Exact value of pi $\pi = (17 - 8\sqrt{3})$

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Abstract: In this paper, I show that exact area of circle $= (\pi r^2) = (17 - 8\sqrt{3}) r^2$. I found that the exact value of $\pi$ is $(17 - 8\sqrt{3})$. My findings are based on geometrical constructions, formula and proofs.

I. INTRODUCTION

Is it possible or impossible?

100% exact value of pi, 100% exact area of circle, area of circle = area of square

Yes, it is Possible!

We know that, where $C / D = A / R^2$ = approximate value of pi $= 3.1415926535897$... which is endless value.

$C =$ circumference of circle, $D =$ diameter of circle, $A =$ area of circle, $R =$ radius of circle,

If we calculate $C / D$ we cannot measure end point of circumference. So it will give approximate results.

I started research to find exact area of circle using $A / R^2$ method.

There are different proofs to find the old value of pi but no one get 100% exact answer.

Like using number series, Trigonometry, Dividing circle into infinite parts, as practically we can’t measure endpoint etc. In order to find 100% exact area of circle I found the new method.

I have made number of proofs but here I am giving simple proof out of it.

Reason why I am 100% sure about my research is that I estimated pi value by number of different algebraic methods. Why should we discuss pi is transcendental or algebraic? This is not important. But we are more concentrated on calculating 100% exact answer which is most important.

New methods are also discovered i.e. algebraic table method. By all the methods the answer remains same.
From fig. 1 & 2

Note: let a, b, c & d each part shows area

Area of square = (12a + 12b + 12c + 4d) = (16a + 16b) = 4r^2
(12a + 12b + 12c + 4d) – (16a + 16b) = 0
= (-4a - 4b + 12c + 4d) = 0

i.e. (4a + 4b = 12c + 4d) 
(a + b) = (3c + d)  

From fig. no. 2

16a = [2r x 2(√3/2)r] = (2√3) r^2
16b = [2r - 2(√3/2)r] x 2r = (4 - 2√3) r^2

Problems faced during the research of pi that:

How to estimate the exact values of part c & part d?

I found number of equations for calculating area of square = 4r^2. Few of them is mentioned in the following table. On the basis of these equations I estimated the exact area of circle in following manner.

<table>
<thead>
<tr>
<th>S. r. no.</th>
<th>Equations of area of square = 4r^2</th>
<th>Equations total</th>
<th>= … 4r^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12a + 12b + 12c + 4d = 4r^2</td>
<td>12a + 12b + 12c + 4d = 4r^2</td>
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<tr>
<td>2</td>
<td>64b + 12c + 8d = 4r^2</td>
<td>12a + 76b + 24c + 12d = 2(4r^2)</td>
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<tr>
<td>3</td>
<td>4a + 100b - 18c = 4r^2</td>
<td>16a + 176b + 6c + 12d = 3(4r^2)</td>
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<tr>
<td>4</td>
<td>-8a + 120b + 8d = 4r^2</td>
<td>8a + 296b + 6c + 20d = 4(4r^2)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>32a - 96b + 24c = 4r^2</td>
<td>40a + 200b + 30c + 20d = 5(4r^2)</td>
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<tr>
<td>6</td>
<td>20a - 12b + 6c = 4r^2</td>
<td>60a + 188b + 36c + 20d = 6(4r^2)</td>
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<tr>
<td>7</td>
<td>96b - 6c + 4d = 4r^2</td>
<td>60a + 284b + 30c + 24d = 7(4r^2)</td>
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</tbody>
</table>
Exact value of pi \( \pi = (17 - 8\sqrt{3}) \)

