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DOUBLING THE CUBE IN TERMS OF THE NEW Pi VALUE (A GEOMETRIC CONSTRUCTION OF CUBE EQUAL TO 2.0001273445)

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ABSTRACT

The three unsolved geometrical problems are trisection of an arbitrary angle, duplication of the cube and squaring of circle. Here is one attempt to get the side of the cube equal to its doubled volume 2.0001… by the help of straight edge and compass only and in terms of the new Pi value (14 – root2)/4. The official Pi value 3.1415926… gives 2.02

KEYWORDS: Circle, cube, diameter, duplication, diagonal, side, square.

INTRODUCTION

The unsolvable nature of three geometrical problems are trisection of an arbitrary angle, duplication of the cube and squaring a circle. However, trisection of 90^0 angle is possible. Squaring of circle is also possible. And we may ask why, squaring of circle was an unsolved problem till now ? The reason is that 3.1415926… has been taken as the value of π constant. **In fact it is not the real π value.** In March 1998, the true π value $\frac{\left(14-\sqrt{2}\right)}{4}$ = 3.14644466… was revealed by the Nature. It has helped to square a circle exactly with the newly discovered value. Unfortunately, we have been adopting only one geometrical method called Exhaustion method of **Eudoxus of Cnidus** (408 BC – 355 BC), Greece. **Sir Thomas Heath** has said of Eudoxus "*He was a man of Science if ever there was one*". In mathematics, Eudoxus is remembered, for two major contributions. One was his theory of proportion, and the other his method of exhaustion. A circle is a totally curvilinear, and thus quite intractable, plane figure. But if we inscribe within it a square, and then double the number of sides of the square to get an octagon, and then again double the number of sides to get a 16-gon, and so on, we will find these relatively simple polygons even more closely approximately the circle itself. In Eudoxean terms, the polygons are "exhausting" the circle from within.

Unfortunately, this method still is the sole method to compute the length of the circle. This inscribed polygon **never** merges with the circumference of the circle, and it **remains inside** the circle. This is the reason why the present official Pi value 3.1415926… is **lesser than** the predicted / unknown actual value which is 3.1464466… discovered in March 1998. So, it is very clear that our assumption is wrong in saying that 3.1415926… is approximate **always** of its **last decimal** onwards, but it is proved now that it is approximate at its **third** decimal, which we never dreamt of it till now.

$$\pi = \frac{\text{Circumference of circle}}{\text{Diameter of circle}} > \frac{\text{Perimeter of inscribed polygon}}{\text{Diameter of circle}}$$

This new Pi value has squared a circle exactly. **Thank God,** no more squaring of circle is an unsolved geometrical problem now.

Another problem is doubling the cube. It means, if the given cube has an edge of unit length, its volume will be the cubic unit, it is required that we find the edge x of a cube with twice this volume. The required edge x will therefore satisfy the simple cubic equation.

$$x^3 - 2 = 0$$

It has been called an impossible problem for many centuries with a straight edge and a compass, only.

The new π value $\frac{14-\sqrt{2}}{4}$ has made this doubling of the cube **almost** possible. The new theory of **oneness** of square and circle has not only revealed the real π value $\frac{14-\sqrt{2}}{4}$ and also revealed doubling of the cube is not impossible. The volume of the doubled cube is equal to 2.00012… is obtained now in the following geometrical construction. The role of π constant, surprisingly is involved in understanding the concept of doubling the cube also. The new formula is

$$\frac{d}{2}\sqrt{89+5\pi^2-42\pi} \approx \sqrt[3]{2}$$

where d = a = side = diameter and $\sqrt[3]{2}$ **= 1.25992104989**

When new π value $\frac{14-\sqrt{2}}{4}$ is involved in the above formula we get the value equal to 1.25994778998 and
$(1.25992104989)^3$ = 1.99999999998 (expected volume of doubled cube)
$(1.25994778998)^3$ = 2.0001273441 (from present construction)

It is clear, therefore, we get less approximation in doubling the cube with the official π value with 2.02 and with the almost accurate value with the new π value and the value for the doubled cube is 2.0001. Let us not forget that square is two dimensional and the cube is three dimensional. **This basic difference may be the reason in not getting the exact value i.e., 2.0 of doubled cube from the two-dimensional square, drawn on a paper.**

This method also tells us that $\frac{14-\sqrt{2}}{4}$ is the real π value. Let us see how ?

PROCEDURE

A square ABCD of a given side is drawn. A circle is inscribed in it. Two diagonals AC and BD are drawn. The diagonals intersect the circle at E, F, G and H. When four parallel lines through the points E, F, G, H to the four sides are drawn, we get four smaller squares for example, one square is KHJD. One parallel line is drawn through EH which is equal to AD. The sum of the lengths of IE, EH and HJ is equal to the side AD. HM is half the length of HJ.

