Problem A. Equation

Input file:	`equation.in`
Output file:	`equation.out`
Time limit:	2 seconds
Memory limit:	256 mebibytes

Given an equation of the form $X^N + Y^N \equiv Z^N \mod M$.

You are to find a number of different solutions to this equation for fixed N and M. The solution is such three integers (X, Y, Z) that:

- $1 \le X \le Y < M$
- $1 \le Z < M$
- $X^N + Y^N \equiv Z^N \mod M$

Input

In the first line of input file there are integers N and M ($1 \le N \le 7^7$, $1 \le M \le 7^7$).

Output

Output one integer — answer to the problem.

Examples

equation.in	equation.out
1 3	2
2 4	5
3 5	8

Problem B. Discrete Logarithm

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Given prime module p and numbers a, b. Find smallest non-negative x such that $a^x = b \mod p$.

Input

Input contains a, b, p ($1 \le a, b \le p < 10^9$, p is prime).

Output

Output smallest non-negative x if exist. Otherwise output -1

Example

standard input	standard output
2 3 13	4

Problem C. Finding Sum

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 second
Memory limit:	16 megabytes

Given prime module p and integer n. Let $1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}$ be equal $\frac{A}{B}$.

Find $A \cdot B^{-1}$ modulo p

Input

Input contains two numbers n and p ($1 \le n \le 10^7$, $n < p < 10^9$, p is prime)

Output

Output the result

Examples

standard input	standard output
1 2	1
7 13	9

Problem D. Smallest Primitive Root

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Given prime number p, find it's smallest primitive root.

Note: g is primitive root if numbers $g^0, g^1, \ldots, g^{p-1}$ modulo p are a permutation of $1, 2, \ldots, p-1$

Input

Input contains prime number $p < 10^9$.

Output

Output smallest positive primitive root of p

Example

standard input	standard output
7	3

Problem E. Give the Parabellum away

Input file:	`standart input`
Output file:	`standart output`
Time limit:	2 seconds
	3 seconds (for Java)
Memory limit:	256 megabytes

Ostap is strolling leisurely along the Yessentuki-Moscow route, and scuttling along him is Kislarsky, begging to take his Parabellum away. Kislarsky keeps distance to Ostap strictly constant. Also he keeps constant his speed relative to the ground. He is moving counterclockwise relative to Ostap. Ostap's velocity stays constant (both direction and magnitude-wise).

Help Kislarsky to get away from the Alliance of the Sword and Ploughshare. Find the coordinates of the points where he will be in the given time moments t_i.

Input

The first line of the input file contains eight integers: p_x, p_y, q_x, q_y, u_x, u_y, v, N, where:

p_x, p_y — the location of Ostap in the initial moment ($|p_x|, |p_y| \le 10^4$),

q_x, q_y — the location of Kislarsky in the initial moment ($|q_x|, |q_y| \le 10^4$),

u_x, u_y — the projections of Ostap's velocity upon the coordinate axes OX and OY respectively ($|u_x|, |u_y| \le 10$),

v — the speed of Kislarsky relative to the ground ($\sqrt{u_x^2 + u_y^2} + \frac{1}{2} < v \le 10$),

N — the number of time moments when the location of Kislarsky is of interest ($1 \le N \le 100\,000$). The second line contains N real numbers t_i – the moments in time for which the location of Kislarsky must be found ($0 \le t_i \le 1000$). All numbers t_i are provided with at most five digits after decimal point.

It is guaranteed that initial locations of Ostap and Kislarsky are different.

Output

The output file must contain N pairs of real numbers (two per line): X and Y coordinates of Kislarsky's location at the time moment t_i.

The absolute or relative error of each number must not exceed 10^{-5}.

Example

standart input	standart output
2 3 4 5 1 1 2 10 1 2 3 4 5 6 7 8 9 10.00	3.311667781 6.811203158 1.618058050 6.525238521 2.396313856 4.895093459 4.356603786 4.697990251 6.268584256 5.267779107 8.050839947 6.172029827 9.724368272 7.265902232 11.304988035 8.490616365 12.800188718 9.818413289 14.210788762 11.235796766

Problem F. Chinese Remainder Theorem

Input file:	`crt.in`
Output file:	`crt.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

You are given relatively prime numbers $m_1, m_2, \ldots m_k$. Find the number a such that $a \bmod m_i = a_i$.

Input

The first line of the input file contains k ($1 \le k \le 100$). The second line contains k integer numbers: m_i. All m_i are relatively prime, $2 \le m_i \le 10^9$. The third line contains k integer numbers a_i ($0 \le a_i < m_i$).

Output

Output one number a. Output the smallest possible non-negative answer.

Example

crt.in	crt.out
2 3 5 1 2	7