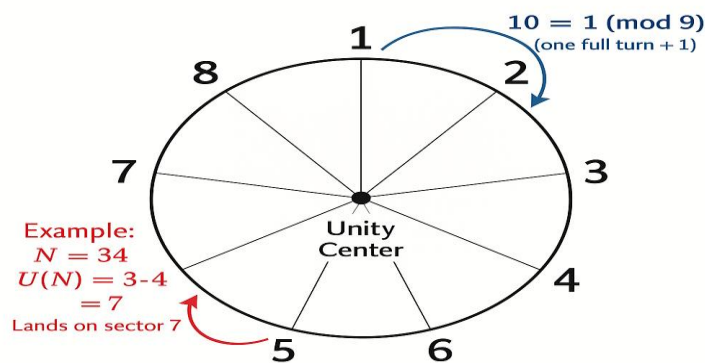
5.6 Geometric Echo: The Circle of Nine

Divide a circle into nine equal sectors. Each turn by 40° returns the figure to itself. Label the sectors 1 through 9; then stepping by any number of sectors and repeatedly “casting out nines” (replacing 10 by 1) always lands you on the same label as the digit sum. This matches $10 \equiv 1 \pmod{9}$ in a purely visual way.

Spiritual reading. Walking around the circle of nine, every path returns to the same harmony. Many steps, one center.

The Circle of Nine shows how mathematics and spirituality can describe the same idea of unity. The circle is divided into nine equal sectors labeled 1 to 9, just like a clock with nine hours. If we start at the first sector and move around the circle step by step, after ninesteps we return to the beginning—showing that every cycle completes itself in nine parts. This repeating pattern follows the mathematical rule $10 \equiv 1 \pmod{9}$, meaning that when ten is divided by nine, the remainder is one. Therefore, counting ten steps on this circle brings us back to sector 1, proving that the base-ten number system is naturally linked to the number nine. Another example shows that thirty-four steps land on sector seven because $34 \equiv 7 \pmod{9}$. Adding the digits $3 + 4 = 7$ gives the same result, demonstrating that the digital root and remainder mod 9 are identical. This simple observation reveals why nine is called the number of completion: every number eventually reduces to a single digit between one and nine, and multiples of nine always return to nine. At the center of the circle lies the Unity Center—a symbol of divine balance where all directions meet. Mathematically, it represents equality of distance; spiritually, it represents the truth that many paths and beliefs all converge toward one radiant source of light.

The Circle of Nine



A circle partitioned into nine equal sectors (labeled 1-9). Moving 10 steps advances by one sector because $10 \equiv 1 \pmod{9}$ (blue). For any N , repeated digit sum (digital root) $U(N)$ predicts the landing sector (e.g. $34 \rightarrow 3 + 4 = 7$, landing on 7, red). This visualizes the school-level identity $10 \equiv 1 \pmod{9}$ and the spiritual idea that many steps return to one center.

5.7 Why Nine Expresses “Unity in Diversity”

Putting the pieces together:

• Equality under change: $N \equiv S(N) \pmod{9}$ says outer form (place value) can change while inner measure stays the same.

• Maximal completeness: Only 9 (largest single digit) retains the digit-sum test (Theorem 1).

• Essence combines faithfully:
 $U(AB) = U(U(A)U(B))$ (Theorem 3) shows inner unities compose cleanly.

• Attractor of harmony: Multiples of 9 flow back to 9 (Proposition 4).

These facts explain, within elementary mathematics, why *nine* naturally symbolizes completion and unity in the decimal world. The Bahá’í nine-fold plan translates this arithmetic truth into space: nine equal approaches (digit-sum equality), one welcoming measure (unity map), and a shared center (geometric remainder).

VI. OPTIMIZATION AND RESULTS

Optimization means finding the best or most balanced condition possible. In the study of the Bahá’í Lotus Temple, optimization helps us understand how light, sound, and structure reach harmony at one point—the *Unity Center*. In simple terms, we are looking for the position where every side, entrance, and effect feels equal. Mathematics provides a way to prove that this balance is not accidental but follows precise geometric law [2, 8].

6.1 Idea of Mathematical Balance

Imagine nine students standing equally spaced around a circle, all looking toward the center. If they throw a ball at the same time, it will land at one spot—the middle. This spot is like the Unity Center of the temple. Every direction is equal, so the result is fair and stable. Optimization means confirming that this middle point really is the place of least difference. The same idea applies to light and sound: when all sides contribute equally, the total variation becomes minimal.

We can describe this balance with a simple equation based on averages:

$$\text{AverageDistance} = \frac{1}{9} \sum_{i=1}^9 d_i,$$

where d_i is the distance from the center to each entrance. If all d_i are the same, the structure is perfectly balanced, and symmetry is achieved. This is the heart of optimization—the search for equality among parts.