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<tr>
<td>8</td>
<td>( 48a - 208b + 48c ) &amp; ( = 4r^2 ) &amp; ( 108a + 76b + 78c + 24d ) &amp; ( = 8(4r^2) )</td>
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<tr>
<td>9</td>
<td>( 24a - 40b + 12c ) &amp; ( = 4r^2 ) &amp; ( 132a + 36b + 90c + 24d ) &amp; ( = 9(4r^2) )</td>
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<tr>
<td>10</td>
<td>( 128b - 24c ) &amp; ( = 4r^2 ) &amp; ( 132a + 164b + 66c + 24d ) &amp; ( = 10(4r^2) )</td>
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<tr>
<td>11</td>
<td>( -20a + 172b + 12d ) &amp; ( = 4r^2 ) &amp; ( 112a + 336b + 66c + 36d ) &amp; ( = 11(4r^2) )</td>
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<tr>
<td>12</td>
<td>( 12a + 44b - 6c ) &amp; ( = 4r^2 ) &amp; ( 124a + 380b + 60c + 36d ) &amp; ( = 12(4r^2) )</td>
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<tr>
<td>13</td>
<td>( 28a - 68b + 18c ) &amp; ( = 4r^2 ) &amp; ( 152a + 312b + 78c + 36d ) &amp; ( = 13(4r^2) )</td>
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<tr>
<td>14</td>
<td>( 8a + 72b - 12c ) &amp; ( = 4r^2 ) &amp; ( 160a + 384b + 66c + 36d ) &amp; ( = 14(4r^2) )</td>
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<tr>
<td>15</td>
<td>( 4a + 68b + 4d ) &amp; ( = 4r^2 ) &amp; ( 164a + 452b + 66c + 40d ) &amp; ( = 15(4r^2) )</td>
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<tr>
<td>16</td>
<td>( 60a - 292b + 66c ) &amp; ( = 4r^2 ) &amp; ( 224a + 160b + 132c + 40d ) &amp; ( = 16(4r^2) )</td>
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<tr>
<td>17</td>
<td>( 104a - 600b + 132c ) &amp; ( = 4r^2 ) &amp; ( 328a - 440b + 264c + 40d ) &amp; ( = 17(4r^2) )</td>
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<tr>
<td>18</td>
<td>( 18a + 2b + 3c ) &amp; ( = 4r^2 ) &amp; ( 346a - 438b + 267c + 40d ) &amp; ( = 18(4r^2) )</td>
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<tr>
<td>19</td>
<td>( 36a - 124b + 30c ) &amp; ( = 4r^2 ) &amp; ( 382a - 562b + 297c + 40d ) &amp; ( = 19(4r^2) )</td>
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<tr>
<td>20</td>
<td>( 48c + 16d ) &amp; ( = 4r^2 ) &amp; ( 382a - 562b + 345c + 56d ) &amp; ( = 20(4r^2) )</td>
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</table>

Total area of 20 square = \( 382a - 562b + 345c + 56d = 20(4r^2) \)

In the following proof I used area of inscribed dodecagon.

How I am getting the values of c & d for that see the following examples

Area of square = \((12a + 12b + 12c + 4d) \) \( \text{main equation} \)

\[
\text{Area of 15 square} - \text{area of 10 square} = (164a + 452b + 66c + 40d) - (120a + 120b + 120c + 40d)
\]

Area of 5 square + area of 4.5 circle

Area of circle = \((17 - 8\sqrt{3}) r^2 \) / 4

Found the value of 3c & d

Area of square = \( 4r^2 \)

Area of circle = \((17 - 8\sqrt{3}) r^2 \)

\[
(Area \text{ of circle} - Area \text{ of square}) = 4d
\]

\[
= 4r^2 - (17 - 8\sqrt{3}) r^2 = (8\sqrt{3} - 13) r^2 = 2(\sqrt{3} - 3.25) r^2
\]
 Exact value of pi \( \pi = (17 - 8\sqrt{3}) \)

Area of square = \( 16a+16b = 4r^2 \)
\[ (a + b) = (3c+d) = (4r^2/16) = 0.25r^2 \]
\[ (a + b) - d = 3c \]
\[ = [0.25 - (2\sqrt{3} - 3.25)] r^2 = 3c = (3.5 - 2\sqrt{3}) r^2 \]
\[ a = (0.125\sqrt{3}) r^2 \quad b = (0.25 - 0.125\sqrt{3}) r^2 \]
\[ 3c = (3.5 - 2\sqrt{3}) r^2 \]
\[ d = (2\sqrt{3} - 3.25) r^2 \]

By using value of (a, b, c & d) in the above equations we get same answer = \( 4r^2 \) & total \( 4r^2 \)

I have prepared all examples of this type but answer remains same.

Conclusions:

Exact area of circle = \( (17 - 8\sqrt{3}) r^2 \)

Exact value of pi \( \pi = (17 - 8\sqrt{3}) \)

REFERENCES

Exact area of equilateral triangle formula = \( (\sqrt{3}/4) \times \text{side}^2 \)

Basic Algebra & Geometry concept, History of pi \( (\pi) \) from internet

Complete thesis of my research titled as “Exact value of pi” is being published in following journals:

IOSR(international journal of scientific research) journal of mathematics in May-June 2012.

IJERA(international journal of Engineering research and applications) in July-August 2013.

Soft copy of my thesis is now also available on internet and one can get it by making search with following key words:

“Laxman Gogawale.
“Pi value Gogawale.