Fill in the Magic Squares

Muhammad worked to find all possible 3 x 3 magic squares.

1) Fill in the following magic square.

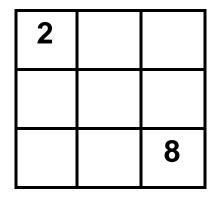| 4	9	2
3	5	7
8	1	6

2) Fill in the following magic square.

2	9	4
7	5	3
6	1	8

3) Find a magic square that has 2 and 8 in the same corners as the square above in question 2, but is different than it.

2	7	6
9	5	1
4	3	8

4) Can you find any other magic squares that have 2 and 8 in the same corners? If so, fill it in below so that it is different than the two above in questions 2 and 3.

2		
		8

If you can't find any other magic squares of this form then explain why not.

The squares in questions 2 and 3 are the only ones of this form. Note that 5 must be the center of a 3 x 3 magic square, and that the magic constant must be 15. Hence the blank corners must add to 10. Using this fact, and the fact that we can only use each number exactly once, the possibilities for the corners are 1 and 9, 3 and 7, or 4 and 6. But, we can rule out the first two cases since if 9 or 7 lies on one of the corners, then the row or column containing that square and 8 would sum to a number larger than 15 (the magic constant). Hence the only choices for the blank corners are 4 and 6. Once we chose the location of the 4 (either the bottom left corner or the top right corner) then the rest of the magic square is determined. Hence there are only two possibilities for magic squares of this form, those shown in questions 2 and 3.

5) Fill in the following 7 x 7 magic square.

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

Muhammad built many magic squares. He even constructed an 11 x 11 magic square.
He worked without a computer or calculator. Imagine filling this in from scratch like
Muhammad!

106	5	4	3	2	1	110	109	108	107	116
10	89	24	23	22	21	92	91	90	97	112
9	28	76	39	38	37	78	77	82	94	113
8	27	42	67	50	49	68	71	80	95	114
7	26	41	52	60	65	58	70	81	96	115
111	93	79	69	59	61	63	53	43	29	11
102	86	74	66	64	57	62	56	48	36	20
103	87	75	51	72	73	54	55	47	35	19
104	88	40	83	84	85	44	45	46	34	18
105	25	98	99	100	101	30	31	32	33	17
6	117	118	119	120	121	12	13	14	15	16