Mental math can be fun [ ] but not all problems are amenable to the "tricks" we used.
We need algorithms ('programmed' procedures that always work) for the arithmetic operations.

Always work
Become automatic
Completes whole-number arithmetic

The mental math exercises have prepared our students.
They need to know arithmetic facts 1+1 = 2, etc. ... , 9+9= 18 and
they need to know such things as 30 + 40 = 70, 300 + 400 = 700, etc.
before progressing to multi-digit addition algorithms.

Addition problems in order of difficulty:

7	7	12	17	32	37
+ 2	+6	+23	+25	+87	+66

(explain why each is more difficult)

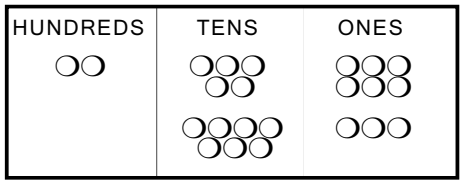
ADDITION ALGORITHM Due to ASSOCIATIVE & COMMUTATIVE properties of + we can rearrange the sum in any order & grouping. Aligning the columns is doing all that!

256 + 73 Performing the addition of tens, hundreds, etc. uses the DISTRIBUTIVE property

$$\begin{array}{rcl} 256 & = & 2\cdot 100 + (5\cdot 10) + 6\cdot \text{UNITS} \\ +\ 73 & + & (7\cdot 10) + 3\cdot \text{UNITS} \end{array}$$

$5\cdot 10 + 7\cdot 10$ ⇦ says...
$(5 + 7)\cdot 10$
$12\cdot 10$ "Carrying"
$(10 + 2)\cdot 10$ is really
$10\cdot 10 + 2\cdot 10$ "Re-grouping"
$1\cdot 100 + 2\cdot 10$ "Re-bundling"

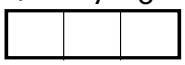
CHIP model:



3 2 9

Lattice addition:

$$\begin{array}{r} 2\ 5\ 6 \\ +\quad 7\ 3 \end{array}$$



Scratch addition:

$$\begin{array}{r} 5\ 6 \\ 7\ 3 \\ 4\ 9 \\ +\ 5\ 5 \\ \hline \end{array}$$

CHIP model for 1354 + 3678: