

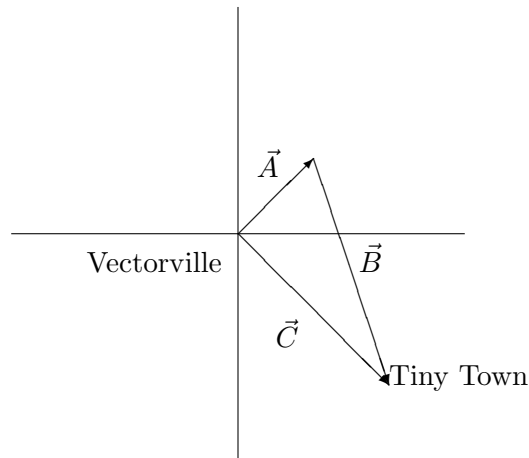
CALIFORNIA STATE UNIVERSITY, LOS ANGELES

PROGFEST 2012

Problem 2

Nautical Navigation

The Navy of Vectorville is looking to change the way it handles navigation. Due to recent treaties with their neighbor Polarpolis, new waterways have opened up that could significantly reduce the time it takes to move from one point to another. For example, to reach Tiny Town, Vectorville's Navy previously had to use Route \vec{A} followed by Route \vec{B} . Now, they can directly use Route \vec{C} (see below).



Each route is represented as a series of vectors, specified by its x and y components of shift. For example, Route \vec{A} above is $\langle 1, 1 \rangle$ and Route \vec{B} is $\langle 1, -3 \rangle$. Vectorville is interested in determining the new, shorter Route \vec{C} and the amount of distance saved for using this new route.

However, in return for access to the waterways, Polarpolis has demanded Vectorville to use their standard of navigation. Thus, instead of representing Route \vec{C} and other new routes through their x and y components, they must now be specified by angle (from the positive x-axis) and magnitude.

Your input to the program will come from a text file specified as a command line argument. Each line will consist of a vector (whitespace separated x, y pair) representing part of the path. A "0" will be used to separate one path from another, and the EOF will signify the end of input.

For each path given, your program must output the shortest route to the final coordinate, using the Polarpolis convention, as well as the distance saved on a new line. These values must be separated by a single whitespace, with the angle in radians from 0 to 2π coming first, followed by the magnitude, and finally the distance saved. Each value must be rounded to 4 decimal digits. The sample input below is for the path above, as well as one more.

SAMPLE INPUT:

```
1 1
1 -3
0
-3 4
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6 0

SAMPLE OUTPUT:

5.4978 2.8284 1.7481

0.9273 5.0000 6.0000