

All answers should be in as simple a form as possible.

1. Simplify  $\sum_i \binom{10}{i}^2$ .
  
2. Compute numbers  $L$  and  $U$  such that  $L \leq \ln 1.1 \leq U$  and  $U - L \leq 0.01$ .
  
3. You are flipping a biased coin where the probability of heads is  $p$ .
  - 3a. What is the probability that the first  $k - 1$  flips yield tails and the  $k$ -th flip yields heads (one probability for the combined result)?
  
  - 3b. What is the probability that the first  $k - 1$  flips all yield one result but the  $k$ -th flip yields a different result?
  
  - 3c. What is the expected number of flips until two different results are obtained? In other words, what is the expected number of flips for the process in question 3b?
  
  - 3d. Which value(s) of  $p$  result in the smallest answer to question 3c? Which value(s) of  $p$  result in the largest answer to question 3c?
  
4. You flip a coin  $m$  times (probability of heads is  $1/2$ ) and you roll a die  $n$  times (probability of a one is  $1/6$ ). You get one point for each head and one point for each one from the die.
  - 4a. What is the probability that you obtain exactly  $i$  points from the coin?
  
  - 4b. What is the expected (average) number of points obtained from the coin?
  
  - 4c. What is the probability that you obtain exactly  $i$  points from the coin and exactly  $j$  points from the die? (This question asked for one probability that is a function of  $i$ ,  $j$ ,  $m$ , and  $n$ .)
  
  - 4d. What is the probability that you obtain a total of exactly  $k$  points (from the coin and the die together)?