Parent Involvement and Awareness:

How to Teach Your Children to Do Mental Math—Part 2

by Paul Giganti, Jr., CMC Math Festival Program
pgiganti@berkeley.edu

In Part 1 of this series I introduced many strategies that work well for mental calculations. I concentrated mostly on mental math addition strategies since they are the simplest and are the most common in use. This article takes the next step with mental math strategies by expanding to subtraction, multiplication, division, and percent.

You will probably find that these strategies are a bit more complex than the addition mental math strategies. But once you have mastered the mental math addition strategies, you will be able to use them with mental math strategies for other operations—because all mathematics is tied together beautifully. For example, it helps to learn subtraction if you see subtraction as addition in reverse!

> *A warning to parents: Do not try to teach the strategies in this part to your children until they are comfortable with many of the addition strategies in Part 1!*

The following mental math strategies are arranged in sections by mathematical operation, but they do not necessarily have to be learned in this order.

Strategies for Subtraction

◆ Subtracting One

This is a great place to start with really young children. Subtracting one means hearing a number, then saying the number that is one down from it—or counting back one number. The best way to introduce this to your children is to say a number out loud and have them tell you the next lower number. Make it fun by having your children tell you a number, and then you tell them the number that is one less. Start with low numbers and, as your children are able to count higher, move to larger numbers. Make it fun.

◆ Counting Back

Children start with a number and count backwards. For example, if the problem is 5 – 2, children say 5 in their heads, then count back by 1 twice—4, 3. Note: This strategy is only easy for subtracting small numbers such as 1, 2, or 3. However, if you will allow your children to use their fingers, they may be able to subtract up to 10 this way—folding down one finger at a time as they subtract one each time in their head.

◆ Imagine a Number Line

All things are easier with visual aides, and images in your head are visuals that can help you do mental math. If your children are familiar with a number line (you DO have one up on the wall in their room, right?) then they can "see" the number line when they count backwards.

◆ If You Would Rather Add Than Subtract

Once children learn that addition and subtraction are reverse operations, they can do the addition instead of subtraction in simple problems, if they prefer. For example, in the problem 15 – 8, they could instead ask themselves what they would need to add to 8 to get to 15, or 8 + 7 = 15. Therefore 15 – 8 = 7

◆ Subtracting Ten

Once students learn that adding ten is easy because ten is an easy "jump" UP the number line, it is easy to learn to subtract 10 by making that jump in reverse. No matter what number you start with, the ones digit stays the same but the tens digit decreases by one when you subtract 10. For example: 35 – 10 = 25 and 47 – 10 = 37.

◆ Subtracting Nine

For subtracting 9, students should use two strategies they already know: subtracting 10 and adding 1. When subtracting 9, children

just subtract 10 (see above) and then count up by one. Children would mentally say 23 – 9 is the same as 23 – 10 + 1, or 13 + 1 = 14. Once understood, this mental math strategy is almost as easy as adding ten.

◆ The No-Regrouping Strategy

When students are called upon to subtract two- or three-digit numbers, the first question to ask—before any subtracting—is: "If I was doing this problem on paper, would I need to borrow (regroup), or can I simply subtract each place value from left to right?" To subtract 368 – 125, think 300 – 100 = 200, 60 – 20 = 40, 8 – 5 = 3. The answer is 243. Of course this requires students to keep the numbers and separate subtractions straight in their heads. Start this strategy with two-digit numbers only. If your children can readily do two-digit subtraction with no regrouping in their heads, THEN try three-digits!

Strategies for Multiplication

A note to parents: While many of us grew up learning to use the "x" to indicate multiplication, such as 6 x 7, many textbooks now reserve "x" for use in algebra and use the "·" sign for multiplication.

◆ Skip Counting

Skip counting should be one of the first mental math skills all children learn. It uses the fact that multiplication is simply repeated addition of the same number. To multiply 5 · 2, children could mentally "say:" 2, 4, 6, 8, 10—or five 2s. If children know their simple multiples, such as 2s, 3s, 5s, and 10s, then they can skip count by 2s, 3s, 5s, and 10s. If they are really good and know all their multiples up to 10, then this strategy is even more useful. Once again, if you are willing to allow your children to use their fingers, they can more easily skip count in their heads while counting on their fingers to make sure they have "skipped" the right number of times (MANY adults do this).

