# How do I calculate cos, sine, etc. without a calculator?

**Bhava Nath Dahal** · Updated September 28, 2016
Breaking Classical Rules in Trigonometry- 5 new methods & higher-degree equation

If you want to calculate trigonometric ratios of an arbitrary angle without using simple arithmetic calculator, it may be difficult to you. Using Simple arithmetic calculator not having trigonometric functions, I introduce two New methods:

- Precise-Rewritten method: Simple method for exact radical values. For this please visit How were sine, cosine, and tangent derived? for example of Sin 20 degrees.
- Arc-Line method: Simple for 'user-defined accuracy' in decimal system as follows:

**Arc-Line method**

Arc-Line method for determination of trigonometric ratios

Scholars using trigonometric values usually refer calculator or trigonometric table or computer for their trigonometric ratios of desired angle. They cannot compute those ratios themselves. Here is Arc-Line method of determination of trigonometric ratios for ANY angle in the question. In this blog, I have used Sin A only.

The Method:

Step 1: Take arbitrary angle (A) in radian measure.

Step 2: Defined your appropriate accuracy (precision level of accuracy) in power-base of $2^n$.

Step 3: Prepare a table with four columns by n+1 rows.

1. In the first column, first input is $A/2^n$. Second to n+1 input is double of earlier angle; i.e. $A/2^{n-1}$, $A/2^{n-2}$, ..., A/2, A.
2. In the second column, first input is just $A/2^n$. This is chord (a) for $A/2^n$. Second to n+1 inputs are product of a and b from earlier row.
3. In the third column, find the supplementary chord (b) using $\sqrt{4-a^2}$.
4. Fourth column is Sine of the angle in that row. Half of product of a and b will be Sine of angle in row. Therefore, Sin $A/2^n$ = ab/2 in the first row; Sin $2A/2^n$ = ab/2; and so on.

Example for Sin 1 degree = 0.017453293 with power base n=128

First chord is 0.017453293/ 128 = 0.000136354

Angle (A') a b Sin A' = ab/2

0.000136354 0.000136354 1.999999995 0.000136354

0.000272708 0.000272708 1.999999981 0.000272708

0.000545415 0.000545415 1.999999926 0.000545415

0.001090831 0.001090831 1.999999703 0.001090831

0.002181662 0.002181661 1.999998810 0.002181660

0.004363323 0.004363320 1.999995240 0.004363313

0.008726646 0.008726619 1.999980961 0.008726563

0.017453293 0.017453071 1.999923844 0.017452628

Exactly, we determined chord (a) and supplementary chord (b) of line angle in each row. From chord (a) and supplementary chord (b), we can compute all six (in fact sixteen) trigonometric ratios. For detail with examples and basis, please use "Exact Values in Trigonometry: Five New Techniques" available at Amazon.

method, exact value of Sin 1 degree is

½ √(2 -√(2 +√(2

$$+\sqrt{(2+\sqrt{(2+\sqrt{(2+\sqrt{(2-\sqrt{(2-\sqrt{(2-\sqrt{(2+\sqrt{(2-\sqrt{(2-\sqrt{(2+\sqrt{(2-\sqrt{(2]}}}}}}}}}}}}$$

Closing brackets are collapsed for easy.

Edit:

Please follow following link in quora for new method of trigonometric values:

1. Bhava Nath Dahal's post in Precise-Rewritten method

2. Bhava Nath Dahal's post in Breaking Classical Rules in Trigonometry

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