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ANNALS OF Mathematics and Physics OPEN ACCESS JOURNAL

ISSN: 2689-7636 DOI: https://dx.doi.org/10.17352/amp

Mini Review

Application of algebra to trisect an angle of 60 degree

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Received: 17 July, 2020
Accepted: 16 April, 2021
Published: 19 April, 2021

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Keywords: Algebra; Geometry; Angles; Trisection; Galois theory; Pierre wintzel and Lindemann

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Abstract

Trisection of an angle, doubling the cube, squaring the circle, to draw a regular septagon and to deduce Euclid V from Euclid I to IV are the famous classical impossibilities. Recently, Sivasubramanian and Kalimuthu jointly and independently found several solutions for the parallel postulate problem. Their findings have been published in various peer reviewed international journals. In this work, by applying linear algebraic equations the authors have attempted and trisected 60 degree without using a protractor.

Introduction

The origins of trisection of an angle began around 500 BC. Many many great mathematicians tried their best to solve this problem but miserably failed. Trisection of an angle and doubling the cube were proved impossible by Pierre Wintzel in 1837, although their impossibility was already known to Gauss in 1800. Squaring the circle problem was proved to be impossible by Lindemann in 1882 [1-7]. Both Wintzel and Lindemann applied the laws of Galois field theory and derived their results. It is to be noted that in quantum mechanics and super string theories the basics of abstract algebra particularly the laws of Lie groups are widely applied. It is a well known fact that the predictions of Einstein's special and general relativity theories have been experimentally established. But there are published experimental tests which challenge these theories. i.e. in some experiments these predictions do not hold [8-18].

Similarly, the authors findings also challenge abstract algebra. The authors never never and never question the consistent field of abstract algebra. But the authors firmly believe that the laws of abstract algebra can not fetter the angle trisection.

Construction

Construct an equilateral triangle ABC in Figure 1. On the extensions of AB and AC, make BD=DE=AB and AC=CE=EF respectively. Join B and F & D and F. Bisect BD at G. Join G and F. With centre C radius CB describe an arc cutting BF at H. Join C and H and produce it till it meets EF at I and GF at J.

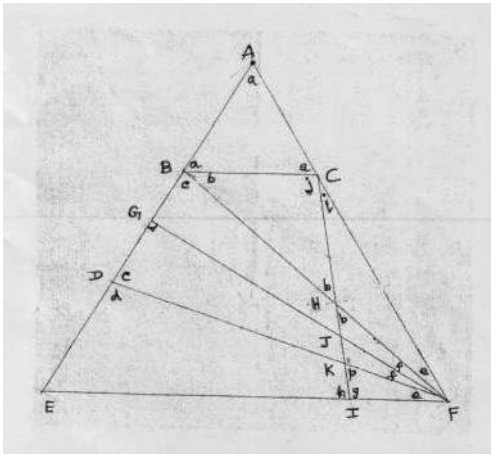

Figure 1: Construct an equilateral triangle.

In triangles ABC and AEF all the sides are equal and all the angles are equal. In triangle BCH, since BC and HC are equal, the base angles are equal. By SAS correspondence triangles AGF and EGF are congruent. So, the angle at G is 90 degree. By SAS correspondence triangles BGF and DGF are congruent. So, angles GBF and GDF are equal, and angles BFG and DFG are equal. By SAS correspondence triangles ABF and EDF are congruent. So, angles AFB and EFD are equal, and angles ABF

Citation: Sivasubramanian M, Kalimuthu S (2021) Application of algebra to trisect an angle of 60 degree. Ann Math Phys 4(1): 013-015.
DOI: https://dx.doi.org/10.17352/amp.000020

and EDF are equal. (1)

Let the sum of the interior angles of all Euclidean triangles is equal to 180 degrees. (2)

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From the above constructions,

b + c = j + i (3)

a + b = d (4)

2e + 2f = a (5)

In triangle IFC,

Using (5) in RHS,

In triangles BHC and IHF,

Using (6) in RHS,

In triangle CHF,

Equating (7) and (8),

In triangle CIF,

Assuming (1),

Adding the above two,

Using (6) in LHS,

a + j = 2e + 2f + g

j = g (6)

b + j = g +2e + 2f

b = e + 2f (7)

b = e + i (8)

i = 2f (9)

h = 4f + 2e by using (9)

2b + j = 2c + 2f

2b + j +h = 6f + 2e + 2c

180 degree + 2b = 6f + 2e +c (10)

Let us apply mathematical induction in (10).

Put e = 2f (11)

So, (10) becomes,

In triangle BCH,

Using (11b) in (11a),

2b + d = 10f + c (11a)

2b= 180 degree – j. (11b)

180 degree + d = 10f + c + j (12)

In triangle BGF, c+ f = 90 degree.

Applying this in (12), 90 degree + d = 9f + j (13)

From straight angles at B and D, d = a + b. Putting this in (13),

90 degree + a + b = 9f + j (14)

Substituting (5) in (14),

Using (11) in (15)

90 degree + 2e + 2f +b = 9f + j (15)

90 degree + 6f + b = 9f + j

i.e. 90 degree+ b = 3f + j (16)

Using (12) in (16),

Applying (9) in (17),

b + c = 2f + j (17)

b + c = j + i (18)

So, if we put e = 2f in (10), we yield (3) and there is no contradiction. In other words equation (3) can be deduced by replacing e by 2f in equation (10). So, e = 2f is the acceptable solution.

Applying e = 2f at angle c, 3e = 60 degrees. So, e is 20 degree.

Discussion

For trial measuring angle e, 2f and i, we get that e=2f=i=20 degree. Describing an arc with center H and radius HC, it moves through F. So, e = 20 degree is consistent. In this work, we have not introduced or assumed any conjecture or hypothesis. Only we have applied one of the fundamental operations of number theory. (i.e. addition). So, beyond any doubt e = 2f = 20 degree is consistent.

Conclusion

The authors attempts will open the further attempts which may explore new and fascinating results.

Acknowledgement

The authors are very grateful to the late professor Palaniappan Kaliappan, Department of Mathematics, Nallamuthu Gounder Mahalingam College, Pollachi, Tamilnadu-642001 India for introducing and encouraging the authors to work on this famous problem. The authors also whole heartedly thank Arutchelvar Padma Bhoosan Dr. N. Mahalingam Esquired Chairman, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamilnadu-642003, India for his kind encouragement and magnanimous monetary support for the preparation of this work.

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DOI: https://dx.doi.org/10.17352/amp.000020

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