◆ Multiplying Numbers, the Same Forwards and Backwards

Multiplication is commutative (as is addition), which simply means that 7 · 3 gives the same answer as 3 · 7. This is true for ALL addition and multiplication problems, regardless of size or complexity. This gives children a choice; if they do not remember the answer to 8 · 5, perhaps they will remember the answer to 5 · 8. Technically, this means that you only have to memorize half the multiplication facts since all facts have a "turn around" fact.

◆ Multiply by Two

If children remember that multiplying any number by two is the same as adding a number to itself—double numbers—they can use mental math addition instead. For example: 2 · 16 = 16 + 16 = 32. People who frequently do mental math always choose the operation with which they are the most comfortable.

◆ Multiply by Ten

This mental math strategy, ironically, is best taught using paper and pencil BEFORE trying it mentally. When writing and solving problems such as 3 · 10 and 25 · 10 the traditional way, children will see that the answers will always be the same number being multiplied by 10, but with a zero placed on the end! 3 · 10 = 30 and 25 · 10 = 250. Once they see this pattern for themselves, they can use the rule of tacking on a zero at the end to multiply any number by 10. If they do not see this pattern with problems done on paper, they are probably not ready for this mental math strategy.

◆ Multiple Neighbors

While we want children to know every multiplication fact, we know that some facts are harder to remember than others. For example many children (and even many adults) sometimes are slow to remember the answer to 8 · 7. However, children who cannot remember the answer to 8 · 7 may easily remember that the answer to 8 · 8 = 64. If so, they can "backup" 8, and get the answer, 56, to the fact they could not remember. Sometimes it helps to be comfortable with what you do not know, just as it is with what you do know.

Other Math Operatons

◆ Zero Is Your Friend

Zero is more than a big, fat nothing! Knowledge of how zero works in many mathematical operations can allow some wonderful mental math short cuts. For example, in an addition or subtraction

problem where both numbers have trailing 0s, such as 120 – 70 or 150 + 30, students who know the power of 0 know they can remove the common 0s, and complete the easier (smaller number) problem, then tack the 0 back on to get the final answer. For example, for 120 – 70, think instead 12 – 7 = 5, then tack that 0 back on to get the answer 50! For 150 + 30, think 15 + 3 = 18 then tack the common zero back on to get the final answer, 180.

For multiplication, if you have a problem such as 70 · 60, mentally remove BOTH 0s, do 7 · 6 = 42, then tack on BOTH 0s you removed, to get the final answer of 4200.

For division, if both divisor and dividend both end in 0s, remove the same number of trailing 0s from each number, then divide—this time you get to forget the 0s you removed because, in effect, they cancel each other out in division! For example, in the problem 3200 ÷ 400, drop two 0s from each number, and divide 32 by 4 in your head, getting the answer 8—ah zero; we love you!

◆ Percentage/Fraction Connection

If children learn the close connection between fractions and percents, they can use that cross-over knowledge more easily. Students need to know that percentage IS a fraction, and that the most common percentages have equally common equivalent fractions—which might be easier to use when finding percents mentally. For example, 50% has the equivalent fraction 1/2. If children are asked to find 50% of $28, they should instead think: one half of $28 or, more simply, divide 28 by 2 to get the answer $14. To make the most of this strategy, children need to know the common percentages as fractions. 20% is 1/5, 25% is 1/4, 33 1/3% is 1/3; 10% is 1/10, etc. So, to find 20%, they would divide by 5, and to find approximately 33%, they would divide by 3, and so on. This is a skill that every shopper needs!

Mental Math Teaches Number Sense

Some people may read the strategies in these two articles on mental math and call them tricks. But for children, learning these strategies is much more than learning a set of useful mental tricks. Each of these strategies demonstrates the pattern, structure, and order in our number system. If children not only are able to do these "tricks," but also can understand WHY they work, they are developing a broad knowledge of how numbers fit together logically—we call this number sense.

A Bit of Mental Math Advice

I said the exact same thing at the end of Part 1, but it is so important that it is worth repeating. For some students these mental math strategies will be interesting and fun—and may even make them feel mathematically powerful. However, what appeals to one child may be uninteresting and hard to another. If there is one important bit of advice before you share any of these strategies with your children, it is: go slow and proceed only IF your children enjoy learning how to do mathematics in their heads. A few minutes of playing with mental math are plenty—do not make it tedious. If learning mental math tricks is not fun for your children, it is best if you stop and look for other areas of mathematics, such as geometry or puzzles, that will appeal to your children more than mental math.