A Special Contest on Christmas Eve

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A	Internet service providers
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Recommended by H. Wu @ 2012/12/24

A. Internet service providers

Description

A group of ***N*** Internet Service Provider companies (ISPs) use a private communication channel that has a maximum capacity of ***C*** traffic units per second. Each company transfers ***T*** traffic units per second through the channel and gets a profit that is directly proportional to the factor ***T***(***C*** - ***TN***). The problem is to compute ***T_optim***, the smallest value of ***T*** that maximizes the total profit the ***N*** ISPs can get from using the channel. Notice that ***N***, ***C***, ***T***, and ***T_optim*** are integer numbers.

Input

Each data set corresponds to an instance of the problem above and contains two integral numbers ***N*** and ***C*** with values in the range from 0 to 10^9. The input data are separated by white spaces, are correct, and terminate with an end of file.

Output

For each data set the program computes the value of ***T_optim*** according to the problem instance that corresponds to the data set.

Sample Input	Sample Output
1 0 0 1 4 3 2 8 3 27 25 1000000000	0 0 0 2 4 20000000

B. Last digit

Description

Determine the last nonzero digit in value of expression:

$$C_n^m = \frac{n!}{m!\,(n-m)!}$$

Input

Each case contains a single line with ***n*** and ***m*** separated by one or several spaces; ***n***, ***m*** are integers from 0 to 1,000,000 (inclusive), ***n*** > 0 and ***n*** $\geq$ ***m*** $\geq$ 0.

Output

Each case contains a single line with the last nonzero digit.

Sample Input	Sample Output
4 2	6

C. Ones

Description

Given any integer $0 \leq n \leq 10{,}000$ not divisible by 2 or 5, some multiple of ***n*** is a number which in decimal notation is a sequence of 1's. How many digits are in the smallest such a multiple of ***n***?

Input

Each line contains a number ***n***.

Output

Output the number of digits.

Sample Input	Sample Output
3 7 9901	3 6 12

D. Volume

Description

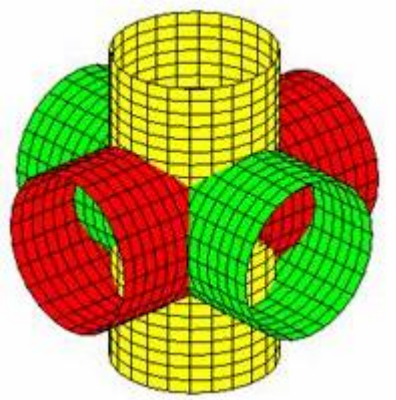
In the three-dimensional space, there are three different shapes, of which equations are as follows.

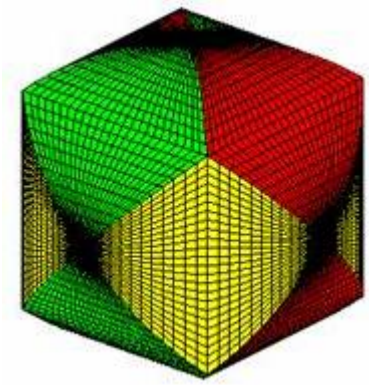
$$S_1: x^2 + y^2 = R^2$$

$$S_2: x^2 + z^2 = R^2$$

$$S_3: y^2 + z^2 = R^2$$

Please calculate the volume of the polyhedron, surrounded by the three shapes, in which $\boldsymbol{R}$ is given.





Input

Each line contains a number $\boldsymbol{R}$, and $0.0 \leq \boldsymbol{R} \leq 1{,}000.0$.

Output

Output the answer per line for each case, with 2 digits after the decimal point.

Sample Input	Sample Output
0 0.2	0.00 0.04

E. Equation

Description

We know that some positive integer $\boldsymbol{x}$ can be expressed as $\boldsymbol{x} = A^2+B^2$ (A, B are integers). Take $x = 10$ for example, $10 = (-3)^2+1^2$.

We define $R(\boldsymbol{N})$ ($\boldsymbol{N}$ is positive) to be the total number of variable presentation of $\boldsymbol{N}$. So $R(1) = 4$, which consists of $1 = 1^2 + 0^2$, $1 = (-1)^2 + 0^2$, $1 = 0^2 + 1^2$, $1 = 0^2 + (-1)^2$. Given $\boldsymbol{N}$, you are to calculate $R(\boldsymbol{N})$.

Input

No more than 100 test cases. Each case contains only one integer $\boldsymbol{N}$ ($\boldsymbol{N} \leq 10^9$).

Output

For each $\boldsymbol{N}$, print $R(\boldsymbol{N})$ per line.

Sample Input	Sample Output
2 6 10 25 65	4 0 8 12 16

Hint

For the 4th case, (A, B) can be (0, 5), (0, -5), (5, 0), (-5, 0), (3, 4), (3, -4), (-3, 4), (-3, -4), (4, 3) , (4, -3), (-4, 3), (-4, -3).

F. *Y*-value

Description

Given a permutation $a_1, a_2, \ldots, a_N$ of $\{1, 2, \ldots, N\}$, we define its ***Y***-value as the amount of elements where $a_i > i$. For example, the ***Y***-value of permutation {1, 3, 2, 4} is 1, while the ***Y***-value of {4, 3, 2, 1} is 2. You are requested to find how many permutations of $\{1, 2, \ldots, N\}$ whose ***Y***-value is exactly ***k***.

Input

There are several test cases, and one line for each case, which contains two integers, ***N*** and ***k***. ($1 \leq N \leq 1{,}000$, $0 \leq k \leq N$).

Output

Output one line for each case. As the answer may be quite huge, you need to output the answer module 1,000,000,007.

Sample Input	Sample Output
3 0 3 1	1 4

Hint

*There is only one permutation with **Y**-value 0: {1, 2, 3}, and there are four permutations with **Y**-value 1: {1, 3, 2}, {2, 1, 3}, {3, 1, 2}, and {3, 2, 1}.*

G. Ohw mayn squaers

Description

Given a grid of $N \times M$ ($1 \leq N, M \leq 1{,}000$), and calculate how many different squares can be found in this gird.

Input

For each case, given a line of 2 integers, N and M.

Output

One integer per line, the number of squares can be found, for each case.

Sample Input	Sample Output
3 3	14

H. U can do it

Description

Determine value of the following expression.

$$\int_0^x \frac{t}{\sqrt{t^3+1}}dt$$

Input

Multiple test cases, each case per line, a float number x ($0.0 \leq x \leq 100.0$) .
Assume that x will be processed with only 1 digit at most after the decimal point.

Output

Output the answers, processed with 4 digits after the decimal point.

Sample Input	Sample Output
0.2	0.0200