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THE NEW THEORY OF THE ONENESS OF SQUARE AND CIRCLE

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ABSTRACT

Originally, Pi constant was understood as the ratio of circumference of a circle to its diameter. As the length of the circumference could not be measured due to its curvature, Exhaustion method was adopted for many centuries, where in, regular polygon are inscribed in a circle and also circumscribed about a circle. The lengths of the perimeter of the polygons is attributed to the circumference of the circle, applying the concept of limit. From 1450 AD onwards Infinite series has been the mode of computation of Pi. In this paper a new approach is adopted and Pi value derived, going back again, to the pre-1450 period of geometrical approach.

KEYWORDS: Algebraic number, area, circle, circumference, diagonal, diameter, length, rectangle, side, square.

INTRODUCTION

This paper stands on the new theory of the **oneness** of square and circle. The length of the circumference πd of the inscribed circle, is applied to the different line segments such as, side and diagonal of the square. The side is independent of π, whereas the diagonal is **not** independent of π. This has made possible, to derive, the real π value.

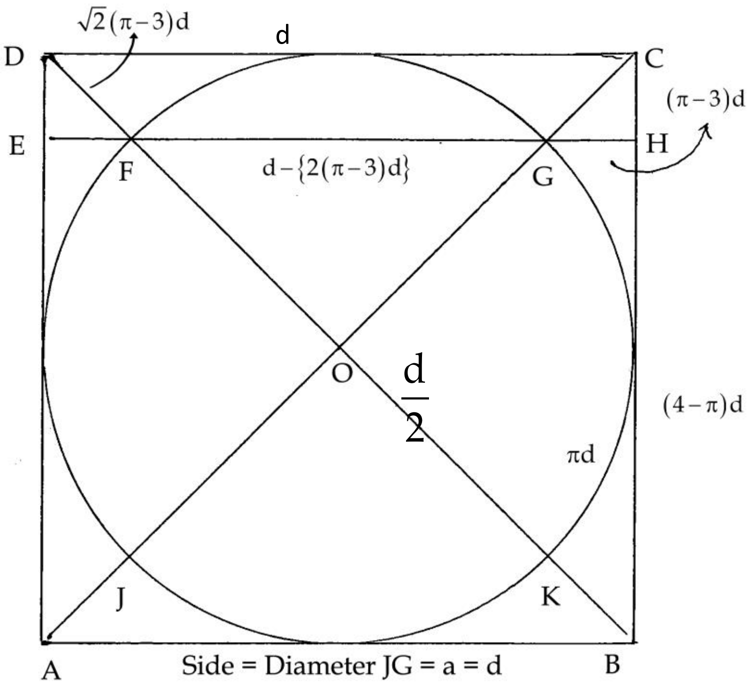
PROCEDURE

1. Square : ABCD
2. Circle : Side of the square = Diameter of the circle = a = d
3. Diagonal = $\sqrt{2}d$
4. Triangle FOG : OF = OG = $\frac{d}{2}$

   Hypotenuse = FG = OF x $\sqrt{2}$ = $\sqrt{2}\times\frac{d}{2}$ = $\frac{\sqrt{2}d}{2}$
5. Parallel side = EH = a = d
6. DE = EF = GH = CH = $\frac{EH-FG}{2}$ = $\left(d-\frac{\sqrt{2}d}{2}\right)\frac{1}{2} = \left(\frac{2-\sqrt{2}}{4}\right)d$

Part-II

7. **Let us suppose, CH = (π – 3) d,** then the other line segments of the square get the following, in terms of π, when the circumference is πd (Proof S.No. 21)
8. FG = d – $\{2(\pi-3)d\}$ = $\frac{\sqrt{2}d}{2}$
9. Corner lengths AJ, CG, KB, and DF = $\sqrt{2}(\pi-3)d = \left(\frac{\sqrt{2}-1}{2}\right)d$
10. JG = diameter = d



d

11. CH = $(\pi-3)d=\left(\dfrac{2-\sqrt{2}}{4}\right)d$
12. HB = $(4-\pi)d=\left(\dfrac{2+\sqrt{2}}{4}\right)d$

Part-III

13. Circumference = $\pi d = 3d + (\pi-3)d$
14. Sides of the ABCD square are independent of π
15. Side EH = EF + FG + GH = d = $$(\pi-3)d+d-\{2(\pi-3)d\}+(\pi-3)d=d$$
16. Side BC = CH + HB = d = $(\pi - 3)d + (4 - \pi)d = d$
17. Perimeter of the ABCD square = 4d
    = BA + AD + DC + CH + HB = 4d
    = d + d + d + $(\pi - 3)d + (4-\pi)d$ = 4d
18. The diagonals of ABCD square, are not independent of π. Hence, the derivation of the real π value has become possible.
19. Diagonal AC = $\sqrt{2}d$
    = Corner length + diameter + corner length
    = AJ + JG + GC = $\sqrt{2}d$
    = $\sqrt{2}(\pi-3)d+d+\sqrt{2}(\pi-3)d = \sqrt{2}d$
    = $2\sqrt{2}(\pi-3)d+d=\sqrt{2}d$

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$$\therefore \pi = \frac{14 - \sqrt{2}}{4}$$

20. It is clear, therefore, that the assumption that CH length is equal to $(\pi - 3)d$ of $3d + (\pi - 3)d$ of circumference in S.No. 7 is real.

