



acm International Collegiate  
Programming Contest



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## Shortest Leash

Input: Standard Input  
Output: Standard Output



John has a dog that he calls Euclid. During their daily walk in the park Euclid only runs a predictable distance parallel to each of a number of  $n$  distinct lines, once and only once, in a predictable order before returning back to him. Therefore, each segment of Euclid's run is a vector that is described by a pair of  $x$  and  $y$  displacements. Euclid may run in the direction of the vector or in the opposite direction (that is, displacement of  $-x$  and  $-y$ ).

John does not like to be dragged around and he would like to know the length of the shortest leash he has to buy for his dog. Your task is to help John by writing a program to compute the maximum distance John's dog can be located away from him.

### Input

The input contains a number of instances. Each instance starts with a line containing the integer  $n$ ,  $0 \leq n \leq 100$ . Each of the next  $n$  lines contains a pair of integers  $x_i$  and  $y_i$  that represents the  $i$ th vector.

The value of  $n$  equals zero indicates the end of input and should not be processed. The absolute values of all the coordinates are less than 1000.

## Output

For each test case, output consists of a single line that contains the maximum distance the dog can be away from John. The distance must be rounded and displayed as three decimal places.

### Reminder: Rounding a positive number R.xxyy to three decimal places

- If the fourth decimal place is less than 5, then the rounded value is R.xxx
- Otherwise, the rounded value is R.xxx + 0.001

Examples are: for the value of 10.3463 the output should be 10.346, and for the value of 10.3695 the output is either 10.37 or 10.370

Sample Input	Output for the Sample Input
3	3.000
1 1	5.099
0 1	37.336
-1 1	
2	
4 0	
1 1	
7	
1 3	
-2 -7	
7 8	
-2 9	
-7 -3	
4 -3	
-2 -2	
0	