Teacher Note

Place Value

In Grade 3, students solidify their understanding of the base-ten number system as they learn to use and understand numbers in the 100s and 1,000s. The base-ten number system is a "place value" system; that is, any numeral can represent different values, depending on where it appears in a written number: the numeral 2 can represent 2 ones, 2 tens, 2 hundreds, 2 thousands, and so forth. Understanding our place value system requires coordinating the way we write the numerals that represent a particular number (e.g., 217) and the way we name numbers in words (e.g., two hundred seventeen), with how those symbols represent quantities. See **Part 6: Teacher Notes for the *Investigations*** Curriculum in *Implementing Investigations in Grade 3:* Computational Fluency and Place Value.

The Base-Ten Number System

In Grade 3, students first focus on how 100 is composed in this unit, *Trading Stickers, Combining Coins.* Later, they look at how multiples of 100, including numbers in the 1,000s, are composed in the unit *Collections and Travel Stories.* The heart of this work is learning to relate the written numerals to a quantity and to how that quantity is composed. This is not simply a matter of saying that 217 "has 2 hundreds, 1 ten, and 7 ones," which students can easily learn to do without attaching meaning to the quantity these numerals represent. Students must learn to visualize how 217 is built up from hundreds, tens, and ones in a way that helps them relate its value to other quantities. That is, understanding the place value of 217 entails knowing that 217 is closer to 200 than to 300, that it is 100 more than 117, that it is 17 more than 200, that it is 3 less than 220, and that it is composed of 21 tens and 7 ones.

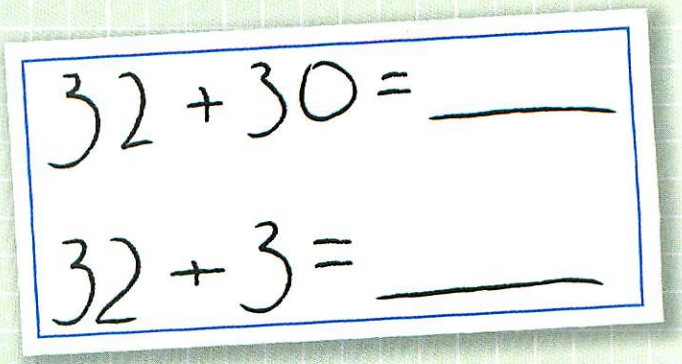
In this unit, students use two contexts—stickers and money—to build 3-digit numbers and visualize how they are composed. They focus on creating different combinations of stickers or coins to make a certain quantity. For example, 117 can be composed of 1 sheet of 100, 1 strip of 10, and 7 individual stickers (or 1 dollar, 1 dime, and 7 pennies), but it can also be composed of 11 strips of 10 and 7 individual stickers (or 11 dimes and 7 pennies). Students work on visualizing the composition of these numbers flexibly.

Place Value and Computational Fluency

A thorough understanding of the base-ten number system is one of the critical building blocks for developing computational fluency. The composition of numbers from multiples of 1, 10, 100, 1,000, and so on, is the basis of most of the strategies students use for computation with whole numbers.

Throughout their work in Grade 3, students learn about using multiples of 10 and 100 as "landmarks" in their computation work. In this unit, students focus on adding and subtracting multiples of 10 (for example, in the game *Capture 5,* introduced in Investigation 1) and on combinations that add to 100 (for example, in the Ten-Minute Math activity, *More or Less,* introduced in Investigation 2).

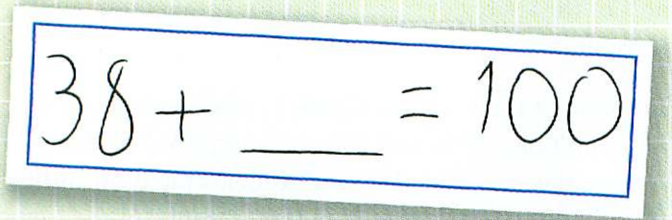
By considering which digits of a number will change when multiples of 1, 10, or 100 are added or subtracted, students focus on a key aspect of estimation—looking carefully at the place value of the numbers in a problem. For example, consider these two problems:



Sample Student Work

How does the sum compare with 32 in each case? Students think about how the first sum will now have 6 tens, but the ones will not change, whereas in the second sum, the ones will change, but the tens remain the same. Considering the magnitude of the numbers in addition and subtraction problems leads to a reasonable estimate of the result. The work with tens and ones in this unit lays the foundation for estimation with larger numbers later in Grade 3.

The single-digit addition combinations (the "facts") are critical for computational fluency in addition, but so are other addition combinations. In this unit, students should develop a solid grasp of the 2-digit combinations that make the sum of 100, as they picture how 100 can be decomposed into tens and ones. For example, consider the following equation:



Sample Student Work

Through visualizing 38 in the sticker context or by thinking about money, students come to recognize easily that $38 + 2 = 40$, and $40 + 60 = 100$, so $38 + 62 = 100$.

In this case, 38 is composed of 3 tens and part of another ten. In order to complete the addition expression so that the sum is 100, or ten 10s, students think, "Two more ones will give me 4 tens, then I need 6 more tens (60) to get to 100, so that's 62 altogether." Students can use coins or sticker sketches to help them visualize this relationship, but eventually they should be able to do any problem of this sort mentally. When students can easily compute any missing addend to make the sum of 100, they can use this information to find the sums of related problems, such as $38 + \_\_\_\_ = 200$. They begin this work with multiples of 100 in this unit and continue it in *Collections and Travel Stories.*

Students' work on adding and subtracting relates directly to their work on the place value system. The two strategies for addition emphasized in this unit—*adding by place* and *adding on one number in parts*—depend on an understanding of how to decompose numbers.

The focus for students in this unit is on understanding the structure of 100 and using that understanding to solve addition and subtraction problems. Students need to spend plenty of time working with 100 in a variety of contexts and activities in order to develop the foundation for computational fluency. In *Collections and Travel Stories,* students will work with multiples of 100 and numbers in the 1,000s.