GRADE 2 • MODULE 5 - Addition and Subtraction Within 1,000 with Word Problems to 100

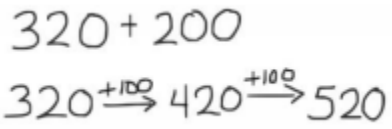
New or Recently Introduced Terms

- Algorithm (a step-by-step procedure to solve a particular type of problem)
- Compensation (simplifying strategy where students add or subtract the same amount to or from both numbers to create an equivalent but easier problem)
- Compose (e.g., to make 1 larger unit from 10 smaller units)
- Decompose (e.g., to break 1 larger unit into 10 smaller units)
- New groups below (show newly composed units on the line below the appropriate place in the addition algorithm)
- Simplifying strategy (e.g., to solve 299 + 6, think 299 + 1 + 5 = 300 + 5 = 305.)

Topic A: Strategies for Adding and Subtracting Within 1,000

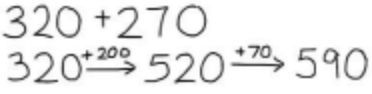
In Topic A, students practice the simplifying strategies they learned in Module 4, but with numbers up to 1,000. They will be asked to consider which strategy is most efficient for each problem they encounter.

In Lesson 1, students relate 100 more, 100 less, 10 more, and 10 less to addition and subtraction. They recognize that they must still add and subtract like units, and that the digit in the hundreds place changes when adding and subtracting 100, just as the digit in the tens place changes when adding or subtracting 10. Students see numbers in terms of place value units: 290 – 100 is 2 hundreds 9 tens minus 1 hundred. They learn to record the addition and subtraction of multiples of 100 using arrow notation (i.e., the arrow way).

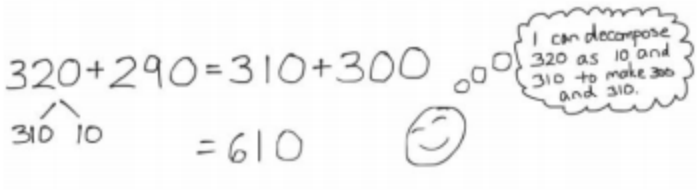


In Lesson 2, students add and subtract multiples of 100 by counting on by hundreds. For example, when adding 200 to 320, they may count up from 320: 420, 520. Students also develop flexibility in using related addition problems. For example, to solve 519 – 200, one student might think “5 hundreds minus 2 hundreds is 3 hundreds, plus 19 is 319,” while another starts at 200, adds on 19 and then 3 hundreds to reach 519, so 319.

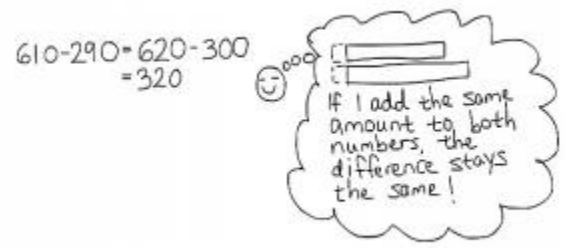
In Lessons 3 and 4, students continue to add and subtract multiples of 100 with the added complexity of some tens. Problems are chosen so that at first the tens digit is close to a multiple of 100 (e.g., 190, 290, 380) to make it easier to form the next hundred by decomposing addends. This prompts students to analyze and use relationships between numbers to develop a variety of simplifying strategies. Students also use arrow notation to record their mental math. First, they add a multiple of 100, and then count on by multiples of 10 to find the total (as shown at right). Lesson 3 focuses on addition, while Lesson 4 emphasizes related strategies for subtraction.



In Lesson 5, students apply the use of number bonds to decompose larger numbers, just as they did with numbers within 100. For example, when solving 320 + 290, they can break 320 into 10 and 310 to make 310 + 300 = 610 (as shown at right), just as they would have decomposed to add 32 and 29 in Module 4. They realize the problem can be conceived of as 32 tens + 29 tens. Note that arrow notation can also be used to solve 320 + 290 by first adding 200, then 80, and then 10, or by adding 300 and then subtracting 10. Students also work with problems such as 298 + 137, using a number bond to decompose 137 into 2 and 135, thus creating the equivalent but easier equation 300 + 135 = 435.



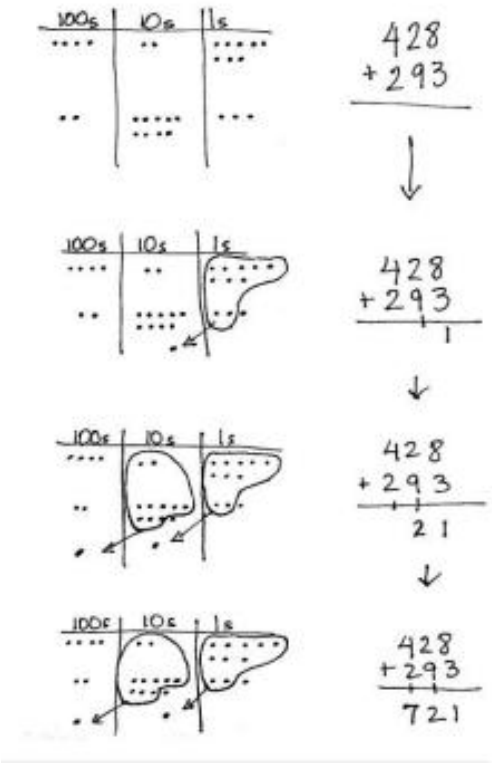
In Lesson 6, the ease of subtracting a multiple of 100 is highlighted again, as students extend their work from Module 4 using compensation (i.e., the associative property) for subtraction. Students may add or subtract a multiple of 10 to make an equivalent problem that involves no renaming. For example, when subtracting 610 – 290, the same number, 10, can be added to both numbers to create a multiple of 100 (as shown at right). Students also solve problems such as 451 – 195, adding 5 to both the minuend and subtrahend to make 456 – 200.



