Dying Polynomial

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	256 megabytes

In the land of the four nations there lived many cubic polynomials. Each polynomial i is identified by its 4 terms, A_i, B_i, C_i, D_i

Unfortunately, due to COVID-19, Q polynomials fell sick!

Wallaby could not stand this, and he enlisted the help of LONG LONG MAN. Fortunately, LONG LONG MAN developed a magic potion that could heal any polynomial. Hooray! However, due to the intricate and delicate nature of polynomial bodies, a specific variant of the potion must be given to each polynomial.

LONG LONG MAN has 100000 different variants of the potion, labelled from 1 to 100000. Each polynomial i must be given a specific potion variant x_i. x_i **is the smallest positive integer**, such that $A_i x_i^3 + B_i x_i^2 + C_i x_i >= D_i$.

Unfortunately, LONG LONG MAN is not good at Math. Can you help him create a program to compute which potion variant has to be given to each polynomial?

IMPORTANT NOTE
If you are using C++ cin/cout, remember to add "ios_base::sync_with_stdio(0); cin.tie(0); cout.tie(0);"as the first line in "int main()". This code will speed up input and output and prevent your solution from incorrectly being graded as TLE due to the large input size.

Input

The first line of input will contain 1 integer, Q, the number of polynomials.
The next Q lines of input will each contain 4 integers representing each polynomial, with the i th line containing A_i, B_i, C_i and D_i.

Output

For each polynomial i, output x_i, the smallest positive integer, such that $A_i x_i^3 + B_i x_i^2 + C_i x_i >= D_i$.

Scoring

For all subtasks:

- $1 \leq A_i, B_i, C_i \leq 100$
- $0 \leq D_i \leq 10^{15}$
- The answer x_i is guaranteed to be a positive integer less than 10^5 $(1 \leq x_i \leq 100000)$

Subtask	Additional Constraints	Points
1	$D_i = 0$	5
2	$Q = 1$	10
3	$1 \leq Q \leq 15$	15
4	$1 \leq Q \leq 500000$	70

Example

standard input	standard output
3 1 1 1 9 1 2 3 306 54 35 36 17928	2 6 7

Note

For the first polynomial, $1(1^3) + 1(1^2) + 1(1) = 3$ and $1(2^3) + 1(2^2) + 1(2) = 14$, hence 2 is the answer.

For the second polynomial, $1(5^3) + 2(5^2) + 3(5) = 190$ and $1(6^3) + 2(6^2) + 3(6) = 306$, hence 6 is the answer.

For the third polynomial, $54(6^3) + 35(6^2) + 36(6) = 13140$ and $54(7^3) + 35(7^2) + 36(7) = 20489$, hence 7 is the answer.