Problem 1002. Jo loves counting

Jo loves his teammate Ky's rick and roll! But he more than loves counting.

Jo thinks, for two numbers n and d (d is a factor of n), $d \in Good_n$ if and only if the prime factor set of d **equals** to that of n. That is, $Good_n = \{d \mid n \bmod d = 0 \wedge \forall p \in Prime \to (d \bmod p = 0 \leftrightarrow n \bmod p = 0)\}$.

For example, $Good_{12} = \{6, 12\}$, since the factors of 12 are $\{1, 2, 3, 4, 6, 12\}$. $\{2, 3\}$ are prime factors of 12, so all its factors of their good factors must contain prime factors $2, 3$. Therefore, only $6, 12$ satisfy the condition.

For a number n, Jo will select a factor d randomly from $Good_n$ with equal possibility. if $d = n$, then the rich Jo will pay you n yuan as reward. Otherwise, you will gain nothing.

Ky, the man who treats money as dirt, wants to choose an integer from $[1, M]$ randomly for Jo's game. Help Ky calculate the expectation of money he can get.

Input

The first line contains an integer $T(T \leq 12)$. Then T test cases follow.

For each test case, there is only one integer $M(1 \leq M \leq 10^{12})$.

It's guaranteed that there are at most 6 cases such that $M > 10^6$.

Output

For each test case, output one integer in a single line --- the expectation of the money Ky can get.

Since it can be too large, print it modulo $4179340454199820289 (= 29 \cdot 2^{57} + 1)$.

Example Input

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1
4
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Example Output

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2
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Hint

$Good_1 = \{1\}$

$Good_2 = \{2\}$

$Good_3 = \{3\}$

$Good_4 = \{2, 4\}$

Therefore, the answer is $\frac{1}{4}(\frac{1}{|Good_1|} + \frac{2}{|Good_2|} + \frac{3}{|Good_3|} + \frac{4}{|Good_4|}) = \frac{1}{4}(\frac{1}{1} + \frac{2}{1} + \frac{3}{1} + \frac{4}{2}) = 2.$