# On the parallel postulate

Muthusamy Sivasubramanian

Department of Mathematics, Dr. Mahalingam College of Engineering & Technology
Pollachi, Tamil Nadu-642003, India
Email: profpk49@yahoo.com

**Abstract:** Before the origin of number theory the primitive people applied geometrical figures nearly 70,000 (seventy thousand) years ago. Still it is found in African rock caves. The exact period of the birth of geometry is not known. The propositions and constructions of classical geometry nearly dates back 2000 B.C. In around 300 B.C., Euclid of Alexandria city in Greek complied the then existing propositions and wrote the first scientific text which is known as Elements. Euclid formulated 468 theorems based on five postulates introduced by Euclid. Among those postulates which are also known as axioms, the parallel postulate was/is a much disputed one. Euclid assumed the first four postulates as obvious. But he tried his best and trotted his mind to prove the fifth postulate as a theorem. Unfortunately he was unsuccessful in his efforts. After Euclid the famous mathematical stalwarts like Proclus, Playfair's, Ptolemy, Proclus, Al-Gauhary, Al-Haytham, Omargayam, Nasir-ad-din-at-tusi, Sacchari, Lambert, Clavius, Clairaut's, Farkas**,** Legender, Abuali–al-Haytham, John Walli, Hilbert, Birkhoff and Decardes, Gauss, Janos Bolyai, Lobachevsky, Riemann, Beltramy, Gayley, Klein, Poincare and others worked on this pronblem. Bu their research not yielded the relevant proof. In this study, the author repeated the previous history and recorded the following revolutionary result: Any three points are co-cyclic which is an equivalent statement to the fifth Euclidean postulate. [Researcher. 2009; 1(5):58-61]. (ISSN: 1553-9865).

**Keywords**: Euclid, elements, postulates, Non-Euclidean geometries

## 1. Introduction

In Elements, Euclid introduced and applied the following five postulates.

1. To draw a straight line from one point to another point.
2. To produce a finite straight line continuously in a straight line.
3. To describe a circle with any center and radius.
4. That all right angles equal to one another.
5. If a straight line falling on two straight lines makes the interior angles on the same side than two right angles, if produced indefinitely meet on the side on which are the angles less than the two right angles.

The studies devoted to the fifth postulate resulted in the invention of a number of equivalent propositions mentioned below:

1. Through a point not on a given line there passes not more than one parallel to the line.
2. Two lines that are parallel to the same line are parallel to each other.
3. A line that meets one of two parallels also meets the other.
4. If two parallels are cut by a transversal, the alternate interior angles are equal.
5. There exists a triangle whose angle sum is a straight angle.
6. Parallel lines are equidistant from one another.
7. There exist two parallel lines whose distance apart never exceeds some finite value.
8. Similar triangles exist which are not congruent.
9. Any three points are collinear
10. Any three points are co-cyclic.
11. Through any point within any angle a line can be drawn which meets both sides of the angles.
12. There exists a quadrilateral whose angle sum is two straight angles.
13. Any two parallel lines can have a common perpendicular.
14. There exists a pair of straight lines everywhere equidistant from one another.
15. Two straight lines that intersect one another cannot be parallel to the third line.
16. There is no upper limit to the area of a triangle.
17. The sum of the angles is the same for every triangle.
18. There exists a quadrilateral of which all angles are right angles.
19. Phythacorean theorem.
20. There exists a pair of straight lines that are at constant distance from each other.
21. Given two parallel lines, any line that intersects one of them, also intersects the other.
22. If there is an acute angle such that a perpendicular drawn at every point on side will meet the other side also.

If one gives a proof for one of these 22 propositions, then Euclid fifth postulate holds. While their attempts to prove the parallel postulate, Gauss-Bolyai- Lobachevsky developed a new field of consistent model of non-Euclidean geometry which is called hyperbolic geometry. Riemann independently found his non-Euclidean geometry which is known as elliptic geometry. In non-Euclidean geometries the fifth postulate is not applied. Both these geometries are widely applied in quantum mechanics and general theory of relativity. In this work by locating the following undisputed proof for the parallel postulate the author politely proposed for the origin of a new field of mathematical science.

