Tower Breakers - The Final Battle

HackerRank

Our unsung tower-breaking heroes (players P_1 and P_2) only have one tower left, and they've decided to break it for a special game commemorating the end of 5 days of Game Theory! The rules are as follows:

- P_1 always moves first, and both players always move optimally.
- Initially there is 1 tower of height N.
- The players move in alternating turns. The moves performed by each player are different:
  1. At each turn, P_1 divides the current tower into some number of smaller towers. If the turn starts with a tower of height H and P_1 breaks it into $x \geq 2$ smaller towers, the following condition must apply: $H = h_1 + h_2 + \ldots + h_x$, where h_i denotes the height of the i^{th} new tower.
  2. At each turn, P_2 chooses some tower k of the x new towers made by P_1 (where $1 \leq k \leq x$). Then P_1 must pay k^2 coins to P_2. After that, P_1 gets another turn with tower h_k and the game continues.
- The game is over when no valid move can be made by P_1, meaning that $H = 1$.
- P_1's goal is to pay as few coins as possible, and P_2's goal is to earn as many coins as possible.

Can you predict the number of coins that P_2 will earn?

Input Format

The first line contains a single integer, T, denoting the number of test cases.
Each of the T subsequent lines contains a single integer, N, defining the initial tower height for a test case.

Constraints

- $1 \leq T \leq 100$
- $2 \leq N \leq 10^{18}$

Output Format

For each test case, print a single integer denoting the number of coins earned by P_2 on a new line.

Sample Input

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3
4
2
7
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Sample Output

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6
4
8
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Explanation

Test Case 0:
Our players make the following moves:

1. $H = N = 4$
   1. P_1 splits the initial tower into 2 smaller towers of sizes 3 and 1.
   2. P_2 chooses the first tower and earns $1^2 = 1$ coin.
2. $H = 3$
   1. P_1 splits the tower into 2 smaller towers of sizes 2 and 1.
   2. P_2 chooses the first tower and earns $1^2 = 1$ coin.
3. $H = 2$
   1. P_1 splits the tower into 2 smaller towers of size 1.
   2. P_2 chooses the second tower and earns $2^2 = 4$ coins.

The total number of coins earned by P_2 is $1 + 1 + 4 = 6$, so we print 6 on a new line.