# Convex Hull of Intersections

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | 2 seconds |
| Memory limit: | 1024 megabytes |

There are $N$ lines on the $xy$-plane. The $i$-th line $\ell_i$ is represented by the equation $a_i x + b_i y + c_i = 0$. Let $P$ be the set of all intersection points among these lines, defined as follows:

$$P = \{p \in \mathbb{R}^2 \mid \exists i, j \in \{1, 2, \ldots, N\} \text{ s.t. } p \in \ell_i,\ p \in \ell_j,\ i \neq j\}.$$

Find the area of the convex hull of $P$. If the convex hull is empty, a single point, or a line segment, the area is considered to be 0.

You have $T$ test cases; solve each of them.

### Definition of the convex hull

The convex hull $\mathrm{conv}(S)$ of a finite set $S = \{x_1, \ldots, x_{|S|}\}$ is defined as follows:

$$\mathrm{conv}(S) = \left\{ \sum_{i=1}^{|S|} \alpha_i x_i \;\middle|\; \sum_{i=1}^{|S|} \alpha_i = 1,\ 0 \leq \alpha_i \leq 1 \right\}.$$

## Input

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

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

Each test case is given in the following format:

$N$
$a_1\ b_1\ c_1$
$a_2\ b_2\ c_2$
$\vdots$
$a_N\ b_N\ c_N$

- $1 \leq T$
- $2 \leq N \leq 10^4$
- $|a_i|, |b_i|, |c_i| \leq 10^3$
- $a_i \neq 0$ or $b_i \neq 0$.
- Any two lines $\ell_i$ and $\ell_j$ are distinct ($i \neq j$).
- The total sum of $N$ over all test cases does not exceed $2 \times 10^5$.
- All inputs values are integers.

## Output

Output $T$ lines. The $i$-th line should contain the answer for the $i$-th test case.

Your output will be considered correct when its absolute or relative error from actual answer is at most $10^{-5}$.

## Example

| standard input | standard output |
|---|---|
| 3<br>4<br>1 -1 -2<br>3 3 -6<br>-1 2 -4<br>1 2 4<br>3<br>3 0 5<br>5 0 18<br>1 0 7<br>3<br>314 159 -1<br>313 158 -1000<br>315 160 999 | 72.0<br>0<br>0.0016129032 |

## Note

In the first example, the convex hull of $P$ forms a triangle connecting the points $(8, 6), (-4, 0)$ and $(8, -6)$ in this order, with an area of 72.

In the second example, since all three lines are parallel, $P = \emptyset$, meaning the convex hull has an area of 0.