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)?