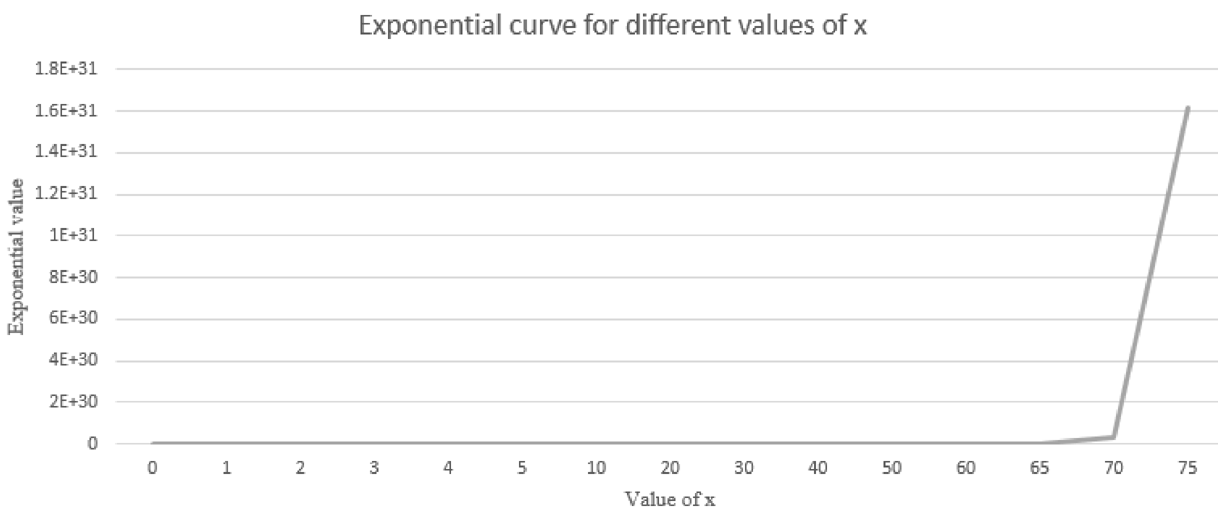
Exponential Series:

Exponential Series is a series which is used to find the value of e^x. The formula used to express the e^x as Exponential Series is

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$$

Analysis 1: Calculation of exponential function for different values of x

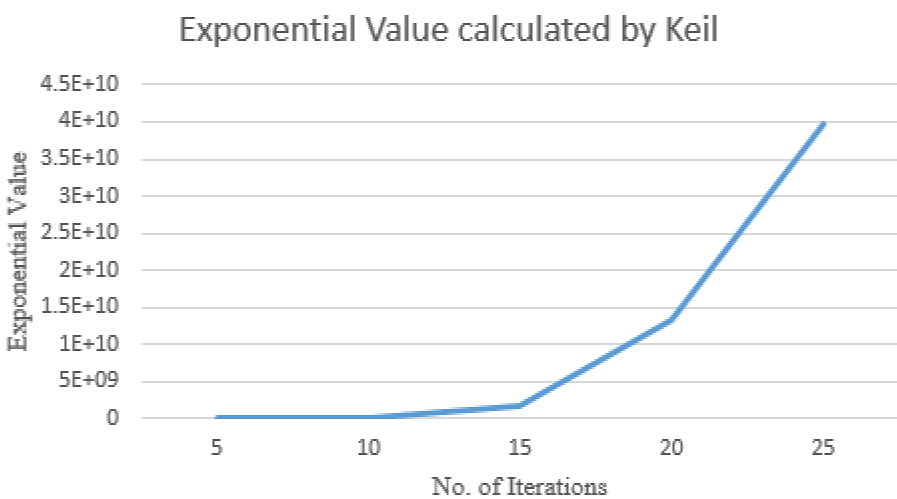
x	(Value calculated by Keil)	(Expected value)	no. of iteration
0	1	1	60
1	2.71828	2.7183	60
2	7.38906	7.3891	60
3	20.0855	20.0855	60
4	54.5982	54.5982	60
5	148.413	148.4132	60
10	22026.5	22026.4688	60
20	4.85E+08	485165216	60
30	1.07E+13	1.07E+13	60
40	2.35E+17	2.35E+17	60
50	4.81E+21	4.81E+21	60
60	6.10E+25	6.10E+25	60
65	4.97E+27	4.97076E+27	60
70	3.19E+29	3.19E+29	60
75	1.62E+31	1.62E+31	60

