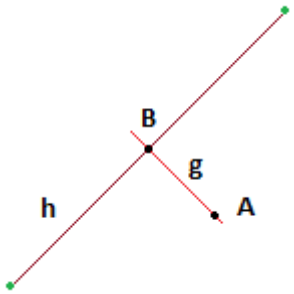
Geometry

SEASON 6 – ROUND 5

After immersing himself in the depths of Algebra, now Ivancho want to explore Geometry.

Ivancho is given N points in a two-dimensional Cartesian coordinate system. On each of them he can apply the following operations:

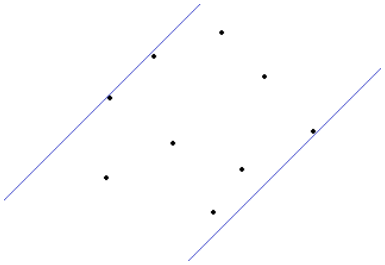
1. We choose two points A and B with different coordinates and apply homothety on point B with center point A and coefficient ±2. As a result, the vector $\overrightarrow{AB}$ is replaced with vector $\overrightarrow{AB'} = k.\overrightarrow{AB}$, where k = ±2. The cost of this operation is 1 if k = 2 and 6 if k = -2.
2. We choose two points A and B with different coordinates. The line defined by A and B is called g. The line which is perpendicular to g and lies on point B is called h. Point A is removed and two new points appear. These points are placed on h and are 2.d distance away from point B, where d is the distance between A and B. The cost of this operation is 3.



3. We are given a stack of points. The operation involves choosing a point which will be replaced with the point on top of the stack. After that the top point is removed from the stack. We can do this while the stack is not empty. The cost of this operation is 15.

Ivancho's purpose is to place the points as close to each other as possible by applying these operations. In order to define the notion "closeness", we set an angle α and find two parallel lines such that the angle between them and Ox is α. Moreover, these lines have all points lying between them and are the closest (minimal distance away from each other) with this property.

Below we can see an example of such lines, where α = π / 4.



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The given plane is a rectangle with bottom left corner (0, 0) and top right corner (1000, 700) and so after operations 1 and 2 a point can leave it. After a point has left the plane it "disappears" and is no longer of interest. However, this adds penalty points to the result. The maximal number of disappeared points is 20.

Ivancho asks you to describe a strategy for application of the operations, which would receive a minimal result. The result is computed as follows:

$$result = 25\left(dist + \frac{1}{100}\left(\frac{e}{2}\right)^{x}(dist+1)\right) + cost * \frac{dist+1}{50},$$

where **dist** is the distance between the lines, **cost** is the cost of the operations used, **x** is the number of disappeared points, **e** is a constant 2,71.

Input

The first line of the input file `geometry.in` contains the integer N – the number of points. The next N lines contain one pair of integers – the coordinates of the points. On a new line the number M is given – the number of points on the stack. The following M lines describe the coordinates of the points in the stack – two integers on each line. The order of the points corresponds to their order from bottom to top in the stack.

Output

On the first line of the output file `geometry.out` output the number of operations which will be applied (must not exceed 10 000).

Describe each operation on a separate line in the following format: <*operation number*> <*coefficient*> <*first point*> <*second point*>. The field *coefficient* is used only for operation 1 and operation 3 does not require the field *second point*. The fields *first point* and *second point* are pairs of coordinates.

On the last line write a rational number α between 0 and π – the angle you choose for the lines (in radians). Output the number with no more than 8 characters total.

Evaluation

You will receive 0 points if:

- After the operations you cause more than 20 disappeared points;
- You do more than 10 000 operations;
- You apply some operation on a non-existing or disappeared point;
- You do not follow the output format.

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Otherwise, you will receive $100.\left(\frac{minScore+1}{yourScore+1}\right)^2$ percent of the points for the current test. We define yourScore as the result of your program for the current test and minScore as the minimal result among all contestants for this test.

Constraints

The number of points in the plane does not exceed 100;
The number of points in the stack does not exceed 20;
Every point has integer coordinates and lies on the plane.
You are allowed at most 20 disappeared points.
You are allowed at most 10 000 operations.

Time limit: 5 sec
Memory limit: 256 MB

Test patterns

In some tests the points are generated randomly and in others the points are divided into groups. The groups are clusters of points and there are no points the space between these clusters. The points on the stack are generated randomly.

Number of test cases	Test type	Number of groups	Number of points on the plane	Number of points on the stack
5	Random	-	15	5
15	Random	-	25	10
10	Random	-	30	10
10	In groups	5	30	10
10	In groups	7	50	10
10	Random	-	60	10
15	In groups	5	90	15

15	In groups	10	100	20
10	Random	-	100	20

Visualizer

On the Tasks page you can find a program which simulates visually the behavior of your solution, accompanied by instructions for usage. There, you can also find an example test.