**2. Construction**

Draw an equilateral triangle ABC as shown in Figure1. Locate the mid points D, E and F of sides BC, CA and AB respectively. Join AD. Join BE contacting AD at O. Since points B and E lie on the opposite sides of AD, BE can meet AD. Please note that Euclid uses this principle. [1, prop. 10] Join C and O. And join F and O.

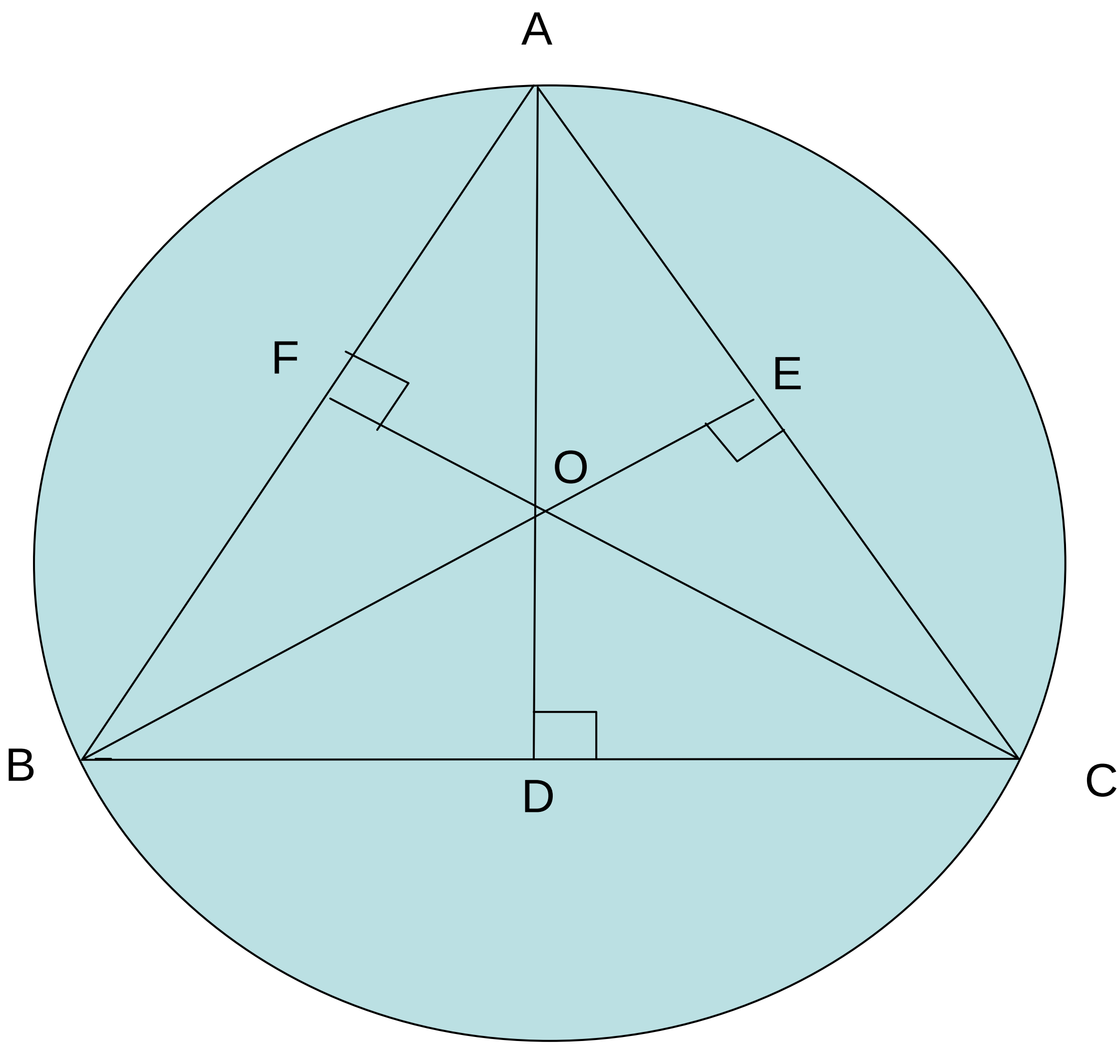


Figure 1. (Euclidean)

## 3. Result

Now by SSS correspondence triangles ADB, ADC, BEA and BEC are congruent [1, prop. 8]. So, the angles, ADB = ADC = BEA = BEC = 90 degrees. Now by SAS correspondence, triangles ODB, ODC, OEA and OEC are congruent. So, sides, OA = OB = OC. From this we obtain that points A, B and C are co-cyclic.