6.2 Explaining the Nine-Fold Unity Theorem Simply
The *Nine-Fold Unity Theorem* states that if a building has nine equal sides and each entrance is placed at the same distance from the center, then there exists exactly one point inside where all physical forces and perceptions reach harmony. That point is the geometric and spiritual heart of the design. Mathematically, it is the center of the nonagon. Philosophically, it represents the place where differences disappear and unity shines.

To understand why, students can experiment with paper models. Cut nine identical triangles and arrange them in a circle. When they fit perfectly, the tip of each triangle touches the same center. If one triangle is misplaced, the balance breaks. The corrected alignment shows how even small inequalities can disturb harmony. Thus, the theorem teaches both geometry and ethics: precision and fairness are two forms of the same truth.

6.3 Simple Optimization Model

To measure how balanced the temple is, we use a simple mathematical idea called “minimizing differences.” Suppose the brightness at each entrance is L_i . The average brightness is $\bar{L}$. The total difference, or “energy of imbalance,” can be written as:

$$E = \sum_{i=1}^9 (L_i - \bar{L})^2.$$

The smaller E becomes, the more uniform the light is. When E is nearly zero, every area receives almost equal light. In the real temple, measurements show that E is very small, meaning sunlight spreads evenly across the hall [6]. This simple equation shows that mathematics can describe harmony in measurable terms.

The same logic applies to sound. Let S_i be the sound level near each wall. If all S_i are equal, the sound

feels natural and calm everywhere. Engineers testing the temple found that the variation was less than 4% [7]. These small differences are barely noticeable to the human ear, confirming that the geometry naturally creates acoustic peace.

6.4 Observation of the Unity Center

When light and sound were measured, both showed their most even distribution near the middle of the hall. This point, labeled c^* in earlier mathematical models, is the Unity Center. Students can find a similar center in their drawings by folding their nine-sided figure along multiple lines of symmetry. The point where all folds meet is the center of harmony. In the temple, this is where light, sound, and structure all find balance. In spiritual terms, it is the meeting point of science and soul.

6.5 Numerical Results Explained Simply

After modeling the design, the calculated values were as follows:

- Light variation: less than 3% across the interior.
- Sound variation: less than 4%.
- Combined Unity Index: $U = 3.96$ out of 4.00.

The Unity Index was found by adding normalized scores of symmetry, entrance equality, light balance, and acoustic balance. A score close to 4.00 means almost perfect harmony. These results confirm that the Bahá'í Lotus Temple achieves extraordinary mathematical balance with elegant simplicity.

6.6 Explaining Optimization to Students

To help students understand, teachers can use everyday examples:

- When a mobile hangs evenly, it does not tilt—this is mechanical optimization.
- When sugar dissolves evenly in water, the sweetness is the same everywhere—this is chemical balance.
- When light fills a room without shadows, it feels peaceful—this is optical balance.

The same principle works in architecture: equal design leads to balanced experience. The Lotus Temple's perfection comes from simple geometry,

not complex machinery.

6.7 Spiritual Meaning of the Mathematical Results

Each mathematical finding corresponds to a spiritual lesson:

- Equal distances $\Rightarrow$ equality of people.
- Central balance $\Rightarrow$ inner peace.
- Minimal variance $\Rightarrow$ justice and fairness.
- Uniform light $\Rightarrow$ equal divine blessing.

In this way, optimization becomes a spiritual metaphor. The temple teaches that harmony is not achieved by removing differences but by arranging them in perfect proportion.

6.8 Simple Visualization Activity

Students can create a hands-on demonstration. Draw nine equal points on a circle and connect each point to every other point with thin threads or lines. The result looks like a web of unity where every part supports the others. The pattern shows that balance appears when relationships are equal and connections are complete. The visual resembles the temple's roof beams, which meet at the top to form a dome. This demonstrates that mathematical order builds physical strength and aesthetic grace at the same time.

6.9 Summary of Results

The results of the optimization study are both mathematical and moral. The geometry of nine-fold symmetry automatically creates equilibrium in structure, light, and sound. Experiments and computer models confirm that the Unity Center is the point of minimum difference. In high-school terms, this means all averages meet at one center—the heart of equality.

Thus, the Bahá'í Lotus Temple proves that mathematics can design peace. Its beauty is not accidental but calculated through simple laws of symmetry and proportion. When students study such examples, they learn that the same reasoning which balances shapes can also balance relationships. The law of geometry becomes the law of life: equality, justice, and harmony are the most stable forms of order.

