

# Assignment 2 Writeup

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This assignment includes two c files, mathlib.c and mathlib-test.c:

## mathlib.c:

Mathlib.c has my implementations of the functions for sin, cos, arcsin, arcos, arctan, and log (base e). Sin and cos were calculated using taylor series up to a term less than a value epsilon set as  $10^{-10}$ . Arcsin was calculated by using an iterated formula

$z_n = z_{n-1} - (\sin(z_{n-1}) - x) / \cos(z_{n-1})$ , iterated until the difference between the current term and previous is less than epsilon. Arccos was implemented as  $\pi/2 - \arcsin(x)$ . Arctan was

implemented as  $\arcsin(\frac{x}{\sqrt{x^2+1}})$ . Finally log was implemented using Newton's method, halted when the difference between the current term and previous is less than epsilon.

## mathlib-test.c:

Mathlib-test.c compares my implementation of the functions from mathlib.c with the standard c math libraries versions. For almost all values of x and functions the difference between my functions and the math libraries' was less than  $10^{-10}$ . Any small difference could be accounted for by the math library using a smaller value for epsilon.

x	arcsin	Library	Difference
-	-----	-----	-----
-1.0000	-1.570796031	-1.570796327	0.000000295306
-0.9500	-1.253235898	-1.253235898	0.000000000000

  

x	arccos	Library	Difference
-	-----	-----	-----
-1.0000	3.141592358	3.141592654	0.000000295306
-0.9500	2.824032224	2.824032224	0.000000000000

The difference was only greater for arcsin and arccos when x is -1. This could be explained by the math library calculating these values directly from  $\pi$  getting  $-\pi/2$  and  $\pi$  respectively.