Use the "fab num sys" worksheet with this lesson plan.

1. our fabulous number system

- number system evolved from tally marks to our valued based system
- Handout papers. No pencil yet
- Question: Please describe this table? How is it organized, what do you see?
- naming conventions. columns, going down,
- Question: What numbers are in the 7's column?
- Question: What numbers are in the 2's column?
- The rows, going across
- Question: What numbers are in the 71's row?
- Question: What numbers are in the 211's row?
- Question: In the number 123, what number is in the one's place? Ten's place? Hundred's place?

2. Patterns and sequences

- Question: What is a pattern? [Something repeating in a systematic way]
- Question: And what is a sequence? [An ordered list of numbers, eg, 10, 20, 30 and so on]
- table has dozens of patterns and sequences.
- Question: what is one pattern you see?
- [depending on responses, add suggestions that they look for patterns in the columns, in the rows, in the 1's place, the 10's place, even-odd, multiples, repeating counting number sequences]
- We call 1, 11, 21, … and infinite sequence. In other words, it is an ordered arrangement of numbers that goes on and on.
- Question: any diagonal patterns?
- Question: If you start at 1 and go one column to the right and down one row, where do you end up? [12] Repeat and get to 23. Ask: How much do you add? Is this true regardless of where you begin. [yes, always add 11]
- How about going down toward the left? [subtract 9]

3. Vocabulary summary (5 min) Total Time: 45

- These statements are all equivalent:

N is divisible by k	N is a multiple of k
k divides N	k is a factor of N

- Do verbal exercise:

15 is divisible by 3	15 is a multiple of 3
3 divides 15	3 is a factor of 15

4. Multiples of 5 and 10; Divisibility by 5 and 10

- Question: What are the multiples of 10?
- Question: what is the pattern in the 10's column?
- Question: what is the rule for when a number is divisible by 10?
- we call this divisibility by 10, or ten divisibility rule.
- Question: what is the divisibility rule for 5? [one's place is 5 or 0]
- Numbers which end in 0 are always divisible by 10
- Number which end in 0 or 5 are always divisible by 5
- Note that "Count by 5's" means the same as divide evenly by 5
- Question: if a number is divisible by 5, is always divisible by 10?
- Question: If a number is divisible by 10, is it always divisible by 5?
- Question: Are numbers divisible by 10, divisible by any other numbers beside 5? [2; Note 5 and 2 are the factors of 10.]

5. Summing digits

- Now let's take a look at the 1s column. What do we get: 1, $\sum 11 = 2$
- What do we do at 100? If we count it as 10+1, our sequence continues. If we do $\sum 101$ digits = 2; different interesting result depending on how you choose to add the numbers. There is no RIGHT way to do those, you select the rule you want to use and then see the pattern that comes out.
- Question: does this work for any other columns?
- diagonal pattern 31, 22, 13, 4.
- Question: is this pattern of the sums true elsewhere?

- How about starting at 3 and going diagonally down to the left: 3, 14, 25, etc. any pattern there?
- Does this work for product of digits, or even the sum of sum form any other patterns. Lots of fun stuff to explore here. This is part of what mathematics is all about – taking something like this table and just "playing" with it.

6. Oh those 9's

- Underline the first ten multiples of 9's
- Now sum the digits?
- What do you observe? [sum is always 9]
- Is this true for all multiples of 9?
- Now underline the next few multiples of 9 [99, 108, 117, …]
- Does the sum of the digits always equal 9? [not for 99, that is 18]
- How about for 189, 198, and 207?
- Can you state a rule for when a number is divisible by 9? [sum of digit is 9 or multiple of 9]
- Use the rule for division by 9 to find all number divisible by 9 between 260 and 280. [261, 270 and 279]
- What is the largest number on this table divisible by 9? [315]
- Is the number 123,453 divisble by 9? [yes]
- What digit do we need to add so that 654,__46 is divisible by 9 [2]
- Can you make up a four digit number divisible by 9? Five digit? Six digit?
- [extra material: why does this rule work

7. Searching for Primes

Sieve of Eratosthenes method (200 BC)

- Circle the first prime number (2) and then cross out all the multiples of that number.
- Now circle the next prime (3) and cross out all multiples of 3.
- Now circle the next prime (5) and cross out all multiples of 5.
- ASK: What is the first number you will cross out? [25, because all multiples of lesser numbers have been crossed out.]
- ASK: What is the next prime not crossed out? [7]
- Now circle the 7 and cross out all multiples of 7.

- ASK: What is the first number you will cross out? [49, because all multiples of lesser numbers have been crossed out.]
- ASK: What is the next prime not crossed out? [11]
- Now circle the 11 and cross out all multiples of 11.
- Repeat until you have all the primes you can find. If you work carefully, you should find 66 primes.
    - 25 prime numbers between 1 and 100
    - 21 prime numbers between 101 and 200
    - 16 prime numbers between 201 and 300
    - 4 prime numbers between 301 and 320.

2	3	5	7	11	13	17	19	23	29
31	37	41	43	47	53	59	61	67	71
73	79	83	89	97					

101	103	107	109	113	127	131	137	139	149
151	157	163	167	173	179	181	191	193	197
199									

211	223	227	229	233	239	241	251	257	263
269	271	277	281	283	293				

307	311	313	317