## **Magic Cross**

http://www.geocities.com/CapeCanaveral/Lab/3469/magiccross.pdf

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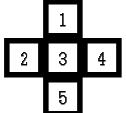
## Definition

A *Magic Cross*  $+^{j}_{i}$  is a cross made by integers of the sequence 1,2,...,ji<sup>2</sup> and formed by j Magic Square of order i.

In addiction the sum of the rows and the columns of the cross is the same.

## A simple method to make a Magic Cross

Degenerated Magic Cross  $+^{j_1}$  is very important because it suggests the simplest way to make a Magic Cross. For example, starting by  $+^{5_1}$  I'll show how to make  $+^{5_3}$ .



is a Magic Cross  $+ {}^{5}_{1}$  because 1,2,3,4,5 are degenerated Magic Square and the sum of the column 1+3+5 is equal to the sum of the row 2+3+4.

Now I'll made  $+{}^{5}_{3}$  using  $+{}^{5}_{1}$ . From the sequence 1,2,...,ji<sup>2</sup>=45 I take the first 9 numbers and make this magic square

8	1	6	
3	5	7	
4	9	2	

I replace 1 from  $+{}^{5}_{1}$  with the magic square made.

Then I take the next 9 numbers (10,...,18) and I make this magic square

17	10	15
12	14	16
13	18	11

I replace 2 from  $+_{1}^{5}$  with the new magic square. And so on. The result is this Magic Cross

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

**Open Problems** Is this the only method to make a Magic Cross? Is there a formula to know the sum of the columns and the rows of the Magic Cross?