

RAFT IDEAS

Topics: Binary (Base-2),
Place Value, Exponents

Materials List

- ✓ Poster board
- ✓ Markers
- ✓ Blank playing cards or index cards
- ✓ Circles (black on 1 side and white on the other) (or any other color combination)

This Activity can be used to support the teaching of: CO Math Standard 1: Number Sense, Properties, and Operations &

- Bases
- Exponents
- Place Value

CO Math Standard 2: Patterns, Functions, and Algebraic Structures

- Exponential Growth
- 21st Century Skills:
- Critical Thinking and Reasoning
 - Information Literacy
 - Invention

Grades: 4, 5, 6, 7, HS

Binary Dots

Seeing Base-2 Spots

32	16	8	4	2	1
●	○	●	○	●	●
1	0	1	0	1	1

Learning to count in binary is quite straightforward and makes for an interesting and compelling activity for elementary students capable of simple addition. This simple game creates an opportunity for your students to practice counting in binary.

Assembly

1. Create the game board by marking a 6 x 3 grid on a suitable piece of poster board or paper (see image).
2. Write in the numbers 1, 2, 4, 8, 16, and 32 as shown.
3. Create cards that have numbers between 1 and 63 written on them (Note: the total number of cards is flexible, no need to have a card for each number.)
4. Finally, label 6 cards with “1” and label 6 cards with “0”.

Playing the Game

1. To play the game, draw a number card and change it into binary using the dots. For example, the number “43” is drawn. Decide which of the numbers in the top row must be “on” (black = 1 = “on”) and which of the numbers must be “off” (white = 0 = “off”) in order to create that number. The sum total of the “on” numbers will add up to the number from the card. The only combination that sums to “43” is $32 + 8 + 2 + 1$ (see image).
2. Create the written binary number by placing a “1-card” underneath each “on” number and a “0-card” underneath each “off” number. (e.g. – $43 = 101011$)

The Math Behind the Activity

There are a variety of strategies that students can use to change a number into binary. One strategy: start with the largest number on the game board (32). Have them ask, “Is my number (43) larger than 32?” If the answer is yes, then that number needs to be “on”, and they can place a black dot under it. Next, they ask the same question for the next number in the table, only now they compare it to the remainder of their number minus the number they just turned “on” (i.e., $43 - 32 = 11$); “Is 11 greater than 16?” Since the answer here is no, they place a white dot to indicate that 16 is “off”. Next would be, “Is 11 greater than 8?” The answer is “yes”, so 8 must be “on”, and a black dot is placed. This continues until they have finished checking each of the numbers.

Web Resources - Visit www.raft.net/more for how-to videos and more ideas!