Project Euler #153: Investigating Gaussian Integers

This problem is a programming version of Problem 153 from projecteuler.net

As we all know the equation $x^2 = -1$ has no solutions for real x.
If we however introduce the imaginary number i this equation has two solutions: $x = i$ and $x = -i$.
If we go a step further the equation $(x-3)^2 = -4$ has two complex solutions: $x = 3 + 2i$ and $x = 3 - 2i$.
$x = 3 + 2i$ and $x = 3 - 2i$ are called each others' complex conjugate.
Numbers of the form $a + bi$ are called complex numbers.
In general $a + bi$ and $a - bi$ are each other's complex conjugate.

A Gaussian Integer is a complex number $a + bi$ such that both a and b are integers.
The regular integers are also Gaussian integers (with $b = 0$).
To distinguish them from Gaussian integers with $b \neq 0$ we call such integers "rational integers."
A Gaussian integer is called a divisor of a rational integer n if the result is also a Gaussian integer.
If for example we divide 5 by $1 + 2i$ we can simplify in the following manner:

Multiply numerator and denominator by the complex conjugate of $1 + 2i$: $1 - 2i$. The result is
$\frac{5}{1+2i} = \frac{5}{1+2i}\frac{1-2i}{1-2i} = \frac{5(1-2i)}{1-(2i)^2} = \frac{5(1-2i)}{1-(-4)} = \frac{5(1-2i)}{5} = 1 - 2i$
So $1 + 2i$ is a divisor of 5.
Note that $1 + i$ is not a divisor of 5 because $\frac{5}{1+i} = \frac{5}{2} - \frac{5}{2}i$.
Note also that if the Gaussian Integer $(a + bi)$ is a divisor of a rational integer n, then its complex conjugate $(a - bi)$ is also a divisor of n.

In fact, 5 has six divisors such that the real part is positive: $\{1, 1 + 2i, 1 - 2i, 2 + i, 2 - i, 5\}$.

The following is a table of all of the divisors for the first five positive rational integers:

n	Gaussian integer divisors with positive real part	Sum s(n) of these divisors
1	1	1
2	1, 1+i, 1-i, 2	5
3	1, 3	4
4	1, 1+i, 1-i, 2, 2+2i, 2-2i,4	13
5	1, 1+2i, 1-2i, 2+i, 2-i, 5	12

For divisors with positive real parts, then, we have $\sum_{n=1}^{5} s(n) = 35$.

For $1 \leq n \leq 10^5$, $\sum s(n) = 17924657155$.

What is $\sum s(n)$ for $1 \leq n \leq N$?

Input Format

First and only line of each test file contains a single integer N.

Constraints

- $1 \leq N \leq 2 \times 10^8$

Output Format

Output the only integer - the answer to the problem.

Sample Input

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5
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Sample Output

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35
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