

**Compound Birthday Magic Square Of Order 16×16**

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**Abstract**

In this paper, there are only one magic square of order 16×16 which is already famous and prepared by Benjamin Franklin. But most important thing is that there is one method for this magic square from that method we can create infinite magic squares with the two different or same date of birth Or we can create infinite magic squares with the help of sixteen any type of real numbers.

**Keywords:-** Magic square

**Introduction:-** Magic squares are one of the most beautiful examples of the mathematical objects with several real-world applications. They have always a great influence upon mankind’s attitude. Benjamin Franklin 16×16 magic square whose sum of any row or column is nothing other than 2056. Because Benjamin Franklin had not a common method to construct a magic square with any type of sum or when 1<sup>st</sup> row is filled with two different or same date of birth or any real numbers. In this paper, I have made a common method for 16×16 magic square from that method everybody can create “ 16×16 compound birthday magic square “ by putting his and his friend or any other person date of birth in first row of magic square like 4×4 birthday magic square made by Srinivas Ramanujan. I made a 16×16 compound birthday magic square with the help of Ramanujan birthday magic square and Benjamin Franklin 16×16 magic square.

**1. Mukhtar-Ramanujan Birthday magic square**

**12-03-1998 is my date of birth and 22-12-1887 is Ramanujan date of birth**

1	2	0	3	1	9	9	8	2	2	1	2	1	8	8	7
9	6	2	7	4	-1	-4	8	10	7	3	7	5	-2	-4	7
-2	5	7	-4	5	5	12	5	-2	6	6	-3	4	5	11	4
10	5	3	6	3	0	4	0	11	6	3	7	2	1	3	0
5	-2	-4	7	10	7	3	7	4	-1	-4	8	9	6	2	7
3	6	2	13	4	0	-5	8	3	7	3	14	3	0	-6	9
2	1	3	0	11	6	3	7	3	0	4	0	10	5	3	6
4	5	11	4	-2	6	6	-3	5	5	12	5	-2	5	7	-4
3	7	11	6	3	0	2	1	3	6	10	5	4	0	3	0
-2	5	6	-2	3	12	12	-3	-1	4	6	-3	4	13	13	-3
5	5	12	5	-2	5	7	-4	4	5	11	4	-2	6	6	-3
3	0	4	0	10	5	3	6	2	1	3	0	11	6	3	7
10	7	3	7	5	-2	-4	7	9	6	2	7	4	-1	-4	8
4	0	-5	8	3	6	2	13	3	0	-6	9	3	7	3	14
11	6	3	7	2	1	3	0	10	5	3	6	3	0	4	0
-2	6	6	-3	4	5	11	4	-2	5	7	-4	5	5	12	5

**Figure.1**

**Properties of this magic square**

- (I) The sum of all rows is 64.
- (II) The sum of all columns is 64.
- (III) The sum of all diagonals is also 64.
- (IV) And many other possibilities like Benjamin Franklin 16×16 magic square.

