

# Math Magic: Creating your own Magic Cards and More

Issue #5: Levels vary (grades 6-12)

[An Index of All Math Magic Activities](#)

CREATING YOUR OWN MAGIC CARDS FOR THE NUMBERS 1-10 HERE BEFORE GOING ON TO To create your own larger Magic Cards, Here are some examples how to start. The number 1,2,4,8, and 16 are, as you now know, are on the important secret numbers that you will add to place all of the other numbers on the cards.

A	B	C	D	E
16	8	4 5	2 3	1 3 5
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Examples to help you fill in the cards above. Card A can also be called the 16 card, B, the 8 card, etc.

—> the number 1 is already written on card E, and so you don't have to write it in a card.

—> the number 2 is also written on card D, and so you don't have to write it in a card.

—> 3 is made by adding 2 and 1 above, so put a 3 in the 2 (D) and 1 on the 4 or (C) card and 3 in the 1 or (E) cards above. **NOTE: in making a number always use the subtract the largest special number from it first. So, for 3 think "3-2 means a 1 is left over and 1-1 = 0 is left over. To make 5 below, the biggest number of the circled ones to fit into 5 is 4. (So put a 5 in C, and then there's just a 1 left, so put a 5 in the 1 or E card.**

—> 4 is already on card 4 or D, and so you don't have to write it in a card.

—> 5 is made by adding 4 and 1 above, so put a 5 on the 4 card (C) and a 4 in the 1 card (E).

—> 6 is made by adding 4 and 2 above, so put a 6 on the 4 card (C) and a 6 in the 2 card (D). As above.

—> 7 is made by adding 4,2, 1 above, so put a 6 on the 4 card (C), the 2 card (D), and the 1 card (E). Do it.

Note: In figuring a number, always

—> 9 is made by adding 8 and 1 above, so put a 6 on the 4 card (C), the 2 card (D), and the 1 card (E). Do it.

—> 10's are written in what two cards above? \_\_\_\_ and \_\_\_\_\_. Do it.

—> 11's are written in what two cards above? \_\_\_\_ and \_\_\_\_\_. Do it.

—> 12's are written in what two cards above? \_\_\_\_ and \_\_\_\_\_. Do it.

NOW THAT YOU HAVE THE IDEA, ASK YOUR TEACHER FOR [A BETTER PRINTOUT OF BASE TWO CARDS HERE](#). AND FILL THEM OUT NEATLY AND LARGE ENOUGH TO SEE.

base 10	base 2 (binary)							
	10 <sup>1</sup>	10 <sup>0</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
1	1							1
2	2						1	0
3	3						1	1
4	4				1	0	0	0
5	5				1	0	1	0
6	6				1	1	0	0
7	7				1	1	1	0
8	8			1	0	0	0	0
9	9							
10	10							
11	11							
12	12							
13	13							
14	14							
15	15							
16	16							
17	17							
18	18							
19	19							
20	20							
21	21			1	0	1	0	1
22	22							
23	23							
24	24							
25	25							
26	26							
27	27							
28	28							
29	29							
30	30							
31	31							
32	32							

<-- 2 is the base, and the raised small number is the exponent.  $2^3 = 2 \times 2 \times 2 = 8$ ,  $2^2 = 2 \times 2 = 4$ ,  $2^1 = 2$ ,  $2^0 = 1$ . Notice how the progression of 1,2,4,8,16,32... grows by two times.

Computer counting, binary or base-two, there is a different place value where each place to the left is 2 times larger than the place to its right.

Making computer numbers with just 1's and 0's are also called binary numbers. This is because computers just understand ON and OFF commands of electricity either being ON or OFF. It's just like playing 20 questions with YES or NO questions. Look at the chart to the left and see if you can figure out what's going on. Work with a partner.

Remember to use the rule discussed on the previous page. Where if you are changing 21 in our counting system (decimal or base 10), to base two: use the largest number to the left of the base two number places, and work backwards, using subtraction like this.

It is easier to explain in person than try to explain in writing, as I am discovering, but I will try in the



Base two increase by  $2 \times = 1, 2, 4, 8, 16, \dots$   
 Base three increases by  $\_ \times = 1, 3, \_, \_, \_, \_$   
 Something to explore.... See Summary for High School presentation on page 3 below.

21 in base ten (far left)  
 $- 16$  less 16 (a 1 in the 16's place in base two to the left) has 5 left over  
 $- 4$  (Less 4 in the 4's place in base two  
 1. Has 1 left over which is gone if 1 in the  
 $- 1$  Base two one's place is subtracted.  
 0. So our number  $21 = 10101$  in base two.

WHEW! Work with a partner in filling in the rest of the worksheet.

The next part of this would be to convert from base two to our system, which would be solved by addition. Example:

$$11010_{\text{two}} = (1 \times 16) + (0 \times 8) + (1 \times 4) + (0 \times 1) = 16 + 8 + 2 = 26_{\text{ten}}$$

What is  $11111_{\text{two}} = \underline{\hspace{2cm}}$

Outline of magic math cards for three 3-4 40 minute class sessions at Woodside HS AVID 2017

1. Show the trick 3-5 times... Discuss if magic or method...hypothesis why presenter knows the number Examine cards...esp upper left for pattern, clues
2. Upper left...discover to try trick on class until more discover method
- 3 Kids to use cards on each other in class, then their parents or siblings at home
3. Kids to note base two number worksheet 1-31 in class
4. Kids to create their own base-two cards in class.
5. Worksheet creating base two to ten and visa versa.
6. Practice evaluation quiz on base two
7. Further enrichment: base-three and why is base ten easier