





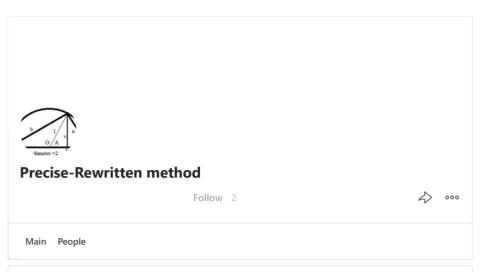








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Classically, we can determine few of the trigonometric values exactly. Under Precise-Rewritten method, we can determine exact trigonometric values of any angle (integer or decimal). Precise-Rewritten method is simple for learning and determining the exact trigonometric values. In this article, we shall discuss the method for exact value of Sin 20 degrees.

#### New method

Classically, trigonometric values were based on few of the exact radicals and other were interpolation of known exact values. In this new method, named as 'Precise-Rewritten method', the target angle is rewritten in the half of right-angle pattern. As the name of method suggest, it rewrite the angle as 45 - (22.5 +(11.25)) for 11.25 degrees. The trigonometric value may be 'exact value in radicals' or may be accurate for user-defined precise level.

### **Concept of centrals**

For Precise-Rewritten method, we just need simple understanding of 'centrals'. Starting from 90 degrees, it's half is 45- first central. Half of 45 is 22.5 - second central, 11.25 is third central and so on. In the example of Sin 20, following picture may describe the Precise-Rewritten method in single shot. For this:

- Calculate centrals starting from 45 degrees. This is the first central in all cases.
- Add or subtract second central (i.e. 22.5) to the cumulative of the first central (which
  is 45) towards our target angle (20 degree in our case, so, we subtracted).
- Repeat the process of adding or subtracting of next central with earlier cumulative angle until we reached to the target angle or if we obtain repeating pattern. In case, we could not obtain target angle or unable to fixed any repeating pattern, the process requires to repeat until user-defined precision level (say 15 digits accurate after decimal etc).

## Concept of sign

In each step of above process, divide earlier central with current central. The answer is always either +2 or -2.

- In the first row of first central 45 degrees, write the quotient dividing 90 by this first central. This is always +2.
- In each step of calculation, find the sign (+ or -) in quotient of +2 or -2. This is critical for our calculation of trigonometric values.

#### Details

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#### **Concept of centrals**

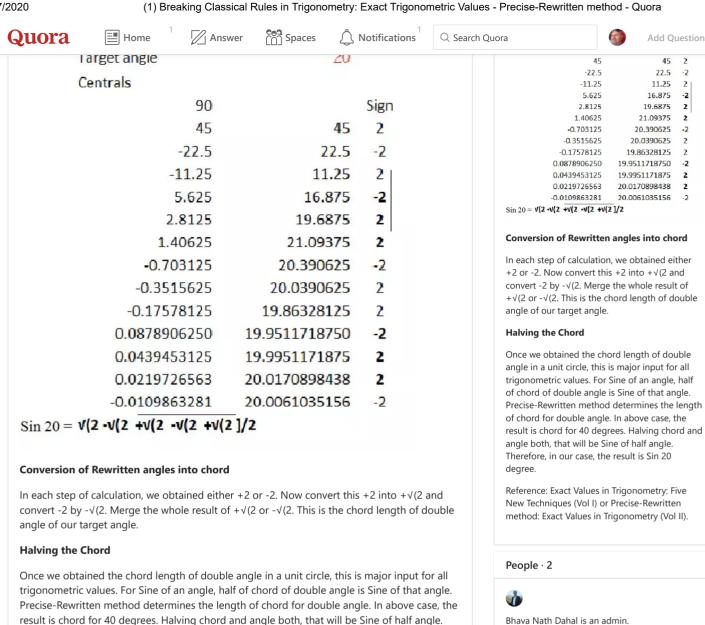
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- Each step, please care the pattern of repetition. The process has shown as follows:



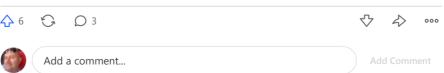
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Therefore, in our case, the result is Sin 20 degree.

This article or books in this series may be beneficial to the scholars. However, due to my low skill in mathematics and modern technologies, I need remarkable support to professional supervision, quality control, formatting, copy-editing etc. I am afraid, the concept I could contribute may be lost without good support for professionals or professional institution. I request someone mathematicians or mathematics institution or universities to support and

Reference: Exact Values in Trigonometry: Five New Techniques (Vol I) or Precise-Rewritten method: Exact Values in Trigonometry (Vol II).

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Joe Zbiciak · November 24, 2016

This sounds an awful lot like CORDIC .

45 2

2

-2

2

2

2

-2

2

22.5

11.25