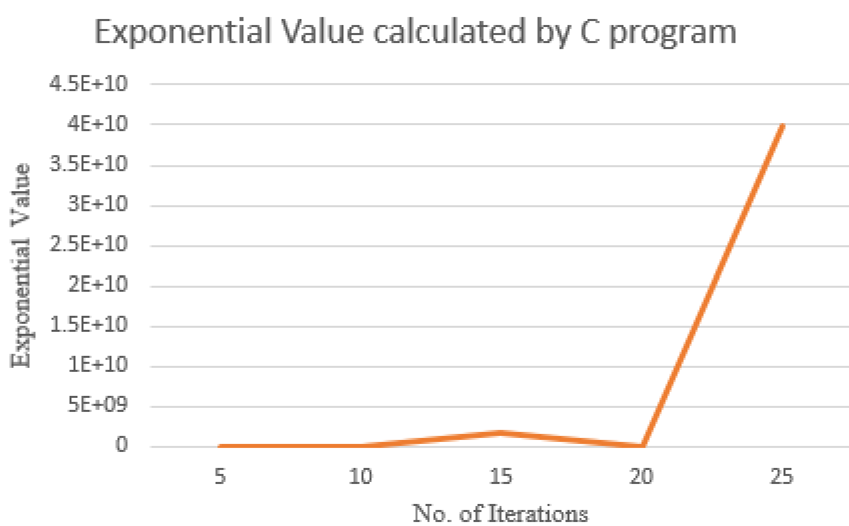


In the above curve, value of exponential function for different values of x has been calculated according the program compiled in Kiel. The curve more or less follows the exponential nature of the function.

Analysis 2: Deviation of curve from the actual one for different values of iteration

No. of iterations	Value by Kiel	Value by C
5	100599	100598.9219
10	4.22E+07	4.22E+07
15	1.61E+09	1605206784
20	1.34E+10	1.333560E+10
25	3.98E+10	39813054464


Exponential Value calculated by Keil
4.5E+10
4E+10
3.5E+10
3E+10
2.5E+10
2E+10
1.5E+10
1E+10
5E+09
0
5
10
15
20
25
No. of Iterations
Exponential Value


Exponential Value calculated by C program
4.5E+10
4E+10
3.5E+10
3E+10
2.5E+10
2E+10
1.5E+10
1E+10
5E+09
0
5
10
15
20
25
No. of Iterations
Exponential Value

Tan(x) series:

Given two integers N and X. The task is to find the sum of tan(x) series up to N terms.

The series: x + x3/3 + 2x5/15 + 17x7/315 + 62x9/2835……..

In our ARM program, implementation of tan(x) series is done by dividing sine(x) and cosine(x) to achieve the same accurate results with more simplicity.

Sine(x) series by Taylor's expansion is given by:

$$\sin x = \sum_{x=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!}$$

Expanding the above notation, the formula of Sine Series is;

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$$

Cosine(x) series by Taylor's expansion is given by:

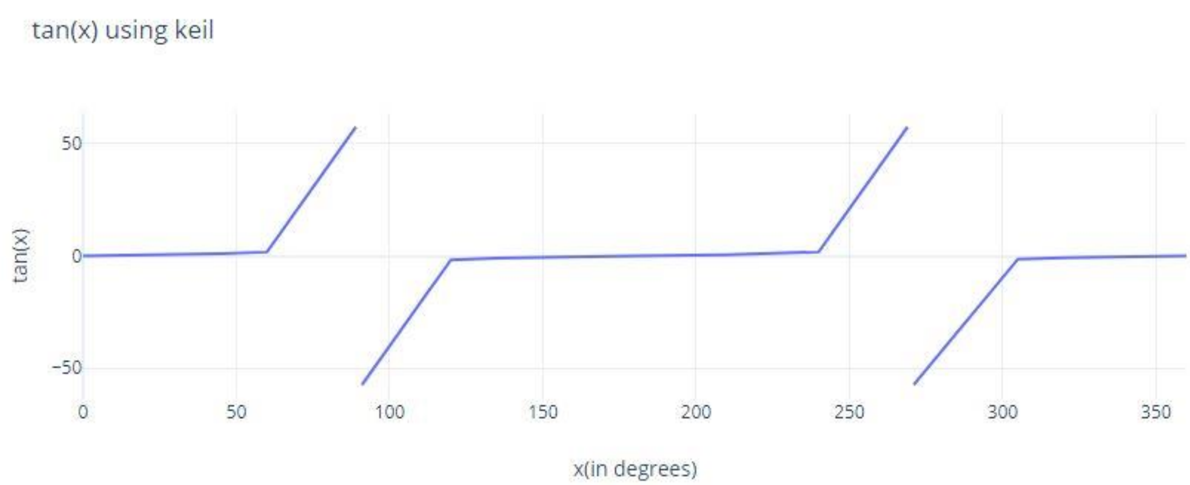
$$\cos x = \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n}}{(2n)!}$$