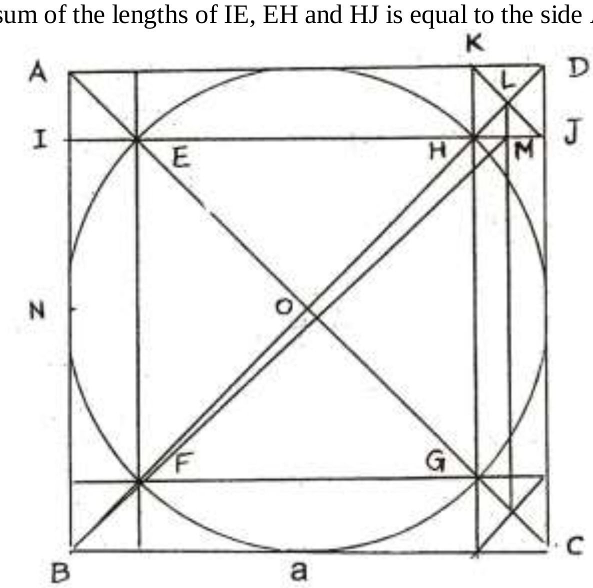

Fig.1

1. IE = IA = HJ = $\frac{\sqrt{2}a-1a}{2\sqrt{2}}$
2. EH = $\frac{\sqrt{2}a}{2}$

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3. IE + EH+ HJ = a (side of the square)
4. HM = $\frac{HJ}{2} = \frac{\sqrt{2}a - 1a}{4\sqrt{2}}$
5. IA + IN + NB = a (side of the square)
6. IN = $\frac{\sqrt{2}a}{4}$
7. NB = $\frac{a}{2}$

When we join BM we get a right angled triangle IBM. IB and IM are the two sides and BM is the hypotenuse.

8. IM = IE + EH + HM
9. IB = IN + NB
10. MB

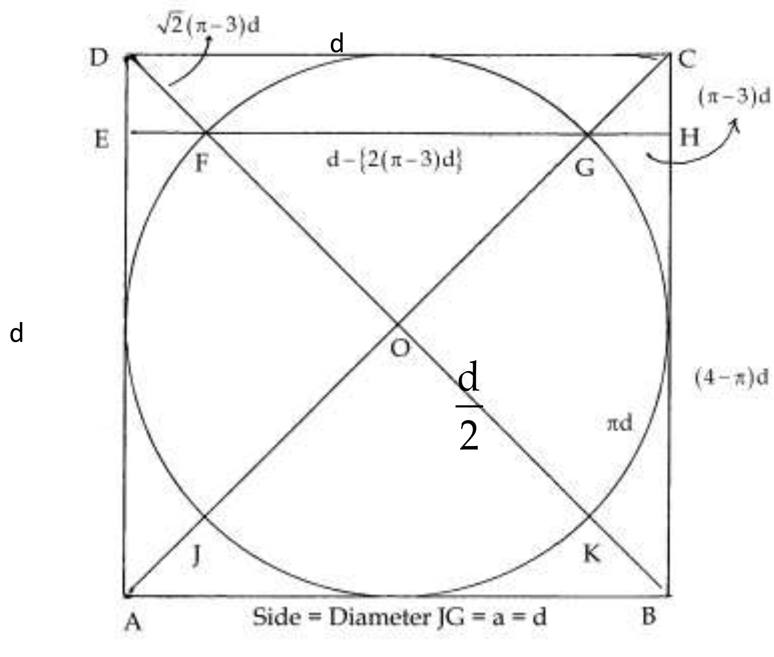
$$= \sqrt{(IE + EH + HM)^2 + (IN + NB)^2}$$

$$= \sqrt{\left(\frac{\sqrt{2}a - 1a}{2\sqrt{2}} + \frac{\sqrt{2}a}{2} + \frac{\sqrt{2}a - 1a}{4\sqrt{2}}\right)^2 + \left(\frac{\sqrt{2}a}{4} + \frac{a}{2}\right)^2}$$

$$= \sqrt{\left(\frac{31 + 14\sqrt{2}}{32}\right)a^2}$$

MB is the hypotenuse which is also the required side of the cube double that with the side BC.

Part-II
DOUBLING THE CUBE IN TERMS OF π CONSTANT



Lens of Fig.1 are equated to Pi here
Fig-2

11. HJ of Fig.1 = GH of Fig. 2 = $(\pi - 3)d$

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12. HM = MJ (Fig.1) = $\frac{(\pi-3)d}{2}$
13. IJ = d
14. MJ = $\frac{(\pi-3)d}{2}$
15. IM = IJ – MJ = d – $\frac{(\pi-3)d}{2}$ = $\frac{2d-(\pi-3)d}{2}$
16. IB of Fig.1 = EA of Fig.2 = $(4-\pi)d$
17. MB = Hypotenuse = $\sqrt{(IM)^2+(IB)^2}$

$$= \sqrt{\left(\frac{2d-(\pi-3)d}{2}\right)^2+\{(4-\pi)d\}^2}$$

$$= \frac{d}{2}\sqrt{89+5\pi^2-42\pi} \approx \sqrt[3]{2}$$

where d = a = diameter = side

In the literature, on survey, we find many values to π. And they are 3.14, 3.141, 3.142 $\left(=\frac{22}{7}\right)$, 3.1416, 3.143 $\left(=17-8\sqrt{3}\right)$, 3.144 …. from Golden ratio etc.

The new π value $\frac{14-\sqrt{2}}{4}$ = 3.1464466… gives the volume of doubled cube equal to as 2.0001… and hence this construction **decides** $\frac{14-\sqrt{2}}{4}$ is the **true** π value.

CONCLUSION

Squaring a circle and doubling a cube are solvable geometrical constructions with straight a edge and compass only. This concept of doubling the cube has helped in this paper in choosing the real π value also.

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