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Squaring the circle and number π

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Abstract

This paper presents an attempt to finally solve the problem of constructing the squares of the same surface of the given circle, in a simple way**:** by determining the exact value of the number **π**. The value of this constant thus far implies the following**:** *in the Universe there is no square of the same surface as the given circle*!?

It's pointless. The number **π** is not irrational, so it is not transcendental number either.

Key words: Geometry; Number Pi; Squaring the circle; Sphere geometry.

1 Introduction

Elementary logic in the case of the Squaring the circle would read like this: *The square of approximately the same surface as the given circle can be increased or decreased for immeasurably small values.* At one point, that square ***must achieve*** an identical surface. Since logical thinking is a prerequisite for effective dealing with any kind of work, instead of calculating the decimal number of the number **π** , we will find its exact value.

2 Pi is a rational number

Pi or **π** is a mathematical constant and is defined as the ratio of the circumference and circle diameter. Pi is a **rational** number because it can be expressed as a quotient *of two integers:*

$$\frac{405}{128} \qquad \pi = 3.1640625$$

3 Accuracy, Exactness, Axiom

If the proposed value of the number **π** would not become an *axiom* (an indisputable, irrefutable fact), this would mean that it was not true at all**.**
Since axioms are mutually independent and one can not prove by another, the only reliable way of checking *accuracy* is the *exact* mathematical calculation.

4 Squaring the circle

Since Pi is a rational number, this means that it is ***constructible.***

Example:

$r = 3.14227$

$a = r\sqrt{\pi} = 5.58941075055973$

$\boldsymbol{A = \pi r^2 = 31.2415125384727}$

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$C = 2r\pi = 19.88467734375$

5 If $r = 2$ then $\underline{\pi r^2 = a^2 = 2r\pi}$

$r = 2$

$a = r\sqrt{\pi} = 3.55756236768943$

$\boldsymbol{A} = \pi r^2 = \mathbf{12.65625}$

$\boldsymbol{A} = a^2 = \mathbf{12.65625}$

$\boldsymbol{C} = 2r\pi = \mathbf{12.65625}$

$$\frac{A}{C} = \frac{r}{2} = 1 \quad \textit{from here follows} \quad \frac{\boldsymbol{\pi r^2}}{\boldsymbol{2r\pi}} = \frac{\boldsymbol{r}}{\boldsymbol{2}}$$

6 Surface Area and Volume of a Sphere

If $r = 3$ then $A = V$

$\mathbf{A} = 4r^2\pi = \mathbf{113.90625}$

$\mathbf{V} = \frac{4}{3}r^3\pi = \mathbf{113.90625}$

We calculate the surface ***A*** by simply multiplying the ***C****ircumference* and the ***d****iameter* :

$C = 2r\pi = \mathbf{6}\pi = 18.984375$

$A = Cd = 18.984375 * 6 = \mathbf{113.90625}$

7 *1 rad* = $56\,\frac{8}{9}$

$$\mathbf{1}° = \frac{2\pi}{360} * 56\frac{8}{9} = 0.017578125 * 56\frac{8}{9}$$

8 Unsuccessful attempts throughout history

All theoretical calculations of Pi did not lead to the correct result: **(**from Wikipedia)

- *geometric* Archimedes (223/71< π <22/7), Ptolemseus (3,1416) , Tsu Ch'ung-chih(355/113), Al-Khwa rizmi**...** Van Ceulen (35 decimals)**…**
- *arithmetic* (Fransoa Viet, 1593), (John Wallis, 1616-1703), (James Gregory , 1638-75), (John Ma-chin, 1680- 1751), (William Shanks, 1812-82)**...**

The most approximate value that has been used throughout history is: "Indian sources by about 150 BC treat as **√10** ≈ 3.1622. " "In ancient China, values for π included **√10** (100 AD, approximately 3.1623)." wikipedia

The construction of Inscribed polygons in a circle was a logical way to determine the exact value of Pi. We suppose it will be interesting for mathematicians to determine why this good method has not led to complete success.

