There are certain properties that are true about a magic square of odd order n. The numbers in the square are the integers from 1 to  $n^2$ . Each row, column, and diagonals consist of numbers that sum to what is called the magic constant. The magic constant is

equal to  $\frac{n(n^2+1)}{2}$ . Also, the middle number in the square is  $\frac{n^2+1}{2}$ .

- 1. What is the magic constant for a 3 x 3? 5 x 5? 13 x 13?
- 2. What is the middle number in the square for a 3 x 3? 5 x 5? 13 x 13?

3. Are the squares in a)-c) magic? Why or why not? If it is a magic square, find its magic constant.

a)		
4	5	1
3	2	8
9	6	7

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

c)						
12	48	46	45	6	8	10
11	20	36	35	16	18	39
9	19	24	29	22	31	41
7	17	23	25	27	33	43
47	37	28	21	26	13	3
49	32	14	15	34	30	1
40	2	4	5	44	42	38

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

4. What is the middle number and magic constant for a  $9 \ge 9$ ? Fill the middle number in below. What are the possible combinations of numbers that can appear any row, column, or diagonal in order to sum to the magic constant?