Putnam practice - Probability

1. A fair coin is flipped 100 times, what is the probability of getting an even number of heads?

2. Three points are selected randomly on a unit circle. What is the probability that they will form an obtuse triangle?

3. (2014) Suppose X is a random variable that takes on only non-negative integer values with expect values $E[X] = 1$, $E[X^2] = 2$, and $E[X^3] = 5$. Determine the smallest possible value of the probability of the event $X = 0$.

4. (2007) Let k be a positive integer. Suppose the integers $1, 2, 3, \ldots, 3k + 1$ are written down in random order. What is the probability that at no time during this process, the sum of integers that have been written up to that time is a positive integer divisible by 3? Your answer should be in closed form, but may include factorials.