9 Conclusion

Now it's only left for mathematicians to check here the exposed value of number Pi.The quest for this natural constant has a long history: from Egyptian and Chinese mathematicians, through the famous Archimedes, whose approximation is 22/7 most well-known. This is understandable, given its frequent use in natural science. Everything in the Universe is a spherical shape, and on the planet Earth problem the *Squaring the circle* became a philosophical and sociological phenomenon. Perhaps the representatives of these teachings could answer the question, what happened with logical thinking: *that computers were tuned to look for the exact value of the number Pi, instead of counting trillion decimals, would they be able to calculate?!?*

Of course you would.

Appendix

Alternative methods of calculating the circle geometry

(a) In ancient Egypt, they used an interesting way of calculating the surface of the circle, which was very precise: $d - \frac{d}{9}$. The result of this formula is multiplied by the same number.

Example: d = 27 $\quad 27 - \frac{27}{9} = 24$

$A = 24 * 24 = 576$

We will now compare the accuracy of the calculation:

d = 27 => r = 13.5 $\quad A = \pi r^2$

$A = 3.1640625*13.5^2 =$ **576.650390625**

(b) By using the same Egyptian method (*number 9*), we can calculate the *surface* of a circle by means of *circumference*. Of course, *this is possible now* , when we know the exact value of Pi:

$C = 2r\pi \quad C = 27*3.1640625 = 85.4296875$

$$A = (C - \frac{C}{9})^2 / 10$$

A = **576.650390625**

(c) The volume of a sphere that is *twice as large* can be calculated as follows: $(V - \frac{V}{9}) * 9$

For radius r = 20, the volume is V = 33750

For radius r = 40, the volume is $\quad (3370 - \frac{3370}{9}) * 9 = 270000$

Since $(\chi - \frac{\chi}{9}) * 9 = 8\chi$, *we can directly multiply by 8:* V = 3370*8 = **270000**

we will check in the school way: $\frac{4}{3} 40^3 * 3.1640625 = 270000$

(d) Finally, by comparing:

section 5 **$\pi r^2 = 2r\pi = 12.65625$** *(r = 2)*

section 6 **A = V = 113.90625** *(r = 3)*

the quotient is $\frac{113.90625}{12.65625} = \boldsymbol{\frac{36\pi}{4\pi}} = \mathbf{9}$

The table clearly shows why the circle is ***the most perfect shape.***

Circle $\pi = 3.1640625$ **Sphere**

r	πr^2	$2r\pi$	r	A $4r^2\pi$	V $4/3r^3\pi$	V/A	
2	12.65625	12.65625	1	12.65625	4.21875	0.33333	1\3
4	50.625	25.3125	2	50.625	33.75	0.66666	2\3
8	202.5	50.625	3	113.90625	113.90625	1	1
16	810	101.25	4	202.5	270	1.33333	1 1/3
32	3240	202.5	8	810	2160	2.66666	2 2/3
64	12960	405	10	1265.625	4218.75	3.33333	3 1/3
128	51840	810	16	3240	17280	5.33333	5 1/3
256	207360	1620	20	5062.5	33750	6.66666	6 2/3
512	829440	3240	32	12960	138240	10.66666	10 2/3
1024	3317760	6840	40	20250	270000	13.66666	13 2/3
2048	13271040	12960	50	31640.625	527343.75	16.66666	16 2/3
4096	53084160	25920	64	51840	1105920	21.33333	21 1/3
8192	212336640	51840	80	810000	2160000	26.66666	26 2/3
16384	849346560	103680	100	126562.5	4218750	33.33333	33 1/3
32768	3397386240	207360	128	207360	8847360	42.66666	42 2/3

Interesting facts:

*"*game numbers" - numerator and denominator* ($\frac{405}{128} = \frac{810}{256}$),*"replace places"* :

'Rhind' papyrus 1800 BC $\frac{256}{81} = 3.1604938$

exact value π $\frac{810}{256} = 3.1640625$

** π is *the* ***16****th letter of the Greek alphabet*