G1 (1/1 point)

The figure below shows a partial 4X4 matrix，is there some way of filling up the rest of the omitted entries to produce a magic square of size 4?

- yes
- no ✔

$$\begin{bmatrix} 2 & 3 & \square & \square \\ 4 & \square & \square & \square \\ \square & \square & \square & \square \\ \square & \square & \square & \square \end{bmatrix}$$

EXPLANATION

If there is some way of producing a magic square of size 4：

$$\begin{bmatrix} 2 & 3 & a & b \\ 4 & c & d & e \\ f & g & h & \square \\ i & j & \square & k \end{bmatrix}$$

then 1≤a,b,c,d,e,f,g,h,i,j,k≤16 and a,b,c,d,e,f,g,h,i,j,k do not equal to each other

the magic sum of size 4 is： $\frac{n*(n^2+1)}{2} = 34$，

Taking the sum of the first row and first column respectively：

$$\begin{cases} 2+3+a+b=34 \\ 2+4+f+i=34 \end{cases}$$

so that

1) if a,b are equal to 13,16, respectively，then we cannot find f,i such that the sum of the two is equal to 28（14+14, 15+13 and 12+16 are all impossible）

2) If a and b are equal to 14 and 15，and f and i are equal to 12 and 16，taking the sum of the second row, second column and the anti-diagonal respectively：

$$\begin{cases} 4+c+d+e=34 \\ 3+c+g+j=34 \\ 2+c+h+k=34 \end{cases}$$

for which c,d,e,g,j,h,k∈{1,5,6,7,8,9,10,11,13},taking the sum of the equations 9+3c+d+e+g+h+j+k=102, so if c=13, d+e+g+h+j+k=54 , but 11+10+9+8+7+6<54 , contradiction. The same is true for c smaller than 13.

Combining our results from 1) and 2), we see that our assumptions cannot hold， so it is impossible to construct a magic square of size four with the given conditions。

Hide Answer *You have used 1 of 1 submissions*

G2 (1/1 point)

Which number below, if used as the magic sum, allows us to construct magic squares of size 3, using only non-repeated natural numbers?

- 12
- 23
- 18 ✔
- 34
- 20

EXPLANATION

Let's first create a magic square of size 3

M1	M2	M3
M4	M5	M6
M7	M8	M9

we assume the value of to add elements in each row/column/diagonal is k, we have:

$$\begin{cases} M_1+M_5+M_9=k \\ M_2+M_5+M_8=k \\ M_3+M_5+M_7=k \end{cases}$$

then we add the three equation together

$$M_1+M_2+M_3+3M_5+M_7+M_8+M_9=3k(1)$$

besides,

$$\begin{cases} M_1+M_2+M_3=k \\ M_7+M_8+M_9=k \end{cases}$$

put these two equation into (1),we have$M_5=\frac{k}{3}$

as a result, k must be natural numbers for k to be multiples of 3.

the least k of magic square is 15, so only 18 is possible

Final Check Save Hide Answer *You have used 1 of 2 submissions*

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