Math Activity: Multiplying by 10

Object of the activity: We often hear students say, "When you multiply by ten, you just put a zero at the end of the number, and when you multiply by one hundred, you put two zeros at the end of the number." What does this mean? How does it work? Keep these questions in mind as you explore this set of problems.

1. Create a representation for each of these multiplications, using a base-ten model. If you have time, create a different kind of representation. Examine your representations to answer this question: How do you explain the relationship between the digits in the problem and the result of the multiplication?

   (a) 23×1 (b) 23×10 (c) 23×100 (d) $23 \times 1{,}000$ (e) $23 \times 10{,}000$

2. I have a collection of 462 monetary objects.

   (a) If these objects are pennies, how much is the collection worth? How many dimes worth of coins is this? How many dollars worth?

   (b) If these objects are dimes, how much is the collection worth? How many pennies worth is this? How many dollars worth?

   (c) If these objects are dollar bills, how much is the collection worth? How many pennies worth is this? How many dimes worth?

3. Consider the number 43,678. How many tens are in this number? How many hundreds? How many thousands? How many ten-thousands? What connections are you noticing between this arithmetic and the way large numbers are read?

4. Explain what happens when you multiply a number such as 43,678 by 10 and why it works that way. Use representations such as base-ten models, story contexts, and arrays to develop your explanations. What connections can you make between the representations you made and arithmetic methods for calculating $43{,}678 \times 10$?

Focus Questions: Chapter 2

1. Turn to Dawn's case 6 and study Andrew. Why does it make sense to him to have "fifty-ten" follow 59? What is right in his thinking? What is he missing?
2. In Danielle's case 7, the students come up with many ways to write one hundred ninety-five. What sense do you see in each one?
3. What ideas about the number system does the activity in Donna's case 9 highlight?
4. Look over your work for questions 1, 2, and 3. How is the work of these students related to practice 7, look for and make use of structure? What mathematical structures are the students calling upon?
5. Make a number line of your own from 0 to 10,000 and place 375 on it. Discuss how you decided where to mark the 375. Now place the following additional numbers on your number line:
   (a) 25
   (b) 2,376
   (c) 7,832
6. Compare Shaquille's and Chris's number lines in case 10. How are they alike? How are they different? What ideas about the number system do you see in these representations? What is not seen?
7. Explain Olivia's multiple number-line strategy in case 10. What ideas about the number system do you see in her representations?
8. In Susie's case 11, she asks her students how many thousands there are in 437,812.
   (a) Trace the thinking of the students as they discuss this. What mathematical ideas about the place-value system are coming up for them? What are they missing?
   (b) In line 476 of case 11, the students use a calculator to determine that there are 437.812 thousands in 437,812. What does that mean?

Third Homework

Reading assignment: Casebook, chapter 3

In the casebook, read chapter 3, "Making Sense of Addition and Subtraction Algorithms," including the introductory text and cases 12 through 14. Use the questions posed in the introduction to guide your reading.

Writing assignment: A math interview

One major thread of this seminar is the examination of the ways students think as they build an understanding of the number system. One approach to learning about students' thinking is to listen carefully to individuals as they articulate their thoughts while doing mathematical tasks.

The math interview is one strategy for obtaining evidence about students' thinking. An interview helps you delve into the thinking of an individual student, to get underneath the surface of the student's responses to better understand his or her reasoning. Your assignment for the next session will be to conduct and write about an interview with a student.

In your interview, explore the student's ideas about the number system, drawing on what we have done in this seminar. Ask the student to perform some tasks, which might include questions about reading and writing numbers, counting, adding, or subtracting. You might want to use activities or questions from the cases we have read, from the videos we have watched, or from activities we have done together in class. These will give you a place to start, but feel free to add your own tasks and questions.

Although you will need to plan questions and tasks in advance, you will also need to carefully follow what the student does and says during the interview so you can follow up with questions or problems that seem appropriate. Keep in mind that your job in the interview is to find out as much as you can about the student's ideas, not to teach the student anything. Record the interview so you will be able to listen to it later.

Include the following in your write-up: what tasks you chose, what happened during the interview, what you learned (or didn't learn) about the student's ideas, what surprised you, what questions you still have, and what you learned from conducting the interview. Give enough information so that a reader can understand what happened and what you learned.

Bring three copies of your write-up to share at the next session.