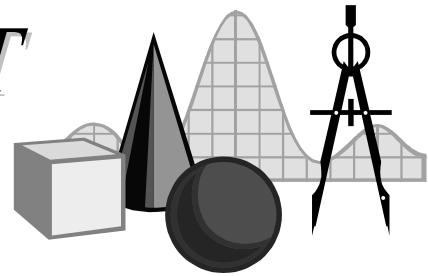# TAKE IT TO THE MAT

A NEWSLETTER ADDRESSING THE FINER POINTS OF MATHEMATICS INSTRUCTION

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Regional Professional Development Program
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When is it appropriate to use an algorithm and when is it not? When should students use number sense versus memorized procedures? We will address these questions in this issue of *Take It to the MAT*.

In which of the following should students use mental math to get the sum and in which should the addition algorithm be used?

(1) $4 + 5$ (2) $5 + 9$ (3) $60 + 14$ (4) $\begin{array}{r} 65 \\ +\ 9 \\ \hline \end{array}$ (5) $\begin{array}{r} 693 \\ +208 \\ \hline \end{array}$

The answers are: mental math—all of them; algorithm—none of them.

Few would debate that students should be able to answer questions 1 and 2 without pencil-and-paper. After all, these are basic arithmetic facts. There is little question that exercise 3 should also be done "in one's head."

The first place one might tell students to use the addition algorithm is question 4. Since the problem requires regrouping, it is a prime candidate for using a pencil-and-paper process. Five plus nine is fourteen; write the four, regroup (carry) the one ten; six tens plus one ten is seven tens. **But is this really the most efficient method?** (Kids often finish this problem by saying, "six plus one equals seven, write the seven." This may indicate a lack of number sense.)

$$\begin{array}{r} \overset{1}{}65 \\ +\ 9 \\ \hline 74 \end{array}$$

Question 4 is definitely a mental math exercise. The fact that it is written in vertical form does not mean that one must use an algorithm. However, our students are often in that very frame of mind—see vertical form, use the algorithm. We must prevent this misconception from forming or quash it if present. Students should be able to see question 4 flexibly, such as five plus nine is fourteen; sixty plus fourteen is seventy-four. We ask kids to do question 3 in their head, why not 4? It's the same problem.

So, what is the most efficient way for students to tackle question 5? Is it a pencil-and-paper algorithm as shown at right? Or is this another case where students should use mental math? Problem 5 is definitely in the mental math/number sense category.

$$\begin{array}{r} \overset{1\ 1}{}693 \\ +208 \\ \hline 901 \end{array}$$

While the mental process we used in question 4 mirrored the traditional algorithm—add the ones first—other strategies work just as well or better. There is no law that says we can't start from the left and work to the right when adding. One line of thinking is shown at right. Of course, this is only one way to find the sum mentally. How many more can you find?

$$\begin{array}{r} 600 + 200 = 800 \\ 800 + 90 = 890 \\ 8 + 3 = 11, \text{ but } 11 = 10 + 1 \\ (890 + 10) + 1 = 900 + 1 = 901 \end{array}$$

Algorithms are useful tools and are important for students to know, but there are times when tools are inefficient or overkill, much like swatting a fly with a sledgehammer. **Overuse of algorithms leads to an over-reliance on them and destroys number sense.** Students must be taught when it is and is not appropriate to use algorithms versus when they should apply number sense and "do it in their heads."

Grade level will also dictate what we expect. We certainly wouldn't expect a first grader to do question 5. Whatever the level, development of number sense and application of mental math must precede using an algorithm.