21. **Proof for CH = (π – 3)d and HB = (4 – π)d**

The length of the circumference of the **inscribed** circle is πd. Circle is inside the square.

The perimeter of the ABCD square is 4a = 4d

The length of the circumference is thus shorter than the length of the perimeter of the ABCD square. And hence, **to equalize** both, let us do the following:

$\pi d + x = 4d$,
where x is unknown
$x = 4d - \pi d = (4 - \pi)d$

We know, that the BC side of the ABCD square is equal to a = d, then,

Side – x = y
= d – x = y
$y = d - (4d - \pi d)$, where $x = (4 - \pi)d$
So, $y = (\pi - 3)d$

The BC side of ABCD square is equal to d, and is divided **naturally** into CH and HB line segments. In the above process too, we have two values, one for x and another one for y.

Further, one line segment is longer and another line segment is shorter. In the above process x line segment is longer and y line segment is shorter. So, we can **match** x with HB longer line segment, and y with CH shorter line segment.

$HB = x = (4 - \pi)\, d$ and
$CH = y = (\pi - 3)\, d$

SECOND PROOF IN TERMS OF AREA

ABCD square can be divided into two rectangles.
(1) DEHC and (2) EABH

1. **Area of DEHC rectangle**

$$\text{DE side} = \left(\frac{2 - \sqrt{2}}{4}\right) d$$

EH side = d

$$DE \times EH = \left(\frac{2 - \sqrt{2}}{4}\right) d \times d = \left(\frac{2 - \sqrt{2}}{4}\right) d^2$$

2. **Area of EABH rectangle**

$$\text{EA side} = \left(\frac{2 + \sqrt{2}}{4}\right) d$$

AB side = d

$$EA \times AB = \left(\frac{2 + \sqrt{2}}{4}\right) d \times d = \left(\frac{2 + \sqrt{2}}{4}\right) d^2$$

3. **In terms of π**

Area of DEHC rectangle $= \left(\frac{32\pi-96}{32}\right)d^2$

Area of EABH rectangle = $\left(\frac{128-32\pi}{32}\right)d^2$

Area of ABCD square = $\left(\frac{32\pi-96}{32}\right)d^2 + \left(\frac{128-32\pi}{32}\right)d^2 = d^2$

Finally, to sum up

4. **By length, CH**

$$CH = (\pi-3)d = \left(\frac{2-\sqrt{2}}{4}\right)d \qquad \therefore \pi = \frac{14-\sqrt{2}}{4}$$

By area, rectangle DEHC

$$\left(\frac{32\pi-96}{32}\right)d^2 = \left(\frac{2-\sqrt{2}}{4}\right)d^2 \qquad \therefore \pi = \frac{14-\sqrt{2}}{4}$$

5. **By length, HB**

$$HB = (4-\pi)d = \left(\frac{2+\sqrt{2}}{4}\right)d \qquad \therefore \pi = \frac{14-\sqrt{2}}{4}$$

By area, rectangle EABH

$$\left(\frac{128-32\pi}{32}\right)d^2 = \left(\frac{2+\sqrt{2}}{4}\right)d^2 \qquad \therefore \pi = \frac{14-\sqrt{2}}{4}$$

Either in terms of length or in terms of extent of area, one π value comes ultimately, hence, this is the **true** π value. If π is equal to the official value 3.14159265358, both length and area of rectangles get nullified or cancelled. So, any value for π in between 3 and 4 appears correct, because the length of the side, BC of ABCD square is **independent of π, but not, when the side is, in its two subdivisions into, CH and HB.**

By length, d=1

$(\pi-3)d$	= (3.14159265358-3) × 1	0.14159265358
$(4-\pi)d$	= (4-3.14159265358) × 1	0.85840734642
		1.00000000000

By area, it will be also the same

The sub division of the side of the square gives, π as $\frac{14-\sqrt{2}}{4}$ only.

By length or by area, $\frac{14-\sqrt{2}}{4}$ comes out, as π value. So, $CH = (\pi-3)d$ is correct and is proved in both the ways (= length and area) of the ABCD square.

Further, the diagonal $\sqrt{2}d$ of the superscribed square of S.No. 19 and the circumference πd of its inscribed circle, are same; and may be the diagonal is a **straight line**, and the circle is a **curvature**.

