# Project Euler #28: Number spiral diagonals



This problem is a programming version of Problem 28 from projecteuler.net

Starting with the number 1 and moving to the right in a clockwise direction a 5 by 5 spiral is formed as follows:

It can be verified that the sum of the numbers on the diagonals is 101.

What is the sum of the numbers on the diagonals in a  $N \times N$ , (N is odd) spiral formed in the same way? As the sum will be huge you have to print the result mod  $(10^9 + 7)$ 

#### **Input Format**

The first line contains an integer T , i.e., number of test cases. Next T lines will contain an integer N.

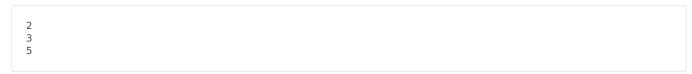
#### **Constraints**

$$1 \le T \le 10^5$$
  
  $1 \le N < 10^{18}$ , N is odd

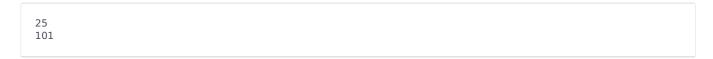
### **Output Format**

Print the values corresponding to each test case.

### **Sample Input**



## **Sample Output**



Calut-a				
Solution n = 1	fa(n)	f2(n)	f3(n)	fa(n) (1) is only used for building
n=1 $n=3$		5	200	9 polynomial model
n=5	13	17	21	25
100000000000000000000000000000000000000		37	43	49
n = 7	48		72-1	
sum	sumy	-	sum <sub>3</sub>	
1 Step 1: Build Polynomial Model				
Take fi(n) as example:				
				7
$f_1(n) = an^3 + bn^2 + cn + d$				
$b-1$ : $a+b+c+d=1=f_1(1)$				
$n=3: 27a+9b+3c+d=3=f_1(3)$ = $b=1$ = $f_2(n)=n^2-3n+3$				
$h=5$ : $125a+25b+5c+d=13=f_1(5)$				
$n=7: 343a+49b+7c+d=31=f_1(7)$				
= Do the same with f2+f3 and fa, we have.				
$c_2(n) = n^2 - 2n + 2$				
$f_3(n) = n^2 - n + 1$				
$f_a(n) = n^2$ $N = \frac{n+1}{2} : Number of numbers$ $To n = \frac{n+1}{2} : Number of numbers$				
(13. $3^2$ : $+n^2$ ) - 3 $(1+3++n) + 3.N$				
• Step 2: Calculate sum of $f(n)$ • Sum <sub>1</sub> = $\sum_{f_1}(n) = (1^2 + 3^2 + + n^2) - 3 \cdot (1 + 3 + + n) + 3 \cdot N$				
1 110(0)				
$12 + 3^2 + \dots + n = 6$				
Sum of arithmetic progression:  N.(a+an) N.(1+n)				
1+3++n=2 Z				
(2) 2 N(1+n) + 3N				
=> Sum_1 = n(n+1)(n+2) -3. -> Do the same with & sum_2, sum_3 and sum_4, we have:				
-> Do the same with & Sturz				

 $sum_2 = \frac{n(n+1)(n+2)}{6} - 2 \cdot \frac{N(1+n)}{2} + 2N$  $sum_3 = \frac{n(n+1)(n+2)}{6} - 1 \cdot \frac{N(1+n)}{2} + 1 \cdot N$  $sum_{a} = \frac{n(n+1)(n+2)}{6}$ => sum = sum, + sum, + sum, + sum, - 3.1