Problem C. Income Tax Rate

Problem Description

Everyone dreams of making money, but although making money and having a steady income is fun, paying taxes is not fun. We live in a country (or a region 😏, based on your political preference) that adopts a progressive tax system, where the tax rate increases as the taxable amount increases.

The table below shows the tax rate ranges (tax brackets) in Taiwan:

綜合所得淨額	乘法	稅率
0~540,000	×	5%
540,001~1,210,000	×	12%
1,210,001~2,420,000	×	20%
2,420,001~4,530,000	×	30%
4,530,001~以上	×	40%

From National Taxation Bureau of Taipei, Ministry of Taiwan

The first column indicates the taxable income, where the third column shows the tax rates of the respective income range. For example, if you have a total income of NTD $\$600\,000$, then you'll have to pay $\$540\,000 \times 5\% + (\$600\,000 - \$540\,000) \times 12\% = \$34\,200$ in total.

Given the tax brackets of a country, can you calculate how much tax a person should pay according to one's income?

Input Format

On the first line there is an integer n, indicating how many ranges there are.

n lines follow, on each line there are two numbers a_i, r_i, where a_i is an integer indicating the least value of this range and r_i is a floating point number indicating the tax rate of this bracket.

On the next line, there is one integer m indicating the number of people.

The next m lines each gives one integer c_i, which is the income of the i^{th} person.

Output Format

Print one number in each line, the i^{th} number denotes the tax one should pay according to income c_i.

The answer will be considered correct if the relative or absolute error does not exceed $\epsilon = 10^{-6}$. (See the section below for further notes.)

Constraints

- $1 \le n \le 1000$.
- $0 \le a_1 < a_2 < \cdots < a_n \le 10^9$.
- $0 < r_1 < r_2 < \cdots < r_n < 1$.
- $1 \le m \le 10\,000$.
- $0 \le c_i \le 10^9$ for $i = 1, 2, \ldots, m$.
- All the inputs except r_i are integers.

Subtasks

1. (100 points) No additional constraints.

No.	Testdata Range	Time Limit (ms)	Memory Limit (KiB)
Samples	1-2	1000	262144
1	1-7	1000	262144

Samples

Sample Input 1

```
5
1 0.05
540001 0.12
1210001 0.2
2420001 0.3
4530001 0.4
3
1
600000
426410
```

Sample Output 1

```
0.05
34200.00
21320.50
```

For $c_1 = 1$, the income tax needed to be paid is \$0.05 since $0.05 = (1 - 0) \times 0.05$ is the least value in the first range.

For $c_2 = 600\,000$, the amount of tax paid is $\$34\,200$ since
$(540\,000 - 0) \times 0.05 + (600\,000 - 540\,000) \times 0.12 = 34\,200.$

Sample Input 2

```
3
1 0.4
101 0.45
501 0.55
3
1
10
100
```

Sample Output 2

```
0.4
4.0
40.0
```

Notes on Floating Points

As we all know, computers use floating point variables to store fractions and irrational numbers, and truncated or rounded errors occur due to the limited bits a variable can use to represent a value.These errors accumulate over multiple floating point calculations, with different methods or even just the order of calculation leading to different accuracies.

How to approximate the answer to it's closest is an interesting problem, but the task is often addressed in numerical analysis. In our course, we focus on getting the algorithm concepts right, so we tolerate some errors ϵ between the answer a and your output x. To do so, we use both **absolute** and **relative** errors to judge your answer.

The former calculates the difference $|x - a|$, so if your output is close enough to the judge's answer, it will be considered correct.

The latter divides the absolute error by the magnitude of the answer, which is $\left|\frac{x-a}{a}\right|$. This is often used when the original answer is a number too large to reach a decent absolute error, thus the answer will also be accepted if it differs a tiny ratio to the judge's answer.

For example, let's say the answer $a = 10\,000$ and the error tolerance is $\epsilon = 10^{-6}$. Considering the absolute value, all x satisfying $10\,000 - 10^{-6} \leq x \leq 10\,000 + 10^{-6}$ are accepted. From the relative error's perspective, all x meeting the conditions $\left|\frac{x-10\,000}{10\,000}\right| \leq 10^{-6}$ are taken as correct answers, lengthening the tolerance range to $[10\,000 - 10^{-2}, 10\,000 + 10^{-2}]$.

In short, if we tolerate an error of ϵ, then your output will be judged as correct if $\frac{|a-b|}{\max\{|a|,|b|,1\}} \leq \epsilon$.