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Computational Physics

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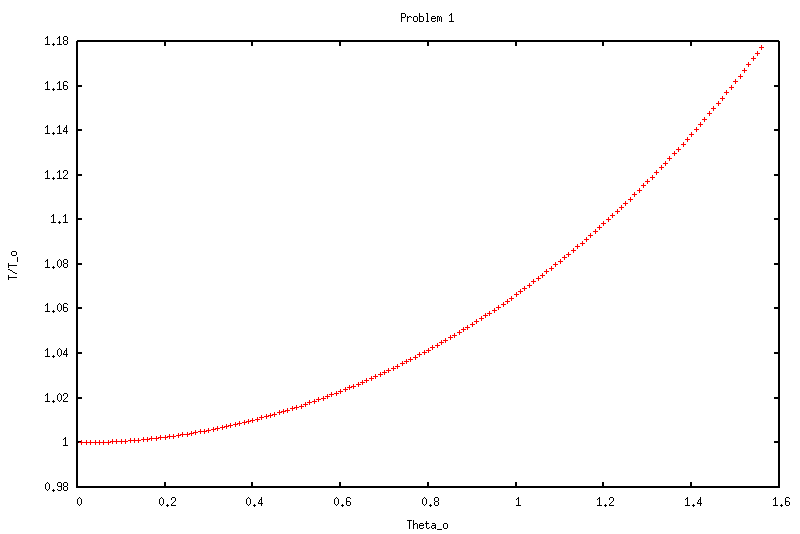
Homework Set #5

**Problem 1**

This problem evaluates the period of pendulum after being released from being held at an angle . This was evaluated was for various up to . I decided this was a good since if the pendulum started at a greater , the tension acting on it would be 0, and thus it would not behave in the same manner. The function creates an Integrand object that has an alterable , with an operator that returns the function to be integrated, which is within the following function:

The coefficients were ignored for the calculation of the integral. The function cannot be evaluated at its upper bound, so I used Midsqu, which takes the midpoint rule exclusive of the upper bound. The midpoint object is then integrated using qromo. This process is repeated for incrementing values of from 0.01 rad up to , in intervals of 0.01 rad. Given that

and I needed to graph , each integral was multiplied by , making them the actual ratio value. The graph is as follows:



**Problem 2**

For this problem, I needed to evaluate the integral

Over the interior of an ellipse whose boundary is given by

to an accuracy of 1 part in 108. Because Numerical Recipes integral functions return numbers (instead of functions) and *I* is a double integral, I needed to make two structs. A double integral works by holding the outside variable constant while evaluating the inner integral. Therefore when calling qromb on the entire function, it triggers a call for the current y value to be held constant while the inner integral is evaluated based on bounds that are dependent on the current y value. This repeats for the entire double integral (as y varied through its limits of integration).

I found the limits of integration for the inner integral by evaluating the boundary condition. I used completing the sqare. This gave:

From this, it was clear that this function would only work if the term inside the square root was not negative, keeping the equation real. Therefore, I did the following operation to find the limits of the y value:

The limits of integration for the outer integral need to be slightly altered since the actual bounds cannot be evaluated. I added 1-12 to each value as result.

The integrand was evaluated a total of 2,228,241 times. The computed integral was: 1.4490264.