Expanding the above notation, the formula of Cosine Series is

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots$$

Analysis 1: Calculation of tangent function for different values of x

S.no.	x(in degrees)	tan(x) (Value calculated by Keil)
1	0	0
2	30	0.57735
3	45	1
4	60	1.73205
5	89	57.2921
6	90	**NaN**
7	91	-57.2879
8	120	-1.73205
9	135	-1
10	150	-0.577349
11	165	-0.267948
12	180	0.00E+00
13	210	0.577352
14	225	1
15	240	1.73206
16	269	57.2947
17	270	**NaN**
18	271	-57.286
19	305	-1.42814
20	320	-0.839094
21	340	-0.36397
22	360	0.00E+00

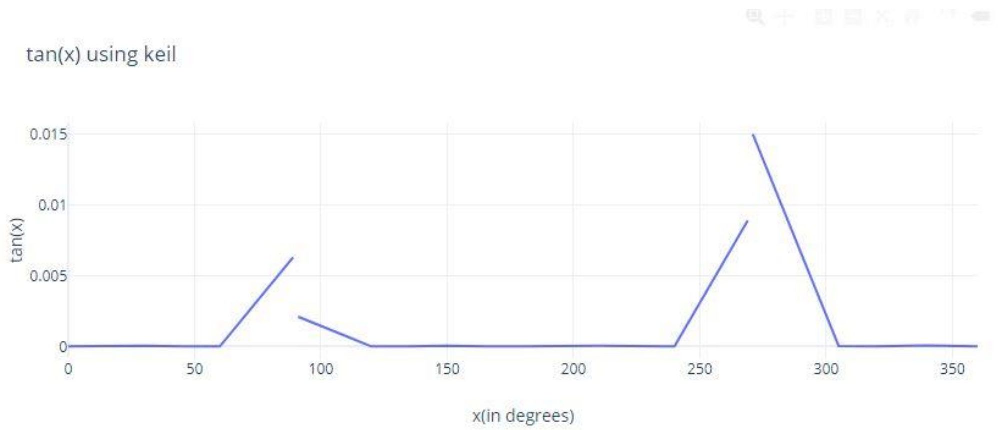


In the above curve, we are observing that the curve follows the ideal tan(x) curve as per the nature of wave shape and values at different angles are to be considered.

Analysis 2: Deviation of curve from the one obtained by C program

S.no.	x(in degrees)	tan(x) (Value calculated by Keil)	tan(x)(Value calculated by C program)	Error
1	0	0	0	0
2	30	0.57735	0.5773	5E-05
3	45	1	1	0
4	60	1.73205	1.73205	0
5	89	57.2921	57.2858	0.0063
6	90	**NaN**	NaN	NaN
7	91	-57.2879	-57.2858	0.0021
8	120	-1.73205	-1.73205	0
9	135	-1	-1	0
10	150	-0.577349	-0.5773	4.9E-05
11	165	-0.267948	-0.26794	8E-06
12	180	0.00E+00	0	0
13	210	0.577352	0.5773	5.2E-05
14	225	1	1	0
15	240	1.73206	1.73205	1E-05
16	269	57.2947	57.2858	0.0089
17	270	**NaN**	NaN	NaN
18	271	-57.286	-57.301	0.015
19	305	-1.42814	-1.4281	4E-05
20	320	-0.839094	-0.83909	4E-06
21	340	-0.36397	-0.3639	7E-05
22	360	0.00E+00	0	0

Deviation of tan(x) values from C program



The values of tan(x) obtained by Keil much likely follows the actual values which were obtained by C program