Breaking Classical Rules in Trigonometry



Bhava Nath Dahal · September 25, 2016
Works at Freelancing

# Trigonometric Ratios by School Student: Arc-Line Method

**New method for determination of trigonometric ratios**

**New terminologies**: Arc-Line method, supplementary chord, power-base ($2^n$), first chord ( $\frac{A}{2n}$ ).

**Skill-requirement**: General trigonometric knowledge (school-level knowledge is enough). Non-scientific calculator requires.

**Time requirement for study**: Half of an hour.

**Accuracy**: User-defined accuracy

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**: Define your appropriate accuracy (precision level of accuracy) in power-base of $2^n$. Recommended accuracy is 10+digits after decimal, for this value of n requires 16+. Its rule is 'Higher power-base, higher accuracy'.

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

1. In the first column, first input is $\frac{A}{2^n}$. From second row to n+1, double of earlier angle; i.e. $\frac{A}{2^{n-1}}$ , $\frac{A}{2^{n-2}}$ , $\frac{A}{2^{n-3}}$ , ... .... .... ... , $\frac{A}{4}$ , $\frac{A}{2}$ , A.
2. In the second column, first input is just $\frac{A}{2^n}$. This is chord (a) for $\frac{A}{2^n}$. From second to n+1 row, it is the product of chord (a) and supplementary chord (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 ($\sin A'$) in that row. Half of product of a and b will be Sine of angle in row. Therefore, Sin $\frac{A}{2^n}$ = ab/2 in the first row; and so on.

Here is the example of new method (named as Arc-Line method). We are taking example for Sin 1 degree = 0.017453293 radian with power-base n=7 ($2^7$). In this example, both value of radian and power-base have compromised. We need to take more accurate value of radian (in fact$\pi$) as well as power-base (at least $2^{16}$)

First chord is 0.017453293/ 128 = 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

[I apologize for bad formatting table. Both table or tab could not work here.]

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”.

In above example, we compromised the precision level taking low power-base.

For exact radical value, we need to use Precise-Rewritten method (Bhava Nath Dahal's post in Precise-Rewritten method).

***Edited on Nov 11, 2016***

For solving $\sin(nA)$ (similar method for $\cos(nA)$ or $\tan(nA)$, visit Bhava Nath Dahal's post in Breaking Classical Rules in Trigonometry



About the Author

**Bhava Nath Dahal**

Breaking Classical Rules in Mathematics

Works at Freelancing

Studied Master of Business Administration Degrees

Lives in Kathmandu, Nepal

510.9K content views 15.4K this month

Active in 9 Spaces