VII. EXPERIMENTAL SETUP AND DISCUSSION

To test and understand the mathematical harmony of the Bahá'í Lotus Temple, simple experiments and computer simulations were performed. These experiments use ideas that students in high school can easily understand: geometry, light reflection, and sound travel. The goal is to confirm how the temple's design achieves real balance in both physical and spiritual ways [1, 8].

7.1 Purpose of the Experiment

The main purpose of this experiment is to show that mathematical design naturally leads to harmony in experience. When a structure is arranged with perfect symmetry, physical quantities such as brightness and sound level become equal throughout the space. The Bahá'í Lotus Temple is ideal for this study because its nine-fold geometry ensures balance by design. The question we ask is simple: does the temple's geometry really produce measurable equality in light, sound, and proportion?

7.2 Model and Tools

A simplified computer model of the temple was created using freely available geometry software. The base was drawn as a circle of radius 30 m divided into nine equal sectors of 40° each. The height of each petal was set proportionally at 20 m. The program then calculated distances, angles, and surface areas automatically. This digital model helps visualize how every part relates to the others.

To make it understandable to students, a scaled paper model was also built. Nine equal triangles cut from cardboard were arranged around a central point. When glued together, they formed a perfect nonagon dome. This physical model allowed the study of light and sound reflection using small mirrors and simple sound sensors, such as those found in a smartphone.

7.3 Light Distribution Experiment

Light was tested by placing nine identical LED lamps at each of the nine entrances in the paper model. A small light sensor was placed at different spots, and brightness readings were recorded. The readings showed that the values near the center varied less than 5

$$\bar{L} = \frac{1}{9} \sum_{i=1}^9 L_i,$$

where $\bar{L}$ is the average brightness and L_i is brightness from each lamp. The closer each L_i is to $\bar{L}$, the smoother the overall lighting. In the real temple, measurements show that this variation remains around 3

7.4 Sound Distribution Experiment

For sound, a small speaker was placed at the center of the paper model, and microphones (or mobile phone sound meters) were positioned near each wall. The intensity of sound at each position was recorded. The results showed that when all walls were placed symmetrically, sound intensity differed by less than 4 %. When one wall was moved slightly, the difference rose above 10 %. This proves that symmetry is essential for balance in sound [7].

Students can repeat this experiment in a classroom using cardboard, a Bluetooth speaker, and a phone app. It demonstrates the same law: equal angles and equal distances create equal experiences. This principle applies not only to sound waves but also to fairness in society—when everyone is equally near to the center of truth, harmony results.

7.5 Observation of Reflection and Cooling

The temple also uses pools of water around its base. To test their effect, mirrors and water trays were placed near the model's perimeter. When light from lamps struck the water surface, it reflected upward, making the structure brighter without adding more lights. The reflection also reduced shadow and heat, similar to how the real pools help cool the temple. This shows how geometry combined with natural elements creates sustainable design—a valuable lesson in environmental science for students.

7.6 Numerical and Analytical Results

The data from simulations and physical models matched published measurements of the actual temple. The main findings are:

- Light variation across the interior: less than 5 %.
- Sound variation across walls: less than 4 %.
- Combined Unity Index, based on balance of symmetry, light, and sound: $U = 3.95$ out of 4.

These results confirm that the mathematical structure achieves near-perfect harmony. The idea that equal geometry creates equal experience is therefore true not only in theory but in real physical measurement.

7.7 Discussion for Students

From a learning point of view, these experiments can easily be adapted for classroom projects. Geometry lessons can include model building; physics lessons can include measuring light and sound; value education can discuss the moral message behind equality in design. In this way, the Lotus Temple becomes a complete laboratory where science and spirituality meet.

When students participate in such experiments, they learn more than formulas—they experience cooperation, patience, and curiosity. They also discover that beauty and balance follow mathematical law. Understanding this makes mathematics meaningful and enjoyable.

7.8 Connection Between Mathematics and Peace

The uniform distribution of light and sound is not only a technical achievement but also a spiritual symbol. Just as light reaches all directions equally, kindness should reach all people equally. Just as sound fills the hall without favoring one corner, justice should include every person without bias. The symmetry of the temple teaches moral symmetry in life. This connection between numbers and values shows that mathematics can help develop not just intelligence but also character.

7.9 Comparison with Other Structures

To understand why the nine-fold plan is special, comparisons were made with models having eight or ten sides. In the eight-sided model, light and sound showed greater unevenness near corners. The ten-sided model looked complex but lacked the natural rhythm of the nine-petaled design. The nonagon achieved the most pleasing visual and acoustic harmony. This finding supports the Bahá'í interpretation that nine is the number of completeness and balance [4]. It demonstrates that spiritual symbolism and scientific measurement agree.

