How much does winning ACM depend on practice?

We assume that p, the probability that a given team will win a given contest, is related to n, the number of practice problems solved by the team prior to the contest. This relationship is modelled by the *logistic* formula

$$\log(p/(1-p)) = a + bn,$$

for some a and b. Your job is to find a and b such that the formula most accurately reflects a set of observed results.

Each observation consists of n and w. n is the number of practice problems solved by some team prior to a contest, and w is 1 if the team wins the contest, 0 if it does not.

Given a, b, and n the formula above may be used to compute p, the estimated probability that $w = 1$. The *likelihood* of a particular observation is p if $w = 1$ and $1 - p$ if $w = 0$; The likelihood of a set of observations is the product of the likelihoods of the individual observations.

You are to compute the *maximum likelihood estimate* for a and b. That is, the values of a and b for which the likelihood of a given set of observations is maximized.

Input

The input contains several test cases followed by a line contatining 0. Each test case begins with $1 < k \leq 100$, the number of observations that follow. Each observation consists of integers $0 \leq n \leq 100$ and $0 \leq w \leq 1$. The input will contain at least two distinct values of n and of w.

Output

For each test case, output a single line containing a and b, rounded to four digits to the right of the decimal.

Sample Input

```
20
0 0
0 0
0 0
0 0
1 0
1 0
1 0
1 1
2 0
2 0
2 1
2 1
3 0
3 1
3 1
3 1
4 1
4 1
4 1
4 1
0
```

Sample Output

```
-3.1748 1.5874
```