

## Albrecht Dürer's magic square

Magic squares are squares with numbers arranged in such a manner that the sum of each row, each column and of both the corner diagonals of the square add up to the same number, called the *magic constant*. All magic squares can be rotated by  $90^\circ$  and symmetrically reflected, column-wise (one), row-wise (one) and diagonal-wise (two), to produce 8 squares alike having the same sum( try yourself, it is fun !). Magic squares can be of any order of 'n'= 3, 4, 5, 6, etc., the magic constants being 15, 34, 65, 111, etc., calculated by the formula  $[n (n^2 + 1)] / 2$ .

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

4	9	5	16
15	6	10	3
14	7	11	2
1	12	8	13

(Rotated clockwise by  $90^\circ$ )

Durer's magic 4 x 4 square with magic constant 34 is found in an engraving entitled *Melancholia* by Albrecht Dürer and is believed to be the first in European art in 1514. The sum of numbers in the rows, columns, diagonals, in each of the four and the central quadrant (2x2 sub-squares) as well as in the four 3x3 sub-squares are 34. In addition to the eight squares produced by rotations and reflections, the sum in the four outer numbers of sub-squares, starting clockwise from 3 (3, 8, 14, 9) and those of sub-square starting counter-clockwise from 2 (2, 5, 14, 12) are also found 34. Similarly, the two analogous sets of four numbers starting counterclockwise from 3 (3, 5, 14, 12) and clockwise from 2(2, 8, 15, 9) again sum up to 34. Further, the sum of the middle two entries of the two outer columns (5 ,9 and 8,12) and of rows (3,2 and 15,14), and in the four kite shaped quartets (3,5,15,11,), (2,10,14,8), (15,9,3,7) and (14,6,2,12) is also found to be 34.

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

(Sum of kite-shaped quartets in individual colours is also 34)

The Dürer's magic square is also linked to Masonic Cipher. Masonic cipher is a way to substitute symbols/numbers with letters in a pattern of grid that can reveal information by deciphering the encrypted hidden clues. In Albrecht Dürer's magic square the two numbers in the middle of the bottom row, 15 and 14 reveal its year of engraving, i.e. 1514, whereas its two end numbers 1 and 4 corresponding to the letters "A" and "D," disclose the initials of the artist. Dürer's magic square and Masonic cipher concepts are brilliantly exploited by the renowned novelist Dan Brown in his fabulous fiction the 'Lost Symbol' (2009) as a challenge for decoding cryptic clues that generates much riveting suspense for the readers.