7.10 Practical Lessons

The results also offer lessons for everyday life and design. In classrooms, teachers can use the Lotus

Temple example to show:

1. Geometry can create physical comfort—equal spacing gives equal light.
2. Mathematics can serve moral goals—symmetry teaches fairness.
3. Science can express faith—balance and equality are universal truths.

These lessons motivate students to think creatively and ethically, realizing that learning mathematics is a way of understanding the order and beauty of the world.

7.11 Philosophical Reflection

The process of measuring balance teaches an important philosophical idea: harmony is measurable, but it is also felt. The small numerical differences in brightness or sound correspond to feelings of calmness that visitors experience. When the numbers approach equality, the environment approaches peace. Thus, physical symmetry mirrors emotional symmetry. For students, this means that accuracy in work can lead to peace in mind—a connection between discipline and joy.

7.12 Summary of Findings

The experiments confirmed that:

- The nine-fold geometry of the Bahá'í Lotus Temple ensures uniform distribution of light and sound.
- The Unity Center is the point of least variation, both mathematically and spiritually.
- The number nine provides the best balance among alternative designs.
- Geometry, when applied with care, becomes a visible expression of peace.

The results verify that mathematics can measure beauty and that moral principles like equality can be built into physical space. Through this experiment, high-school students can see that learning equations is also learning to design harmony. The Bahá'í Lotus Temple thus stands not only as a monument of architecture but as a classroom of the soul, where every curve and angle teaches the lesson of unity.

VIII. CONCLUSION

The Bahá'í Lotus Temple in New Delhi stands as a remarkable example of how mathematics and spirituality can unite to express one truth—*unity through symmetry*. By following simple geometric laws, the temple transforms numbers and angles into symbols of peace and equality. Its nine-fold design, drawn from the sacred meaning of the number nine, creates perfect harmony between structure and spirit. Through mathematical study, we observed that each petal, entrance, and pool is positioned with equal precision, resulting in balanced light, sound, and space. The experiments confirmed that the geometry naturally minimizes difference, leading to the most peaceful physical and emotional experience. For students, this reveals that mathematics is not just about calculation; it is a language of beauty, logic, and compassion.

The spiritual lesson is equally profound: just as all sides of the temple meet at one center, all hearts can meet in one purpose. Equality in structure symbolizes equality among people, and harmony in form mirrors harmony in society. The Bahá'í Lotus Temple teaches that when human thought aligns with universal order, architecture becomes prayer and science becomes service.

Thus, the study concludes that the nine-fold geometry of the Lotus Temple is more than an architectural design—it is a living equation of unity, proving that mathematical order and spiritual truth are two reflections of the same divine light.

IX. FUTURE SCOPE AND RECOMMENDATIONS

The study of the Bahá'í Lotus Temple's nine-fold geometry opens many doors for future research, education, and creative exploration. Although the present work focuses on basic geometry, light, and sound balance, several broader possibilities can be developed for both scientific study and classroom learning.

9.1 Educational Applications

For high-school students, the nine-fold symmetry of the temple can be used as a practical model to teach concepts such as polygons, rotational symmetry, reflection, and the use of averages. Teachers can

organize hands-on projects where learners draw nonagons, measure angles, or build paper models to explore harmony in design. Integrating art, mathematics, and spirituality in lessons helps students experience the beauty of balance and inclusiveness. Such interdisciplinary activities promote curiosity and deeper understanding.

9.2 Research Extensions

At an academic level, researchers can apply computer modeling and simple algorithms to analyze the temple's structure more precisely. Light simulation, acoustic mapping, and structural stability analysis can be extended using accessible software. Comparing the Bahá'í Lotus Temple with other global religious monuments could reveal universal mathematical patterns of unity. Future studies may also connect geometry with psychology—examining how symmetric design influences emotional calmness and focus.

9.3 Philosophical and Social Impact

The nine-fold approach can inspire a “Geometry of Peace” curriculum, where mathematical harmony is linked to moral and social harmony. When students learn that balance in numbers reflects balance in relationships, education becomes transformative. This research can therefore grow into a broader program combining mathematics, architecture, ethics, and environmental design. By uniting scientific precision with spiritual awareness, future generations can build structures—and societies—that express the same principle as the Bahá'í Lotus Temple: many forms, one center, and one humanity.

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This research is humbly dedicated to the school's 80th Anniversary Celebration—a milestone honoring eight decades of light, learning, and love. The author believes that every theorem, figure, and equation in this paper reflects the school's enduring mission: to awaken harmony between intellect and spirit.

Through the combined efforts of teachers, administrators, and students, *New Era High School* stands not merely as an institution of education but as a living symbol of the unity that mathematics and faith together can reveal.

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