

Teacher Note

Learning the Addition Combinations

To develop efficient computation strategies, students need to become fluent with the addition combinations from $1 + 1$ to $10 + 10$. Fluency means that the combinations are quickly accessible, either because they are immediately known or because the calculation is so effortless as to be automatic (in the way that some adults quickly derive one combination from another; for example, thinking $8 + 9 = 8 + 10 - 1$). In *Investigations*, all students should be fluent with all of the addition combinations up to $10 + 10$ by the end of Grade 2. However, some students may need to review and practice some of these combinations in Grade 3.

Why Do We Call Them *Combinations*?

The addition problems from $1 + 1$ through $10 + 10$ are traditionally referred to as “addition facts.” The *Investigations* curriculum follows the National Council of Teachers of Mathematics (NCTM) convention of calling these expressions *combinations* rather than *facts* for two reasons. First, referring to *only* particular addition and multiplication combinations as *facts* seems to give them elevated status. This makes them seem more important than other critical parts of mathematics.

In addition, the word *fact* implies that something cannot be learned through reasoning. For example, it is a fact that the first president of the United States was George Washington, and it is a fact that Rosa Parks was born in Alabama in 1913. If these facts are important for us to know, we can remember them or use reference materials to look them up. However, the sum of $7 + 8$ can be determined in many ways; it is logically connected to our system of numbers and operations. If we forget the sum, but understand what addition is and know some related combinations, we can find the sum through reasoning. For example:

If we know that $7 + 7 = 14$, we can add 1 more to get 15.

If we know that $8 + 8 = 16$, we can subtract 1 to get 15.

If we know that $7 + 3 = 10$, we can then add the 5 that is left from the 8 to get 15. ($7 + 8 = 7 + 3 + 5 = 15$)

The term *facts* does convey a meaning that is generally understood by some students and family members, so you will need to decide whether to use the term *facts* along with *combinations* in certain settings in order to make your meaning clear. Further, it does not seem appropriate to refer to the counterparts for subtraction and division as “combinations,” because subtraction and division do not involve the action of combining. Therefore, for convenience we refer to “subtraction facts” and “division facts.”

Learning the Addition Combinations Fluently

The *Investigations* curriculum, like NCTM, recognizes the importance of students’ learning the basic combinations fluently through reasoning about number relationships: “Fluency with whole-number computation depends, in large part, on fluency with basic number combinations—the single digit addition and multiplication pairs and their counterparts for subtraction and division. Fluency with basic number combinations develops from well-understood meanings for the four operations and from a focus on thinking strategies”. . . . “[*Principles and Standards for School Mathematics*, pp. 152–153]”

In other words, students learn these combinations best by using strategies, not simply by rote memorization. Relying on memory alone is not sufficient. If you forget—as we all do at times—you are left with nothing. If, on the other hand, your learning is based on an understanding of numbers and their relationships, you have a way to rethink and restructure your knowledge when you do not remember something you thought you knew.

In Grade 2, students learned these combinations in groups (make-10 combinations; plus-1, -2, or -10 combinations; doubles and near-doubles), which helped them learn good strategies for solving them easily. Fluency develops through frequent and repeated use; therefore, as students worked on a particular category of combinations, they played games and engaged in activities that focused on those combinations. For example, students reviewed the combinations that make