Problem statement: 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 1001 by 1001 spiral formed in the same way?

```
21 22 23 24 25
20  7  8  9 10
19  6  1  2 11
18  5  4  3 12
17 16 15 14 13
```

To solve this problem, let's introduce a few auxiliary functions. f_1, f_2, f_3 and f_4 are responsible for telling the n-th number on a diagonal in the matrix.

$$f_1(x) = 4n^2 - 10n + 7$$
$$f_2(x) = 4n^2 - 6n + 3$$
$$f_3(x) = 4(n-1)^2 + 1 = 4n^2 - 8n + 5$$
$$f_4(x) = (2(n-1)+1)^2 = 4n^2 - 4n + 1$$

Next step is combining all of these functions, so that a function $f(x)$ [1] yields the sum of matrix elements in a single iteration for given x. Assume function $s(x)$ yields the problem solution. For instance $f(3) = 21 + 25 + 17 + 13 = 76$:

```
21 22 23 24 25
20  7  8  9 10
19  6  1  2 11
18  5  4  3 12
17 16 15 14 13
```

Obtaining the result:

$$f_1(x) = 4n^2 - 10n + 7$$
$$f_2(x) = 4n^2 - 6n + 3$$
$$f_3(x) = 4(n-1)^2 + 1 = 4n^2 - 8n + 5$$
$$f_4(x) = (2(n-1)+1)^2 = 4n^2 - 4n + 1$$

[1] $x \in \mathbb{N} - 1$

$$f(x) = \sum_{n=1}^{4} f_n(x) = n(16n - 28) + 16 = 16n^2 - 28n + 16$$

$$s(k) = \sum_{n=1}^{k} (16n^2 - 28n + 16) - 3 = \frac{2k}{3}(8k^2 - 9k + 7) - 3$$

Or, as expressed in APL: `s←{3-⍨(3÷⍨2×⍵)×7+(8×⍵×⍵)-9×⍵}`. To transform the matrix dimensions to the distance from it's center to it's edges for matrices of odd dimensions, the following APL expression can be used: `⌈2÷⍨⊢`.

```
      s←{3-⍨(3÷⍨2×⍵)×7+(8×⍵×⍵)-9×⍵}
      m←⌈2÷⍨⊢
      s∘m 1001
669171001
```

The answer is **669171001**.