Project Euler #216: Investigating the primality of numbers of the form 2n² - 1



This problem is a programming version of Problem 216 from projecteuler.net

Consider three integers a, b and c where a > 0, $\gcd(a, b, c) = 1$ and $b^2 - 4ac$ is not the square of an integer.

Let the second degree polynomial $P = aX^2 + bX + c$. In this challenge, we will be interested in the prime values of P(n) for integers $n \ge 0$.

E.g. with a = 2, b = 0 and c = -1, the first such numbers are 7, 17, 31, 49, 71, 97, 127 and 161.

How many numbers P(n) are prime for $0 \le n \le N$?

Input Format

The first line of each test case contains three space-separated integers a, b and c. The second line contains a single integer q which is the number of queries. Each of the next q lines contains a value of N.

Constraints

- $1 \le q \le 10^5$.
- $a \in \{1, 2\}$.
- $|b| \leq 100$.
- $|c| \le 10^7$.
- ullet $\gcd(a,b,c)=1$ and b^2-4ac is not a perfect square.
- $0 \le N \le 10^7$.

Output Format

Print the answer to each query in a new line.

Sample Input 0

Sample Output 0

7

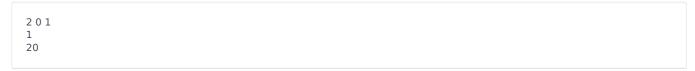
Explanation 0

The values of $P(n)=2n^2-1$ for $0\leq n\leq 10$ are :

$$[-1, 1, 7, 17, 31, 49, 71, 97, 127, 161, 199]$$

Only [7, 17, 31, 71, 97, 127, 199] are prime. Hence the answer is 7.

Sample Input 1



Sample Output 1

4

Explanation 1

The evaluation of $P(n)=2n^2+1$ for $0\leq n\leq 20$ yields to :

$$[1, 3, 9, 19, 33, 51, 73, 99, 129, 163, 201, 243, 289, 339, 393, 451, 513, 579, 649, 723, 801]$$

The prime values in this list are [3, 19, 73, 163]. Therefore the answer is 4.

Sample Input 2

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1 0 1
1
13
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Sample Output 2

5

Explanation 2

There exist 5 prime numbers of the form n^2+1 where $0\leq n\leq 13$: [2,5,17,37,101].