Problem E - Fire Emblem: Heroes

Maybe you've played the new phone game "Fire Emblem: Heroes"? It's a turn-based strategy game, where your characters are pitted in an arena (usually 4 vs 4) to defeat the opposing squad. Different characters have different skillsets, and one of the goals in the game is to assemble a squad of top-tier characters. The best tier of heroes is the **legendary** tier, and everyone knows that the best teams are chock full of **legendary** heroes.

In our simplified version of the game, the game consists of a series of N battles against the AI (which we always win, because we're so good at the game). After battle i, we summon 1 new champion, with probability p_i of being a **legendary** champion. Battles are always done in the order 1 through N. Our intention is to roll a team consisting of at least K **legendary** champions. After K legendary champions are rolled, we can stop the game.

There's a trick, though, that I haven't mentioned yet. Sometimes we get very unlucky with our rolls: for example, imagine playing ten battles in a row and receiving no **legendary** champions! This might have even been the best opportunities to receive **legendary** champions (i.e. the p_i's associated with these battles was relatively high). Here's where our trick comes in: we DELETE THE GAME from our phone, and re-install! Now we can start over from the beginning, at no cost (note that this resets everything, so we don't get to keep the **legendary** champs that we've got so far). It is possible to restart the game after exhausting every battle in the game, if we didn't get K **legendary** champions.

What's the expected value of the number of battles required to get a team with K **legendary** heroes, assuming that we re-install whenever it's optimal to do so?

Input Specification:

The problem begins with an integer $T \leq 100$, the number of testcases. Each testcase begins with two integers on their own line: $1 \leq N \leq 420$, the number of potential battles, and $0 < K \leq N$, the number of **legendary** heroes we're trying to summon. This is followed by a line containing N probabilities p_1 through p_N, where p_i is the probability that we summon a **legendary** champion after battle i; $p_i \geq 0.01$ and will be given to 3 decimal places.

Output Specification:

For each testcase, output a single number on its own line: the expected value of the number of battles required to obtain K **legendary** champions. It is guaranteed that this will never exceed 10^6 battles. A special judge will accept any answer with less than absolute or relative error of 10^{-6}.

Sample Input:

```
1
4 2
0.500 0.200 0.900 0.200
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Sample Output:

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4.130434782
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