

Pythagoras n-sided polygon with Natural Numbers using Programming Language

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Abstract - In this paper, using computer programming language Java we determine the Pythagoras n-sided polygon for any (n-1) natural numbers and this Pythagoras n-sided polygon satisfies the extension of the Pythagoras theorem i.e the sum of the squares of the first (n-1) side lengths is equal to the sum of the square of the nth side length.

Key Words: Pythagoras theorem, Triangle, Quadrilateral, Polygon, Pythagoras n-sided polygon

1. INTRODUCTION

In [1, 2, 3, 4, 5, 6] the authors developed extension of Pythagoras theorem for 4, 5, 6, 7, 8, 9 sided polygons using programming language C. But, for a polygon with sides more than 10 this process is difficult using programming language C.

In this paper we developed a program using programming language Java for formation of an n-sided polygon when (n-1) natural numbers are provided. This n-sided polygon satisfies the Pythagoras theorem.

2. MAIN RESULT

2.1 Algorithm

Step 1: Start.

Step 2: Enter the number of sides of the desired polygon.

Step 3: Read the value n defining it as k which is of integer data type.

Step 4: If k is greater than 2, go to step 5, else, go to step 15.

Step 5: Define integer data type variables, i, j, t, sum.

Step 6: Initialize t as (n+1) and sum as zero.

Step 7: Define arrays arr1[] and arr2[] with size n and t respectively.

Step 8: Enter any n natural numbers.

Step 9: Read those values using a for loop.

Step 10: Using another for loop, calculate sum of squares of all the entered numbers.

Step 11: Calculate first element of second array arr2[0] as $\{(2*arr1[0]*arr1[0]) - sum\}$.

Step 12: If arr2[0] is positive go to step 13, else, go to step 13.

Step 13: Multiply arr2[0] with -1 and go to step 14.

Step 14: Calculate the remaining elements of arr2[i] as $(2*arr1[i]*arr1[0])$ except the last element.

Step 15: Assign the value sum for arr2[n-1].

Step 16: Use another for loop to print the elements of arr2[].

Step 17: Print the statement "Entered number of sides can't form a polygon."

Step 18: Stop.

2.2 Result Analysis

Step 1: Enter number of sides of your polygon.

Step 2: Enter any (n-1) natural numbers.

Step 3: It displays the side lengths of an n-sided polygon.

The above procedure can be explained below :

For example,

- Consider a 5-sided polygon (pentagon).
- Let the four natural numbers be 1, 7, 5, 8.
- The side lengths of the polygon are 137, 14, 10, 16, 139.

The side lengths mentioned above satisfies Pythagoras theorem.

We can represent this result in outputs.

2.2 Outputs

```
<terminated> mathspro [Java Application] C:\Program Files\Java\jre1.8.0_60\bin\javaw.
Enter number of sides of your polygon
5
Please enter any 4 natural numbers
1
7
5
8
|
The sides lengths of the polygon are
137    14    10    16    139

The side lengths shown above satisfies Pythagoras theorem.
So it is a Pythagoras n-sided polygon
```

Fig-1: For 5-sided polygon

```
<terminated> mathspro [Java Application] C:\Program Files\Java\jre1.8.0_60\bin\javaw.e
Enter number of sides of your polygon
6
Please enter any 5 natural numbers
5
12
15
22
28
|
The sides lengths of the polygon are
1612   120   150   220   280   1662

The side lengths shown above satisfies Pythagcras theorem.
So it is a Pythagoras n-sided polygon
```

Fig -2: For 6-sided polygon

```
<terminated> mathspro [Java Application] C:\Program Files\Java\jre1.8.0_60\bin\javaw.ex
Enter number of sides of your polygon
13
Please enter any 12 natural numbers
1
3
5
7
11
29
59
97
111
123
154
178
|
The sides lengths of the polygon are

96784   6    10    14    22    58    118

194    222    246    308    356    96786

The side lengths shown above satisfies Pythagoras theorem.
So it is a Pythagoras n-sided polygon
```

Fig -3: For 13-sided polygon

```
Problems @ Javadoc Declaration Console
<terminated> mathspro [Java Application] C:\Program Files\Java\jre1.8.0_60\bin\javaw.exe (05-
Enter number of sides of your polygon
21
Please enter any 20 natural numbers
1
2
3
4
5
6
7
8
9
11
15
17
19
35
39
48
78
99
111
124
|
The sides lengths of the polygon are

49911   4    6    8    10    12    14    16

18    22    30    34    38    70    78

96    156    198    222    248    49913

The side lengths shown above satisfies Pythagoras theorem.
```

Fig -4: For 21-sided polygon

```
<terminated> mathspro [Java Application] C:\Program Files\Java\jre1.8.0_60\bin\javaw.exe
Enter number of sides of your polygon
12
Please enter any 11 natural numbers
1
3
5
7
11
13
17
23
29
31
37
|
The sides lengths of the 12-sided polygon are :

4361    6    10

14    22    26

34    46    58

62    74    4363

The side lengths shown above satisfies Pythagoras theorem.
So it is a Pythagoras n-sided polygon
```

Fig -5: For 12-sided polygon

3. CONCLUSIONS

By using this program, we can easily find the n-sided Pythagoras polygon for any (n-1) natural numbers. That n-sided polygon satisfies the extension of a Pythagoras theorem.

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