Topic A closes with Lesson 7, which provides students the opportunity to solidify their new skills. They confront a variety of problems, solve them, and then share their solution strategies. Through spirited discussion, students critique the work of their peers while deepening their understanding of various strategies. The strategies taught in Topic A are designed to develop students' conceptual understanding of addition and subtraction using models, drawings, properties of operations, and strategies based on place value. At the same time, students relate these strategies to written methods such as arrow notation and number bonds.
This sets the stage for flexible thinking as students move into composing and decomposing units in Topics B and C.

Topic B: Strategies for Composing Tens and Hundreds Within 1,000

Topic B in Module 5 is analogous to Topic B in Module 4, but while in Module 4 students composed ones and tens within 200, Module 5 expands upon this, finding students composing tens and hundreds within 1,000. The work of Topic A transitions naturally into Topic B, with students employing concrete and pictorial representations of the vertical algorithm when they encounter addition problems for which they do not have an obvious simplifying strategy.



In Lessons 8–9, students continue to build their conceptual understanding as they relate manipulatives to the algorithm, recording compositions as new groups below in vertical form as they did in Module 4. As they move the manipulatives, students use place value language to express the action and physically exchange 10 ones for 1 ten and 10 tens for 1 hundred, as needed. They record each change in the written vertical method, step by step.

In Lessons 10 and 11, students move from concrete conception to pictorial representation as they draw chip models to represent addition within 1,000. As they did with the manipulatives, students record each action in their drawings step by step on the algorithm (see image at right).

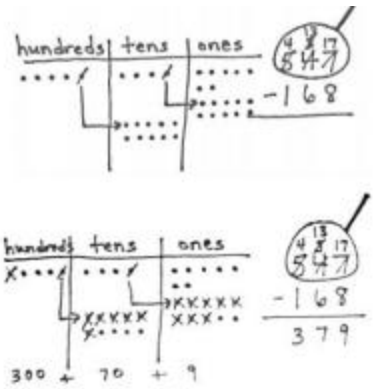
In Lesson 12, students are presented with a variety of problems for which they must choose an appropriate strategy to solve. Students are encouraged to be flexible in their thinking and to defend their reasoning using place value language. They may choose to represent and solve problems using number bonds, the arrow way, number disks, or chip models.

Topic C: Strategies for Decomposing Tens and Hundreds Within 1,000

Topic C builds upon Module 4's groundwork, now decomposing tens and hundreds within 1,000.

In Lesson 13, students model decompositions with number disks on their place value charts while simultaneously recording these changes in the written vertical form. Students draw a magnifying glass around the minuend, as they did in Module 4. They then ask the familiar questions:

- Do I have enough ones to subtract?
- Do I have enough tens?
    - When the answer is no, students exchange one of the larger units for ten of the smaller units. They record the change in the algorithm, following this procedure for each place on the place value chart.



In Lessons 14 and 15, students transition to making math drawings, thus completing the move from concrete to pictorial representations. They follow the same procedure for decomposing numbers as in Lesson 13, but now they use number disk drawings (Lesson 14) and chip models (Lesson 15). Students continue to record changes in the vertical method as they relate their drawings to the algorithm, and they use place value reasoning and the properties of operations to solve problems with up to two decompositions (e.g., 547 – 168, as shown above).

Lessons 16 and 17 focus on the special case of subtracting from multiples of 100 and numbers with zero in the tens place. Students recall the decomposition of 100 and 200 in Module 4 in one or two steps, using the same reasoning to subtract from larger numbers. For example, 300 can be decomposed into 2 hundreds and 10 tens, then 1 ten is decomposed into 10 ones (two steps); or 300 can be renamed directly as 2 hundreds, 9 tens, and 10 ones (one step). In each case, students use math drawings to model the decompositions and relate them to the written vertical form, step by step.

In Lesson 18, students work with three-digit subtraction problems, which they apply multiple strategies to solve. For example, with 300 – 247, students learn they can use compensation to subtract 1 from each number, making the equivalent expression 299 – 246, which requires no renaming. They may also use the related addition sentence, 247 + ___ = 300, and then use arrow notation to solve, counting up 3 to 250 and then adding on 50, to find the answer of 53. For some problems, such as 507 – 359, students may choose to draw a chip model and relate it to the algorithm, renaming 507 as 4 hundreds, 9 tens, 17 ones in one step. As students apply alternate methods, the emphasis is placed on students explaining and critiquing various strategies.

Topic D: Student Explanations for Choice of Solution Methods

Topic D focuses on the application of the tools and concepts presented in Topics A through C. Students synthesize their understanding of addition and subtraction strategies, and then use that understanding to determine which of those strategies to apply to a variety of problems, including number bond problems and problems with the unknown in all positions (e.g., 200 + ____ = 342, ____ – 53 = 400). Students then discuss and analyze their chosen methods and decide which method is most efficient for the given problem type. For example, when digits are close to the next ten or hundred (e.g., 530 – ____ = 390), some students might use related addition and mentally add on tens and hundreds, while others might solve the same problem using arrow notation. Working with these problems provides a sound foundation for future work with word problems. Listening to peer explanations can make certain strategies more accessible for struggling students, and allows more time and practice to achieve mastery.