Teacher Note

Developing Computation Strategies That Make Sense

In this unit and throughout Grade 5, students solve computation problems by building on numbers and relationships they know. By the end of Grade 5, students should have computation strategies that they can justify and carry out easily for addition, subtraction, multiplication, and division of whole numbers. Most students will have one algorithm or procedure for a particular operation that they use often, but they should also be familiar with, understand, and be able to explain more than one procedure for each operation.

Watch and listen carefully as your students solve computation problems. Find out what makes sense to them. If a student's approach is unfamiliar to you, do a problem or two yourself, using the student's approach. Common procedures for solving multiplication and division problems are described in **Teacher Note:** Multiplication Strategies, page 161, and **Teacher Note:** Division Strategies, page 170. Some of these strategies may be different from the procedures that are most comfortable for you. Do not assume that what seems easy and efficient to you is necessarily the best or most efficient approach for your students.

If students have procedures that they can apply easily and accurately, that do not bog them down in laborious calculations, and that they know how to apply to a variety of problems, then they have the tools they need to solve virtually any problem. If, on the other hand, students lose track of their own procedures, make many errors, or end up with calculations that are very difficult, they need to become more proficient at decomposing their problems into manageable parts. They do this in order to develop strategies that both make sense to them and are easy to carry out.

Here are some guidelines for helping students refine their strategies:

Provide time to work with different strategies. When students first meet a new strategy, they need opportunities to try it with a range of problems before they begin to see how efficient it is in different situations. Through their work in Grade 5, some students will develop a repertoire of strategies, others only one. What is important is that students understand why their strategies work and be able to use them with confidence.

Encourage students to think about ways to start a problem. Students need support in order to work with unfamiliar strategies that can eventually give them tools to become more fluent problem solvers. In this unit, activities such as Multiplication Clusters, Starter Problems, and Division Clusters are designed to help students consider different building blocks for solving multiplication and division problems. You can use these ideas throughout Grade 5 to help students approach a problem. For example, suggest a first step and ask students to talk in pairs about what else they would need to know in order to find the answer.

Terrence wanted to solve 374 ÷ 12. He started by doing 20 × 12. Does that first step help? What else would he need to find? What would be *your* first step?

When a student seems stuck, ask the student to think about known number relationships that can help.

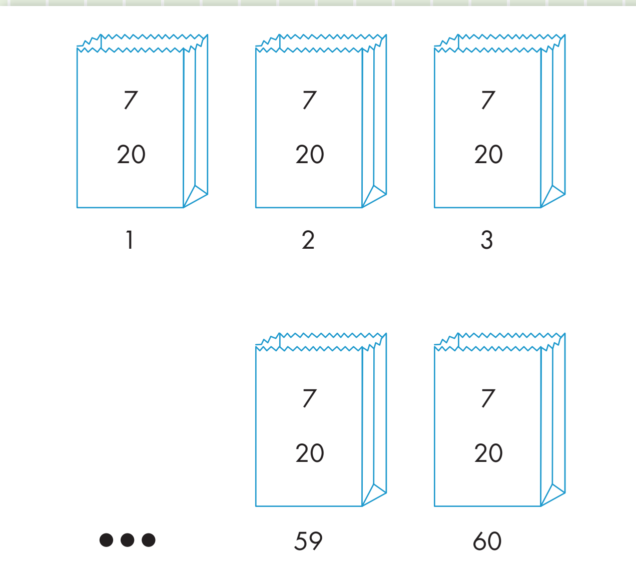
I noticed that a few of you are having a hard time thinking of a first step to solve 374 ÷ 12. What numbers do you know that you can divide by 12? Let's brainstorm a few.

I hear 24, 36, 48, 120, 1,200, 360, 480. Which of these can help with this problem?

Emphasize representations and story contexts. Frequently ask students to use a diagram or a story to help them think through or explain how they are breaking up a problem. The goal is for students to learn how to use representations and story contexts as part of their own mental repertoire for visualizing problems. If students are working on keeping track of all the parts of a multiplication problem, help them use stories, pictures, and arrays to visualize the parts.

