

Problem E: Randomize

For her new ICS assignment, Caroline needs to design a program that uses random numbers. However, she discovers that Ms. Dyke has forbidden using any built-in functions! Now, she needs to create a random number generator to make her assignment work. After checking online, she finds that random numbers can be generated using the following function:

$$F(0) = \text{SEED}$$

$$F(N) = (A * F(N - 1) + B) \bmod P$$

Where SEED is some initial value between 0 and P-1 inclusive. After some tinkering she finds that for most values of **A**, **B**, and **P**, the generated numbers quickly fall into a repeating cycle. She'd like to figure out which values of **A**, **B**, and **P** produce the best results and has enlisted your help to find the average length of a cycle for one set of values.

Note: The cycle length for some value of SEED is defined as smallest value N for which $F(N)$ produces a number already in the sequence. For example, if $\text{SEED} = 1$, $F(1) = 2$, $F(2) = 3$, and $F(3) = 3$, then the cycle length is 3, as 3 was already in the sequence. The average length of a cycle is defined as the average of the cycle lengths for every possible value of SEED.

Input:

The first line of the input provides the number of test cases, **T** ($1 \leq T \leq 100$). **T** test cases follow. Each test case contains 3 integers, **A**, **B**, and **P** ($1 \leq A, B, P \leq 10^6$). For the first 20% of cases, **A**, **B**, **P** $\leq 10^3$.

Output:

For each test case, your program should output one real number, rounded to 6 decimal places, the average length of a cycle.

Sample Input:

```
2
3 2 5
4 5 3
```

Sample Output:

```
3.400000
3.000000
```

Explanation of Sample Input:

In the second test case, if you start with a SEED of 0, then

$$F(1) = 4(0) + 5 \bmod 3 = 2$$

$$F(2) = 4(2) + 5 \bmod 3 = 1$$

$$F(3) = 4(1) + 5 \bmod 3 = 0$$

Since 0 is already in the sequence, the cycle length is 3. Starting with 1 or 2 will also result in a cycle length of 3, so the average cycle length is 3.