Problem K
Kingdom of Hamsters

Near the great desert of Byteland lies a technologically advanced kingdom of hamsters. In the year 2020, to protect better their territories, the hamsters have decided to build a great wall surrounding crucial parts of their kingdom.

The kingdom of hamsters is represented by a **convex** polygon with n vertices. Vertices are numbered from 1 to n, either in clockwise or counter-clockwise order. The i-th vertex's coordinate is (x_i, y_i). The hamsters want to choose 6 unique vertices (among the n vertices) and build a **convex** hexagonal wall connecting these 6 vertices. Furthermore, the hamsters want their wall to be as long as possible. In other words, the hexagonal wall should have largest circumference.

The hamsters want to know, for each vertex of their kingdom, if they choose this vertex as one of the vertices of the hexagonal wall (along with 5 other vertices), what is the longest wall they can build?

Even though the hamsters are technologically advanced, their computers crashed when they executed a brute force code for this problem. Please help them!

Input

- The first line of the input contains a single integer n $(6 \leq n \leq 2\,000)$.
- In the next n lines, the i-th line contains two integers x_i and y_i $(-10^9 \leq x_i, y_i \leq 10^9)$.

Output

Print exactly n lines, the i-th line contains the maximum circumference of the convex hexagonal wall, such that the hexagon has the i-th vertex.

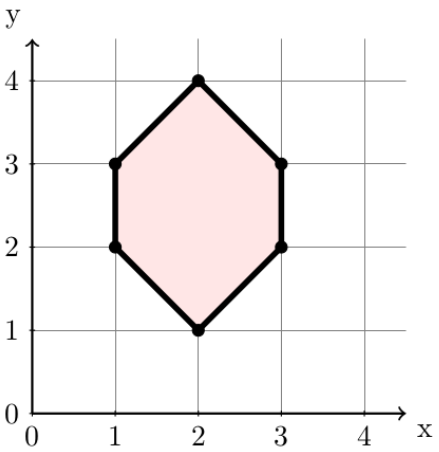
Your answer will be considered correct if its relative or absolute error doesn't exceed 10^{-3}.

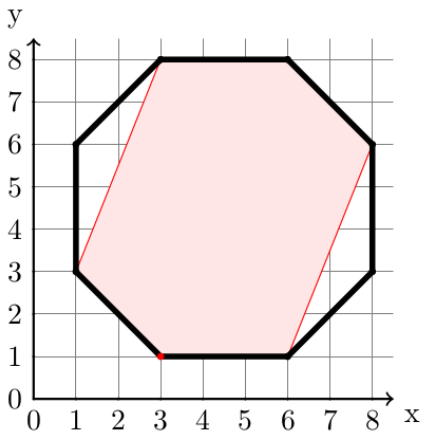
Namely: let's assume that your answer is a, and the answer of the jury is b. The checker program will consider your answer correct, if $\frac{|a-b|}{max(1,b)} \leq 10^{-3}$.

Explanation of the sample input

The left figure shows the first sample. There is only one way to create a convex hexagon. Its circumference is $2 + 4 \cdot \sqrt{2}$.

The right figure shows the second sample. The hexagon with the maximum circumference containing the first vertex is shown below. Its circumference is $6 + 2 \cdot \sqrt{29} + 4 \cdot \sqrt{2}$. Due to the symmetry of the polygon, the hexagons with the maximum circumference containing other vertices should have the same result.





Sample Input 1

```
6
1 2
1 3
2 4
3 3
3 2
2 1
```

Sample Output 1

```
7.656854249492381
7.656854249492381
7.656854249492381
7.656854249492381
7.656854249492381
7.656854249492381
```

Sample Input 2

```
8
3 1
6 1
8 3
8 6
6 8
3 8
1 6
1 3
```

Sample Output 2

```
22.42718386376139
22.42718386376139
22.42718386376139
22.42718386376139
22.42718386376139
22.42718386376139
22.42718386376139
22.42718386376139
```