E - Closest Moment   Editorial (/contests/abc426/tasks/abc426_e/editorial)   🇯🇵 / 🇬🇧

Time Limit: 3 sec / Memory Limit: 1024 MiB

Score : 450 points

Problem Statement

Takahashi and Aoki walk on a two-dimensional plane.

Takahashi's start point is (TS_X, TS_Y) and goal point is (TG_X, TG_Y). Aoki's start point is (AS_X, AS_Y) and goal point is (AG_X, AG_Y).

They simultaneously depart from their respective start points and walk straight toward their respective goal points at speed 1, and stop when they reach their respective goal points. (Note that they depart simultaneously, but they do not necessarily stop at the same time.)

Find the distance between them at the moment when the distance between them is shortest (including the moment they depart and after they stop).

Here, distance refers to Euclidean distance. That is, the distance between two points $(x_1, y_1), (x_2, y_2)$ is defined as $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$.

You are given T test cases, so solve each of them.

Constraints

- $1 \le T \le 2 \times 10^5$
- $-100 \le TS_X, TS_Y, TG_X, TG_Y, AS_X, AS_Y, AG_X, AG_Y \le 100$
- $(TS_X, TS_Y) \ne (TG_X, TG_Y)$

- $(AS_X, AS_Y) \neq (AG_X, AG_Y)$
- All input values are integers.

Input

The input is given from Standard Input in the following format:

$$T$$
$$\text{case}_1$$
$$\text{case}_2$$
$$\vdots$$
$$\text{case}_T$$

case_i represents the i-th test case. Each test case is given in the following format:

$$TS_X \quad TS_Y \quad TG_X \quad TG_Y$$
$$AS_X \quad AS_Y \quad AG_X \quad AG_Y$$

Output

Output T lines. The i-th line $(1 \leq i \leq T)$ should contain the answer for the i-th test case.

Your answer will be considered correct if the absolute or relative error from the true value is at most 10^{-6}.

Sample Input 1 Copy

```
4
0 0 -2 2
-1 -1 4 4
4 0 2 0
6 0 8 0
1 0 1 1
-1 0 1 1
-8 9 2 6
-10 -10 17 20
```

Sample Output 1 Copy

```
1.000000000000000
2.000000000000000
0.000000000000000
1.783905950993199
```

For the first test case, let time 0 be the moment they depart. Their behavior is as follows:

- Time 0: Takahashi departs from $(0, 0)$ and starts walking toward $(-2, 2)$ at speed 1. At the same time, Aoki departs from $(-1, -1)$ and starts walking toward $(4, 4)$ at speed 1.
- Time $2\sqrt{2}$: Takahashi reaches his goal point $(-2, 2)$ and stops. At this time, Aoki is at $(1, 1)$ and is still walking.
- Time $5\sqrt{2}$: Aoki reaches his goal point $(4, 4)$ and stops.

The distance between them is shortest at time $\frac{1}{\sqrt{2}}$, when Takahashi and Aoki are at $\left(-\frac{1}{2}, \frac{1}{2}\right)$ and $\left(-\frac{1}{2}, -\frac{1}{2}\right)$ respectively, and the distance is 1.

For the second test case, the distance between them is shortest at the moment they depart, and the distance at that time is 2.

For the third test case, the distance between them is shortest after they both stop, and the distance at that time is 0.

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