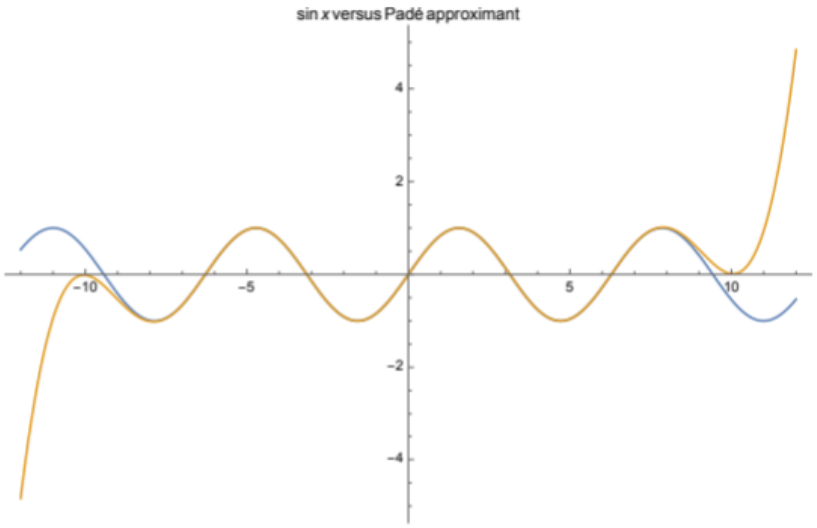
Assignment 2 Writeup – Jack Vento (1816097)

Sin/Cos

For values between [-π/2, π/2], the Sin and Cos Pade approximants I implemented are incredibly close to the standard math.h library versions (which typically use a combination of precomputed table values and Taylor series). However, as we get further out towards our domain restrictions (specifically beyond 3π/2), they begin to vary significantly. This result is confirmed by the following graph from the lab manual:



Although we do not go beyond [-2π, 2π] with these functions and see the dramatic difference seen in the graph, we do see slight deviation that would be fixed by using a Taylor series. Were we to follow similar methodology used in implementing Exp, the difference would be negligible.

Tan

For Tan, the domain is restricted to [-π/3, π/3] with steps of π/16 so we only end up 11 tests. The sample size is small but the difference is incredibly small (smaller than what our table is configured to display). Were the sample size bigger and operated beyond π/3 (specifically, out near 3π/2 where our Sin/Cos approximations had the most trouble) we would see the same dramatic deviation as our previous functions.

Conclusively, the Pade approximants work incredibly well for values close to 0, but the closer we approach -2π and 2π, the less our approximants work. A Taylor series would dramatically improve our results, as seen by our Exp function.

Exp

Unlike the Pade approximants, our Maclaurin series that we used for Exp keeps our difference typically fluctuating between 0 and $1e^{-10}$ and from ever exceeding $3e^{-10}$. With an even stricter epsilon than 10^{-9}, we could get this difference to a point where our program would not even display a difference. This is

the power of the Taylor series that we lacked with the trig functions. Now, that is not to say that the Taylor series is perfect—it struggles with accuracy the further away from 0 we get. However, it is one of the strongest tools we have for approximating difficult functions like the four featured in this library.