

Impromptu Outdoor Gallery

Problem

The artist Cody-Jamal recently decided to out-hip all of his hipster friends by showing his latest paintings in an impromptu outdoor gallery. He is going to show up in a field, put up some paintings, and display them.

The field has N posts in it, with no subset of 3 of them being collinear (which also implies that no two posts are in the same place). Cody-Jamal is going to choose four of them — call them p_1 , p_2 , p_3 , and p_4 . He will then string velvet ropes between p_1 and p_2 , p_2 and p_3 , p_3 and p_4 , and finally, p_4 and p_1 . He must choose the four ordered posts such that no two ropes cross, effectively forming a [simple quadrilateral](#) $p_1p_2p_3p_4$. The quadrilateral may be convex or concave. He will then hang his paintings inside the perimeter delimited by the ropes.

To attract wealthy art lovers that might purchase his paintings, Cody-Jamal is hiring waitstaff to go around and serve refreshments to visitors. The cost of the refreshments is fixed, but the cost of the waitstaff is proportional to the area they will have to walk. Specifically, they charge 2 artcoins per square meter. Therefore, Cody-Jamal wants to choose p_1 , p_2 , p_3 and p_4 to minimize the area of the quadrilateral $p_1p_2p_3p_4$, and thus minimize the cost (in artcoins) of the refreshments service. What is the minimum such cost?

Input

The first line of the input gives the number of test cases, T . T test cases follow. Each test case begins with a line containing a single integer N : the number of posts in the field. N more lines follow, each containing two integers X_i and Y_i , representing the coordinates, in meters from an arbitrary origin, of the i -th post.

Output

For each test case, output one line containing `Case #x: y`, where x is the test case number (starting from 1) and y is the minimum number of artcoins Cody-Jamal will have to pay — or, in other words, twice the area (in square meters) of a smallest simple quadrilateral that has four of the input points as vertices.

Limits

Memory limit: 1GB.

$-10^9 \leq X_i \leq 10^9$, for all i .

$-10^9 \leq Y_i \leq 10^9$, for all i .

No three points in the input are collinear.

Test set 1 (Visible Verdict)

Time limit: 20 seconds.

$1 \leq T \leq 50$.

$4 \leq N \leq 25$.

Test set 2 (Hidden Verdict)

Time limit: 60 seconds.

$1 \leq T \leq 30$.

$4 \leq N \leq 1200$.

Sample

Input	Output
4	
4	
-5 5	
-5 -5	
5 5	
5 -5	
5	
-5 5	
-5 -5	
5 5	Case #1: 200
5 -5	Case #2: 30
4 2	Case #3: 31
5	Case #4: 80000000000000000000
-5 5	
-5 -4	
5 5	
5 -5	
4 2	
4	
-1000000000 -1000000000	
-1000000000 1000000000	
1000000000 -1000000000	
1000000000 1000000000	

In Case #1, there are only 4 points in the input, and the only orderings that can be chosen to form a simple quadrilateral yield a square of side length 10.



In Cases #2 and #3, an optimal choice is to leave the first point out and use the last four, in the order given in the input.

