Homework 1 Answers

Problem 1

What is the relative error of your implementation for x = 1e-10?

8.274037096265818e-08

Why is there a discrepancy between Matlab's answer and yours?

We are adding and subtracting numbers that are extremely close together, giving room for catastrophic cancellation and round off error.

How might you improve your accuracy for small x?

We might consider defining tanh = sinh/cosh. This will hopefully remove some of the catastrophic cancellation and rounding errors.

How might you fix your implementation for large x?

We need to eliminate the usage of e^x, since e^1e10 is much too large to work with. Also, when x>1e2, tanh rounds to 1, so maybe when x is >1e2, just return 1.

Problem 4

How does the convergence using this continued fraction expansion compare to the convergence of the series expansion?

The continued fraction expansion converges after fewer terms, especially for x values far from 0.