Van Miller
MATH 1350
Math for Elem. School Teachers
Dr. Alm 9-4-18

Assigned HW: Ch. 1 – 1, 9
Ch. 2 – 1, 7, 8(i) – (iii), 12
Ch. 4 – 5, 7, 8

Using 0, 1, 2, how many #'s come before 12121?

00 01 02
10 11 12
20 21 22

#'s before 10? 3
before 100? 9
before 1,000? 27
before 10,000? 81

000 022
100 ... 122
200 222

0000 0001 0002 0010 0011 0012 0020 0222
1000 1222
2000 2222

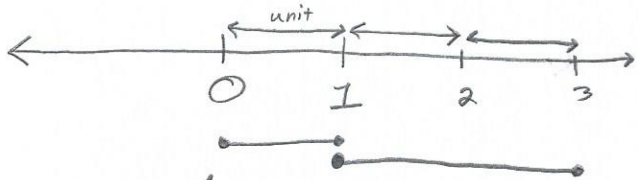
Hindu-Arabic	3 Fingered Alien	
81	10,000	10,000
27·2 = 54	2000	12,000
9	100	12,100
6	20	12,120
1	1	$\boxed{12121}$

Total = 151 #'s before 12121

☆ In problem explanations, assume your target audience has previous knowledge.. Only go back 1 step in explanations.

Number Line:

We take for granted an infinite straight line.



This allows us to calculate steps **and** distance!

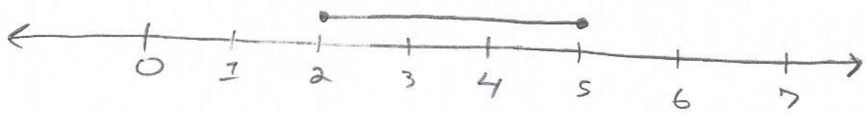
$1+2$

↳ 1 step, then 2 more steps.

↳ It's also the length of 3.

☆ This helps show the equality of $1+2$ and $2+1$!

Lets use the notation $[2,5]$ to denote the line segment with endpoints at 2 and 5.



Comparing Numbers:

Definition: Let a and b be whole numbers,

a is less than b if a comes before b in our method of counting.

We write $a<b$

$\boxed{\text{Ex.}}$ Why is $45 < 123$?

$45 = 045$

So, in the three digit grid 045 is in the 1st row while 123 is in the next row.

Therefore, $045 < 123$.

Why is $56 < 70$?

↑ ↑

In the 2 digit grid 56 is in the row that starts with 5's which comes before the row that starts with 7's (where 70 is located).

Test Questions:

Be prepared to explain your answers in terms of what has been covered in class previously.

Multiplication:

$3 \times 5 \overset{def}{=} 5+5+5$ → means by definition

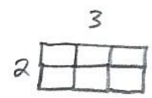
Definition –

In general, if m and n are whole numbers,

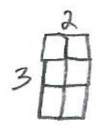
$$m \times n = \begin{cases} \overbrace{n+n+n+\ldots+n}^{m}, & \text{if } m \neq 0 \\ 0, & \text{if } m = 0 \end{cases}$$

Ex.

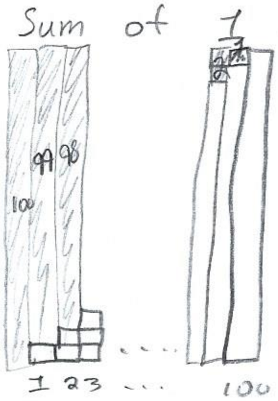
$2 \times 3 = 3+3$



$3 \times 2 = 2+2+2$



Sum of 1 to 100 integers:



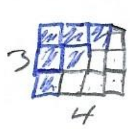
100 boxes tall

101 boxes wide

So, $\dfrac{100 \times 101}{2}$ → b/c we copied the boxes twice.

$\dfrac{n(n+1)}{2}$ generalized to any n whole #'s!

Ex. $1+2+3$



⇒ Number of blocks?

$\dfrac{3 \cdot 4 = 12}{2 \quad\;\; 2} = \boxed{6}$

Powers of 10

- Notice that the number of numbers in any number grid is a 1 followed by some zeros.
  - There are 10 1-digit numbers
  - There are 100 2-digit numbers (incl. 00, 01, 02,.. etc)

$$100 = 10+10+10+10+10+10+10+10+10+10$$
$$= 10 \times 10$$

$$1000 = 100+100+100+100+100+100+100+100+100+100$$
$$= 10 \times 100$$
$$= 10 \times 10 \times 10$$
$$= 10^3$$

In general,

$$10^{n+1} = 10 \times 10^n$$

10^n is a 1 followed by n zeros.

It can be useful to write numbers using powers of ten like so:

$$1{,}234 = 1{,}000 + 200 + 30 + 4$$
$$= (1000) + (100+100) + (10+10+10) + 4$$
$$= 1 \times 1000 + 2 \times 100 + 3 \times 10 + 4$$
$$= 1 \times 10^3 + 2 \times 10^3 + 3 \times 10^1 + 4 \times \underline{10^0} \rightarrow 1$$

— Expanded Form —