SECOND PROOF BY AREA – BACKGROUND WORK

I thank you very much for your critical study of **August 3rd Method to derive Pi value.** One **Professor Johan Viaene** of Belgium has helped to understand the second proof much better with his formula. The second proof is based on the following diagram where a circle is inscribed in a square and the composite construction is divided into two different segments, called S_1 and S_2, and whose areas, can be derived, in terms of π constant, **spontaneously,** as the inscribed circle's area has to be calculated using $\frac{\pi d^2}{4}$.

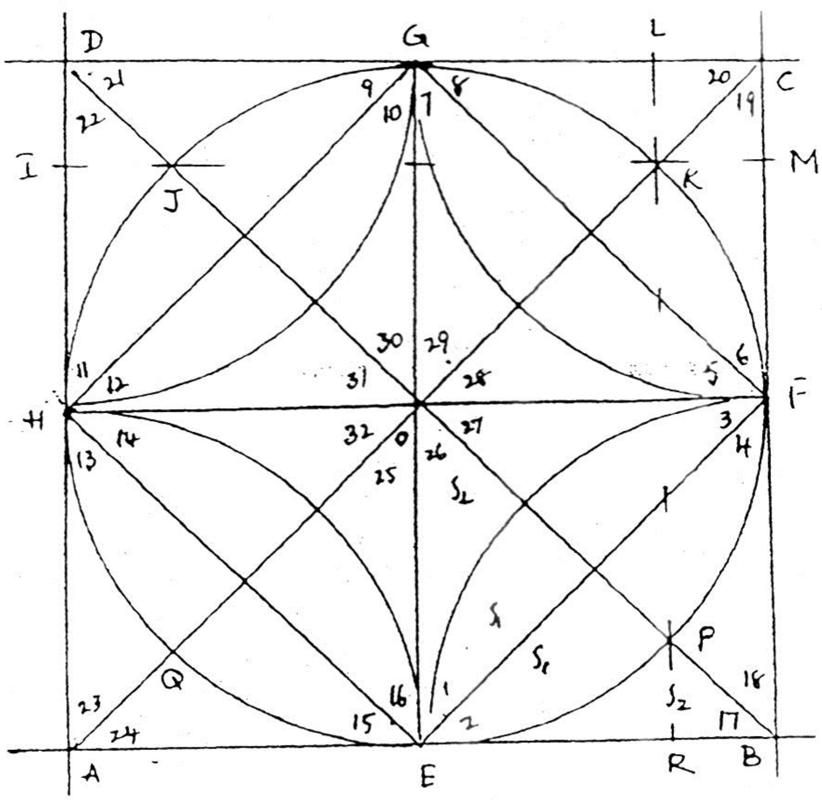
S_1 segment = $\frac{a^2}{32}(\pi - 2)$

and

S_2 segment = $\frac{a^2}{32}(4 - \pi)$

where, side = diameter = a = d

Some Professors have disagreed with this work, saying, the first proof, where line segments, such as side of the square and diagonal of the square, equating in terms of π constant, **is wrong**.



First diagram

Construction procedure

Draw a circle with center '0' and radius *a*/2. Diameter is 'a'. Draw 4 equidistant tangents on the circle. They intersect at A, B, C and D resulting in ABCD square. The side of the square is also equal to diameter 'a'. Draw two diagonals. E, F, G and H are the mid points of four sides. Join EG, FH, EF, FG, GH and HE. Draw four arcs with radius *a*/2 and with centres A, B, C and D. Now the circle square composite system is divided into 32 segments and numbered

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them 1 to 32. 1 to 16 are of one dimension called S_1 segments and 17 to 32 are of different dimension called S_2 segments. **Circle has 16S_1 and 8S_2 segments.**

Derivation of Formulae for the calculation of S_1 and S_2 segmental areas.

$16\,S_1 + 16\,S_2 = a^2$ = area of the Square … Eq. (1)

$16\,S_1 + 8\,S_2 = \frac{\pi a^2}{4}$ = area of the Circle … Eq. (2)

………………..…………………

$(1) - (2) \Rightarrow \quad 8S_2 = a^2 - \frac{\pi a^2}{4} = \frac{4a^2 - \pi a^2}{4} =$

$= \frac{(4-\pi)a^2}{32} = \frac{a^2}{32}(4-\pi)$

$S_2 = \frac{a^2}{32}(4-\pi)$

$(2) \times 2 \Rightarrow 32\,S_1 + 16\,S_2 = \frac{2\pi a^2}{4}$ … Eq. (3)

$16\,S_1 + 16\,S_2 = a^2$ … Eq. (1)

