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CSE 13S Spring 2021
Assignment 2: A Small Numerical Library
Design Document

This program utilizes Newton's method to calculate the value the inverse trig functions and log functions

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

Newton's Method

Estimate roots of a function

Sin^{-1} with Newton's method

$x = \sin^{-1}(a)$ $\quad f(x) = \sin(x) - a$

$\sin(x) = a$ $\quad x_{n+1} = x_n - \left(\frac{\sin(x_n) - a}{\cos(x_n)}\right)$

$\sin(x) - a = 0$

Cos^{-1}

Cos^{-1} can be implemented by doing:

$\frac{\pi}{2} - \arcsin(x)$

tan^{-1} can be implemented by doing:

$\arcsin\left(\frac{x}{\sqrt{x^2+1}}\right)$

log

$x = \ln(a)$ $\quad f(x) = \sin e^x - a$

$a = e^x$ $\quad x_{n+1} = x_n - \left(\frac{(e^x - a)}{e^x}\right)$

$e^x - a = 0$

I. Pseudocode

```
double arcSin(double x) {
        double oldguess;
        double guess=1;
        double answer = sin(guess) -x;
        while (Abs(answer) > EPSILON) {
                oldguess = guess
                guess = oldguess-(sin(guess)-x)/cos(guess)
                answer = sin(guess)-x
        }
        return answer;
}
double arcCos(double x) {
        return (PI/2)-arcsin(x)
}
double arcTan(double x) {
        return arcsin(x/sqrt((x^2)+1))
}
```

```
double Log(double x) {
        double oldguess;
        double guess=1;
        double answer = e^guess -x;
        while (answer > EPSILON) {
                oldguess = guess
                guess = oldguess-(e^guess-x)/e^guess
                answer = e^guess-x
        }
        return answer;
}
```