**2. Common method for 16×16 compound birthday magic square.**

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
$P+(x-y)$	$O+(-x+y)$	$N+(-x+y)$	$M+(x+y)$	$L+(x-y)$	$K+(-x+y)$	$J+(-x-y)$	$I+(x+y)$	$H+(x-y)$	$G+(-x+y)$	$F+(-x-y)$	$E+(x+y)$	$D+(x-y)$	$C+(-x+y)$	$B+(-x-y)$	$A+(x+y)$
$B-x$	$A+x$	$D+x$	$C-x$	$F-x$	$E+x$	$H+x$	$G-x$	$J-x$	$I+x$	$L+x$	$K-x$	$N-x$	$M+x$	$P+x$	$O-x$
$O+y$	$P-y$	$M+y$	$N-y$	$K+y$	$L-y$	$I+y$	$J-y$	$G+y$	$H-y$	$E+y$	$F-y$	$C+y$	$D-y$	$A+y$	$B-y$
$D+(x-y)$	$C+(-x+y)$	$B+(-x+y)$	$A+(x+y)$	$H+(x-y)$	$G+(-x+y)$	$F+(-x-y)$	$E+(x+y)$	$L+(x-y)$	$K+(-x+y)$	$J+(-x-y)$	$I+(x+y)$	$P+(x-y)$	$O+(-x+y)$	$N+(-x-y)$	$M+(x+y)$
$M+(x-y)$	$N+(-x+y)$	$O+(-x+y)$	$P+(x+y)$	$I+(x-y)$	$J+(-x+y)$	$K+(-x-y)$	$L+(x+y)$	$E+(x-y)$	$F+(-x+y)$	$G+(-x-y)$	$H+(x+y)$	$A+(x-y)$	$B+(-x+y)$	$C+(-x-y)$	$D+(x+y)$
$C+y$	$D-y$	$A+y$	$B-y$	$G+y$	$H-y$	$E+y$	$F-y$	$K+y$	$L-y$	$I+y$	$J-y$	$D+y$	$P-y$	$M+y$	$N-y$
$N-x$	$M+x$	$P+x$	$O-x$	$J-x$	$I+x$	$L+x$	$K-x$	$F-x$	$E+x$	$H+x$	$G-x$	$B-x$	$A+x$	$D+x$	$C-x$
$E+y$	$F-y$	$G+y$	$H-y$	$A+y$	$B-y$	$C+y$	$D-y$	$M+y$	$N-y$	$O+y$	$P-y$	$I+y$	$J-y$	$K+y$	$L-y$
$L-x$	$K+x$	$J+x$	$I-x$	$P-x$	$O+x$	$N+x$	$M-x$	$D-x$	$C+x$	$B+x$	$A-x$	$H-x$	$G+x$	$F+x$	$E-x$
$F-x$	$E+x$	$H+x$	$G-x$	$B-x$	$A+x$	$D+x$	$C-x$	$N-x$	$M+x$	$P+x$	$O-x$	$J-x$	$I+x$	$L+x$	$K-x$
$K+y$	$L-y$	$I+y$	$J-y$	$O+y$	$P-y$	$M+y$	$N-y$	$C+y$	$D-y$	$A+y$	$B-y$	$G+y$	$H-y$	$E+y$	$F-y$
$H+(x-y)$	$G+(-x+y)$	$F+(-x-y)$	$E+(x+y)$	$D+(x-y)$	$C+(-x+y)$	$B+(-x-y)$	$A+(x+y)$	$P+(x-y)$	$O+(-x+y)$	$N+(-x-y)$	$M+(x+y)$	$L+(x-y)$	$K+(-x+y)$	$J+(-x-y)$	$I+(x+y)$
$I+(x-y)$	$J+(-x+y)$	$K+(-x-y)$	$L+(x+y)$	$M+(x-y)$	$N+(-x+y)$	$O+(-x-y)$	$P+(x+y)$	$A+(x-y)$	$B+(-x+y)$	$C+(-x-y)$	$D+(x+y)$	$E+(x-y)$	$F+(-x+y)$	$G+(-x-y)$	$H+(x+y)$
$G+y$	$H-y$	$E+y$	$F-y$	$C+y$	$D-y$	$A+y$	$B-y$	$O+y$	$P-y$	$M+y$	$N-y$	$K+y$	$L-y$	$I+y$	$J-y$

J- x	I+ x	L+ x	K-x	N- x	M + x	P+ x	O- x	B- x	A+ x	D+ x	C-x	F-x	E+ x	H+ x	G-x
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**Figure. 2**

From this method we can create infinite birthday magic squares with the help of two date of birth whether it is same or different.

In fig. 2 x and y belong to any real numbers and also there are two date of birth in this figure one is from A to H and another is from I to P.

**A** and **I** will be first digits of days.

**B** and **J** will be second digits of the days.

**C** and **K** will be first digits of months.

**D** and **L** will be second digits of months.

**E** and **M** will be first digits of years.

**F** and **N** will be second digits of years.

**G** and **O** will be third digits of years.

**H** and **P** will be fourth digits of years.

For example:- In figure 1<sup>st</sup> the top row is of 12-03-1998 and 22-12-1887 ( two different date of birth).

In which day has two digit and moth has also two digit but year has four digit in both date of birth.

**Properties of this common 16×16 compound birthday magic square are mostly same as Benjamin Franklin 16×16 magic square.**

Sum of all rows, columns and both the diagonals are same and many others possibilities.

**Conclusion.**

The discussion of 16×16 magic square is named as “compound birthday magic square of order 16” . In this magic square there is one common method for creating different magic squares with any type of sum or with the help of two date of birth but the main thing is that there is also a new birthday magic square after Ramanujan Birthday magic square. Properties of this magic square are almost same as Benjamin Franklin 16×16 magic square. Moreover, construction method of this magic square together with its properties are expressed. Physical application is still a new topic that needs to be explored more . There are many interesting ideas for research in this field such as in this magic square how we can create infinite ways of constant sum .

**References.**

1. **Ramanujan Birthday magic square**
2. **Benjamin Franklin 8×8 and 16×16 magic square**