NUMERACY COUNTS

September 2016

# Mental Math Part 2: Mental Calculations

**Mental Calculations** involve arriving at an exact answer by using strategies that enable most of the calculations to be done in one's head. Mental calculations require an understanding of place value and the distributive, commutative, and associative properties.

## Teaching Points

- Mental math needs to be taught, not just tested. The emphasis should be on how students arrive at their solutions rather than on how quickly or correctly they answer the questions. Students should be given time to calculate so they can think about the numbers they are working with and try out different strategies.
- It is important that teachers understand a wide variety of strategies for all four operations and are able to model and explain those strategies for students. Teachers should know when and how to move students from using less efficient strategies such as counting to using more sophisticated or efficient strategies.
- Class discussion is important. As students are explaining their solution methods to the class, they are solidifying their own understanding. In turn, the students who are listening are developing an awareness of other possible strategies (that is, they are building a toolbox of strategies). Ultimately students will be able to select the most efficient strategy from their toolbox for a given calculation.
- Mental math does not involve tricks or magic. Make sure that students understand the mathematics behind any shortcuts they might use. For example, with the "adding zeroes" shortcut, the trick to finding the answer to 123 x 100 is to keep the 123 and add two zeroes. Students should understand the math behind this trick (that is, 123 x 10 x 10). With the "number in the middle" shortcut, students find the answer to 25 + 27 by just doubling the number in the middle, 26. They should also understand the math behind this trick, which is (25 + 1) + (27 – 1) = 26 + 26. Students often fail to use these shortcuts correctly when they are presented as rules to be memorized. There is more of a chance for success when students have a mathematical understanding of why these shortcuts work.


### Can mental calculations involve the use of manipulatives?

Students who calculate mentally are able to visualize problems and work them out in their heads. To do so, however, they require practical experiences and models that can help them apply these problems to the real world. They should be provided with appropriate resources that they can use to observe the problem, apply the strategy, and visualize the solution. Such resources include coins,

counting sticks, number cubes, base-10 blocks, interlocking cubes, counters, number lines, 100-squares, bead strings, place-value cards, diagrams of shapes divided into fractional parts, et cetera. Interactive whiteboards are also useful, as they allow students to manipulate images and thereby visualize a solution.

### Can mental calculations involve pencil and paper?

Pencil and paper can be used in mental calculations, such as for the following purposes:

- for informal notes made during the intermediate steps in a calculation to support short-term memory
- for recording explanations of the methods used (as an alternative to having the students provide explanations orally)
- for creating models and diagrams that support the development of mental imagery/visualization

### Why might students struggle?

Students may experience difficulty in the following instances:

- they have a limited number of strategies in their toolbox
- they do not understand number properties (distributive, commutative, associative)
- they try to use standard written methods in their heads (mental blackboard)
- they rely on counting strategies
- their understanding of place value is not well developed

## Questions for Reflection

1. How can instruction and assessment of mental math be differentiated in order to meet the needs of all students?
2. Are all staff members aware of the development of mental math strategies across the grades, and are they consistent in their use of vocabulary?
3. What resources/supports might be needed? (Listed below are some useful resources to start with.)

## Resources


Nova Scotia Education and Early Childhood Development. *Mental Math Video Clips and Support Files for Math Leaders*. Halifax, NS: Nova Scotia Education and Early Childhood Development, n.d. https://lrt.ednet.ns.ca/PD/mentalmath/

Professional Development Service for Teachers. *Practical Approaches to Developing Mental Maths Strategies for Addition and Subtraction*. Dublin, IR: Professional Development Service for Teachers, n.d. www.pdst.ie/sites/default/files/Mental%20Maths%20Workshop%201%20Handbook.pdf

Professional Development Service for Teachers. *Practical Approaches to Developing Mental Maths Strategies for Multiplication and Division*. Dublin, IR: Professional Development Service for Teachers, n.d. www.pdst.ie/sites/default/files/Mental%20Maths%202%20Handbook.pdf

United Kingdom Department for Education. *Teaching Children to Calculate Mentally*. Manchester, UK: United Kingdom Department for Education, 2010. http://dera.ioe.ac.uk/778/1/735bbb0036bed2dcdb32de11c7435b55.pdf