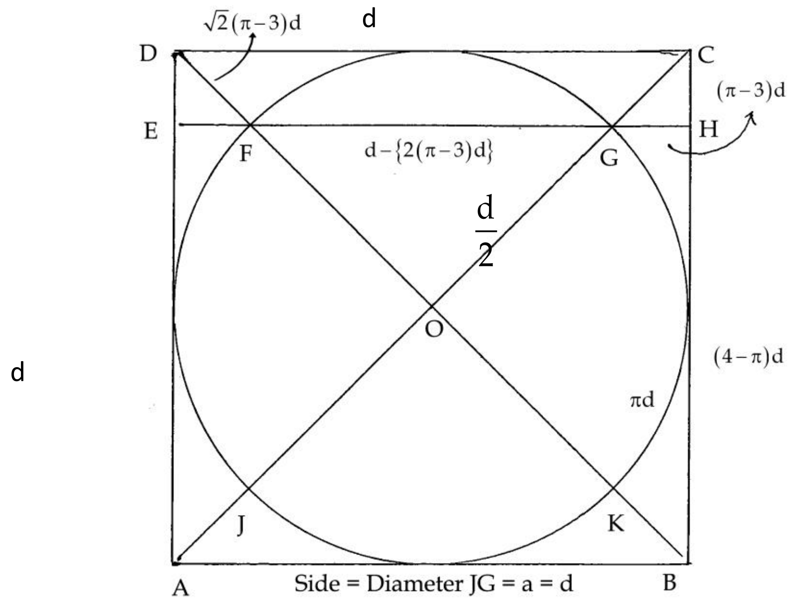
………………………………

$(3) - (1) \quad 16S_1 = \frac{\pi a^2}{2} - a^2$

$= \frac{a^2(\pi-2)}{32} = \frac{a^2}{32}(\pi-2)$

$S_1 = \frac{a^2}{32}(\pi-2)$

So, from the above diagram, it is clear, that the areas of square (i.e. square with its inscribed circle) can be calculated in terms of π constant also, and is **not un-mathematical** and it is a new approach in deriving the real Pi value of the inscribed circle, by **natural and spontaneous process** in seeing the unseen fundamental truth, which is evasive till now.



Second diagram

Prof. Johan, who is aware and deep studied this work, has equated the area of rectangle DEHC of the second diagram with his simple formula, which this author could do it only in eight pages and could not explain in mathematical terms, all the steps, as this author, is a non-mathematician. The idea of using S_1 and S_2 segmental formulas thus, has been made simple and clear by **Prof. Johan** for which this author is greatly indebted to him. His formula for DEHC rectangle in terms of S_1 and S_2 segmental formulas, is, as follows:

$$=\underbrace{2\left\{\frac{a^2}{32}(\pi-2)\right\}+2\left\{\frac{a^2}{32}(4-\pi)\right\}+\{(\pi-3)d\}^2}\;=\left(\frac{32\pi-96}{32}\right)d^2$$

of this author of **Prof. Johan** Based on **Prof. Johan's** above formula, the second formula, on his line of approach – is as follows, for the area of second rectangle EABH of the second diagram.

$$=2\left\{\frac{a^2}{32}(\pi-2)\right\}+2\left\{\frac{a^2}{32}(4-\pi)\right\}+\{(4-\pi)d\}^2\;=\left(\frac{128-32\pi}{32}\right)d^2$$

CONCLUSION

The real π value is $\frac{14-\sqrt{2}}{4}$ = 3.1464466… it is an algebraic number. Squaring a circle is no more an unsolved geometrical problem.

ACKNOWLEDGMENTS

This author has been on this Pi project from 1998 March onwards non-stop. More than one hundred different geometrical methods have been formulated to derive one π value and is $\frac{14-\sqrt{2}}{4}$=3.1464466… Nearly seven thousand Professors of the whole world have been informed by Post (Air mail). Four revised editions of books on Pi have been published and sent as complimentary copies to two thousand Professors all over the world by post (Air mail) spending Rupees One Million from his pocket. Prof. Constantine Karapapopulos of University of Patra, Greece, Prof. Gernot Hoffmann of Emden, Germany, Prof. Johan Viaene of Belgium have contributed their works in support of this discovery. Prof. Gerry Leversha, Editor, The Mathematical Gazette, UK, Prof. Christopher J Sangwin of Birmingham University, UK, Dr. G.Narendran of Kerala, Prof. Puduru Arunachalam of Tirupati, India, have recognized this work by their deep study. Many more Professors have extended their help in the preparation of all the hundred articles. I am highly indebted to all these mathematicians. Miss Rama Mishra who was then a newly joined faculty member at IIT, Kharaghpur, India, Mathematics Department sent very encouraging comments on April 1998. This was author's first paper after a struggle of 26 years on-and-off search. I must personally express my gratefulness to her. Her encouraging comments led this work to travel to this paper next 17 years to this end.

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