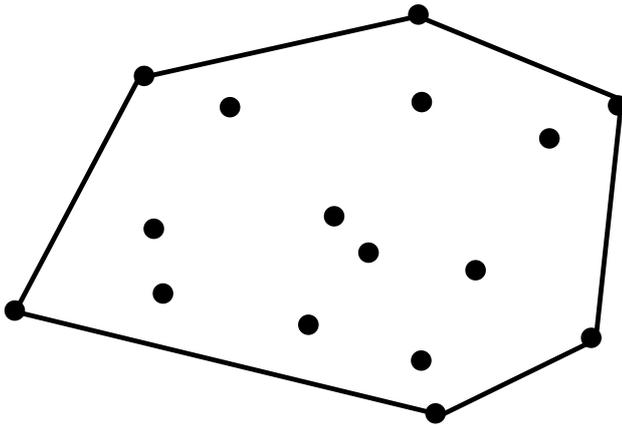


218 Moth Eradication

Entomologists in the Northeast have set out traps to determine the influx of Jolliet moths into the area. They plan to study eradication programs that have some potential to control the spread of the moth population.

The study calls for organizing the traps in which moths have been caught into compact regions, which will then be used to test each eradication program. A region is defined as the polygon with the minimum length perimeter that can enclose all traps within that region. For example, the traps (represented by dots) of a particular region and its associated polygon are illustrated below.



You must write a program that can take as input the locations of traps in a region and output the locations of traps that lie on the perimeter of the region as well as the length of the perimeter.

Input

The input file will contain records of data for several regions. The first line of each record contains the number (an integer) of traps for that region. Subsequent lines of the record contain 2 real numbers that are the x - and y -coordinates of the trap locations. Data within a single record will not be duplicated. End of input is indicated by a region with 0 traps.

Output

Output for a single region is displayed on at least 3 lines:

First line: The number of the region. (The first record corresponds to **Region #1**, the second to **Region #2**, etc.)

Next line(s): A listing of all the points that appear on the perimeter of the region. The points must be identified in the standard form “ $(x\text{-coordinate},y\text{-coordinate})$ ” rounded to a single decimal place. The starting point for this listing is irrelevant, but the listing must be oriented *clockwise* and *begin and end with the same point*. For collinear points, any order which describes the minimum length perimeter is acceptable.

Last line: The length of the perimeter of the region rounded to 2 decimal places.

One blank line must separate output from consecutive input records.

Sample Input

```
3
1 2
4 10
5 12.3
6
0 0
1 1
3.1 1.3
3 4.5
6 2.1
2 -3.2
7
1 0.5
5 0
4 1.5
3 -0.2
2.5 -1.5
0 0
2 2
0
```

Sample Output

Region #1:

(1.0,2.0)-(4.0,10.0)-(5.0,12.3)-(1.0,2.0)

Perimeter length = 22.10

Region #2:

(0.0,0.0)-(3.0,4.5)-(6.0,2.1)-(2.0,-3.2)-(0.0,0.0)

Perimeter length = 19.66

Region #3:

(0.0,0.0)-(2.0,2.0)-(4.0,1.5)-(5.0,0.0)-(2.5,-1.5)-(0.0,0.0)

Perimeter length = 12.52