## 4. Discussion:

Soon after publishing the special theory of relativity in 1905, Einstein started thinking about how to incorporate gravity into his new relativistic framework. In 1907,beginning with a simple thought experiment involving an observer in free fall, he embarked on what would be an eight year search for a relativistic theory of gravity. After numerous detours and false starts, his work culminated in the November,1915 presentation to the Prussian Academy of science of what are now known as the Einstein Field Equations. These equations specify how the geometry of space and time is influenced by whatever matter is present, and from the core of Einstein's general theory of relativity. General theory of relativity is the non-Euclidean geometric theory of gravitation. It is the current description of gravitation in modern physics. It unifies special relativity and Newton's Universal law of gravitation, and describes gravity as a GEOMETRIC PROPERTY OF SPACE AND TIME OR SPACETIME. In particular, the curvature of space time is directly related to the four momentum (mass – energy and linear momentum) of whatever matter and radiation are present. The relation is specified by the Einstein's field equations, a system of non – linear partial differential equations which are very difficult to solve. The following are the consequences of GTR:

1. Gravitational time dilation and red shift
2. Light deflection and gravitational time delay
3. Gravitational waves
4. Orbital effects and the relativity of direction
5. Precession of apsides
6. Orbital decay
7. Gravitational lensing
8. The experimental verifications of black holes and other compact objects
9. Singularities
10. Global and quasi local quantities
11. Quantum field theory in curved space time
12. Advanced concepts such as Casual structure and Global geometry

Einstein achieved the above mentioned results by applying the principles of non – Euclidean geometries in his general theory of relativity. Without non-Euclidean concepts, the existence of general theory of relativity is an imagination. Relativity is only a body where as non-Euclidean geometries is life.

## 5. Conclusion

The famous French Empereror Naepoliean Bonaparte used to tell time and again: The word impossible must be taken away from dictionary. In this paper, the author proved Nepolian's quotation by obtaining a result for the parallel postulate. But there are many geometrical battles which are to be won. I politely request the research community to probe into the following unsolved classical problems:

1. Squaring the circle
2. Duplicating the cube
3. Trisection of the given general angle without using protractor
4. To draw a regular septagon

Till this date the human excellence explored many interesting results in fifth postulate field. Let us note that there is no such results in the above mentioned four problems. Mother Nature does not show any partiality to both any person and any natural phenomena. I am confident that our attempts and studies in theses classical problems will certainly lead us to wonderful and applicable results. The future investigations to be devoted into these problems will yield new results and give rise to new field of mathematical sciences. Present day physics is facing too many odds. Physicists are trotting their mind to solve the following challenging problems:

1. Quantum gravity
2. Understanding the nucleus
3. Fusion energy
4. Climate change
5. Turbulence
6. Glassy materials,
7. High-temperature superconductivity
8. Solar magnetism
9. Complexity
10. Consciousness
11. Are all the (measurable) dimensionless parameters that characterize the physical universe calculable in principle or are some merely determined by historical or quantum mechanical accident and uncalculable?
12. What is the lifetime of the proton and how do we understand it?
13. Is nature super symmetric, and if so, how is super symmetry broken?
14. Why does the universe appear to have one time and three space dimensions?

15 Why does the cosmological constant have the value that it has? Is it zero and is it really constant?
16. What are the fundamental degrees of freedom of M-theory (the theory whose low-energy limit is eleven-dimensional super gravity and that subsumes the five consistent superstring theories) and does the theory describe nature?
17. What is the resolution of the black hole information paradox?
18. What physics explains the enormous disparity between the gravitational scale and the typical mass scale of the elementary particles? In other words, why is gravity so much weaker than the other forces, like electromagnetism?
19. Can we quantitatively understand quark and gluon confinement in quantum chromo dynamics and the existence of a mass gap?

An outstanding invention in geometry will certainly help us to locate solutions for these unsolved problems. There will be NO impossibility provided one works hard. Yes, there is no substitute for hard work.

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**Correspondence to:**
Muthusamy Sivasubramanian
Department of Mathematics
Dr. Mahalingam College of Engineering and Technology, Pollachi
Tamilnadu – 642 003, INDIA
Mobile: 91 9095542186
Email: profpk49@yahoo.com

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