Programming Homework 1

Due Tuesday, Sep. 8 (see Prof. Avery for help or hints on any problem)

1. Problem that can be solved with wxMaxima, Sage, Sympy, Mathematica or Maple
   a. (4 pts) Find the coefficient of $x^{12}$ in the taylor expansion of $\exp(\cos x)$.
   b. (3 pts) Find $\sum_{n=1}^{\infty} \frac{1}{n^{10}}$.
   c. (3 pts) Find the 10th derivative of $e^{-x^2/2}$.
   d. (3 pts) Show that the relativistic kinetic energy can be expanded as
      \[ \frac{1}{2} m \beta^2 \left( 1 + a_1 \beta^2 + a_2 \beta^4 + \cdots \right) \]
      using energy units. Find $a_1$ and $a_2$. How small must $\beta$ be to keep the non-relativistic kinetic energy formula accurate to 2%?

2. Python problems. Please turn in your programs and their output.
   a. (5 pts) Write a program using a for loop that prints only the integers divisible by 13 from 13 to 491.
   b. (5 pts) Write a program using strings and the count function that reports the number of occurrences of all letters of the alphabet in the string below (the string is the text between the quotation marks). Note that upper case and lower case letters are different. You might have to eliminate newline characters (\n) when you paste the text.

   “It is best to express the 4-momentum of the outgoing electron in terms of the other particles, then square it (getting rid of all its properties except for its mass). Please write down the 4-vectors of all other particles in the problem.”