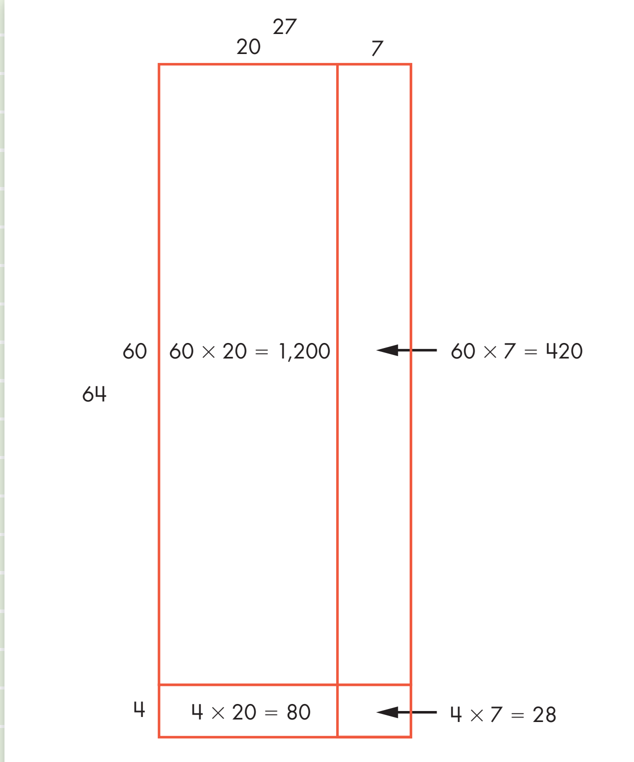
If students are solving 64×27 and first multiply 60×20, you might pose the following question:

The other day, we were imagining a grocer at Ted's Fruits and Vegetables filling bags with oranges. If the grocer needs to fill 64 bags with 27 oranges in each bag, and we start with 60 × 20, what have we done so far? *(filled 60 bags with 20 oranges each)* **What would you do next? OK, Mercedes suggests 60 × 7. So now what have we done?** *(put 7 more oranges into those 60 bags)* **What have we done so far?** *(put 27 oranges into 60 bags)*



What is left to do? *(put 27 oranges into each of 4 more bags)*

Also ask students to use an array to show the same partial products, and ask questions that relate the story to the array.



So where does the 60 × 20 from our story show up in the array?

Ask students to come up with their own contexts. Even if the student who is explaining a solution is easily keeping track of all the parts of the problem, the other class members may benefit more from the student's explanation if you discuss how to represent the solution with a story and a representation. Refer students to the Math Words and Ideas section of the *Student Math Handbook* for examples of representations and stories.

Work with students to develop clear and concise notation. Clear and concise notation helps students keep track of the steps in solving problems, allows them to check their work, and allows others to understand their solution process. By Grade 5, students need to develop ways to notate their computation strategies that are easy for them and others to follow. One of the most important ways you can help students develop good notation habits is by modeling clear and concise notation as you record students' strategies during class discussions. You will also need to identify individual students with whom you need to work more closely. See **Teacher Note:** Division Notation, page 163, for more about notation.

Help students think about why and when certain strategies are easy to use. Students need to understand that there is no one best strategy for every person and every problem. As students reflect on why and when strategies are easy to use and share their thinking with others, they come to see that their choice of strategy depends on the numbers in the problem, the kinds of computations with which a person is most comfortable, and the number relationships a person knows very well.

Many students will solve most multiplication problems by breaking up the numbers by place and creating all the necessary partial products. However, for some problems, other methods are easier to apply. Consider 52×36, for example. One student might first think about an easier problem, 50×36, then change this into the equivalent problem 100×18, find the products of 100×18 and 2×36, and, finally, add those products. Another student might double 52 and halve 36 and then double and halve again to create the simpler problem, 208×9.