Problem H. Optimal Quadratic Function

Input file:	*standard input*
Output file:	*standard output*
Time limit:	10 seconds
Memory limit:	1024 mebibytes

Two variables x and y are dependent to each other with the relation $y = f(x)$ where f is a quadratic function: $f(x) = ax^2 + bx + c$ with some real numbers a, b, and c. However, the function f is unknown and you want to figure out its best estimation.

For that purpose, you have obtained N observed y-values $y_1, y_2, \ldots, y_N$ for x-values $x_1, x_2, \ldots, x_N$, respectively, by experiments. The observed values $y_1, y_2, \ldots, y_N$ contain some errors from several sources, so it is unlikely that all of them are exact function values for a certain quadratic function. Therefore, you need to find an optimal estimation of the function f that minimizes the error.

For any quadratic function f, the error of a data pair (x_i, y_i) is defined to be $(y_i - f(x_i))^2$, and the error of f is defined to be the maximum of these errors over all the N data pairs. Write a program that, given the N observed data pairs, finds out an optimal estimation of function f that minimizes the error and prints out the error value.

Input

The first line contains an integer T, the number of test cases ($1 \le T \le 100\,000$). The test cases follow.

The first line of each test case contains an integer N, the number of observed data pairs ($1 \le N \le 100\,000$).

Each of the next N lines contains two integers x_i and y_i, the i-th data pair ($-10^6 \le x_i, y_i \le 10^6$).

The sum of N over all test cases does not exceed 200 000.

Output

For each test case, print a line with a real number: the minimum possible error value.

The answer will be considered correct if its absolute or relative error is within 10^{-6}.

Example

standard input	*standard output*
1 4 0 0 1 3 2 9 3 0	5.062500000000