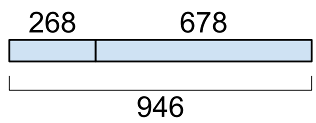
2:10 Three-Digit Addition/Subtraction

Teacher Notes

Central math concepts

To know how to check the subtraction in an equation like 946 - 678 = 268, students must understand the relationships between the terms in the equation. The diagram shows one way to represent the three quantities and their relationship. This diagram could be used to generate several equations, forming a "fact family":



268 + 678 = 946

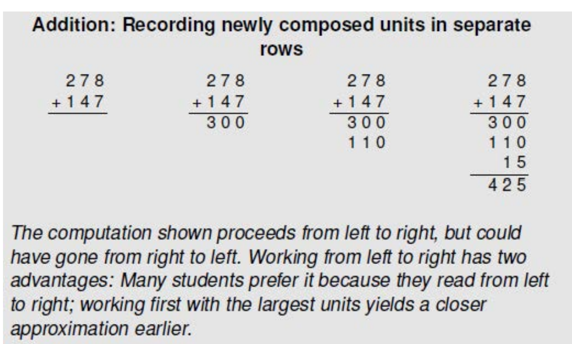
678 + 268 = 946

946 - 678 = 268

946 - 268 = 678

In general, the mathematical relationship between addition and subtraction is that $C - A$ is the unknown addend in $A + ? = C$. Therefore, problems involving subtraction also implicitly involve addition, because subtraction finds an unknown addend. This is why a subtraction calculation is checked by adding.

To calculate sums such as 678 + 268, students in grade 2 learn to use an efficient, accurate, and generalizable strategy that can develop further to meet the procedural expectations in grade 3 and grade 4. For example, pages 9 and 10 of the *Progression* document† show two calculation methods for three-digit addition. Images of these methods are presented below, along with the two points of commentary from the *Progression* document.



Addition: Recording newly composed units in separate rows

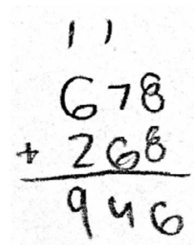
278 + 147	278 + 147 = 300	278 + 147 = 300, 110	278 + 147 = 300, 110, 15, 425

The computation shown proceeds from left to right, but could have gone from right to left. Working from left to right has two advantages: Many students prefer it because they read from left to right; working first with the largest units yields a closer approximation earlier.

2:10 Check the subtraction by adding.
946 − 678 = 268

Answer

See the example. Students might use different strategies and/ or algorithms than the one shown in the example.



Click here for a student-facing version of the task.

Refer to the Standards

2.NBT.B.7; MP.6, MP.7. Standards codes refer to www.corestandards.org. One purpose of the codes is that they may allow a task to shed light on the Standards cited for that task. Conversely, reading the cited Standards may suggest opportunities to extend a task or draw out its implications. Finally, Standards codes may also assist with locating relevant sections in curriculum materials, including materials aligned to comparable standards.

Aspect(s) of rigor:

Concepts, Procedural skill and fluency

Additional notes on the design of the task

The sum 678 + 268 involves two steps of composing a new unit.

Curriculum connection

1. In which unit of your curriculum would you expect to find tasks like 2:10? Locate 2-3 similar tasks in that unit. How are the tasks similar to each other, and to 2:10? In what specific ways do they differ from 2:10?

Addition: Recording newly composed units in the same row

Add the ones, 8 + 7, and record these 15 ones with 1 on the line in the tens column and 5 below in the ones place.

Add the tens, 7 + 4 + 1, and record these 12 tens with 1 on the line in the hundreds column and 2 below in the tens place.

Add the hundreds, 2 + 1 + 1, and record these 4 hundreds below in the hundreds column.

Digits representing newly composed units are placed below the addends, on the line. This placement has several advantages. Each two-digit partial sum (e.g., "15") is written with the digits close to each other, suggesting their origin. In "adding from the top down," usually sums of larger digits are computed first, and the easy-to-add "1" is added to that sum, freeing students from holding an altered digit in memory. The original numbers are not changed by adding numbers to the first addend; three multi-digit numbers (the addends and the total) can be seen clearly. It is easier to write teen numbers in their usual order (e.g., as 1 then 5) rather than "write the 5 and carry the 1" (write 5, then 1).

- "The first written method is a helping step variation that generalizes to all numbers in base ten but becomes impractical because of writing so many zeros. Students can move from this method to the second method (or another compact method) by seeing how the steps of the two methods are related. Some students might make this transition in Grade 2, some in Grade 3, but all need to make it by Grade 4 where fluency requires a more compact method."
- "Counting-on and adding-on methods become even more difficult with numbers over 1000. If they arise from students, they should be discussed. But the major focus for addition within 1000 needs to be on methods such as those [shown in the two images] that are simpler for students and lead toward fluency (e.g., [as in the first image]) or are sufficient for fluency (e.g., [as in the second image])."

The *Progression* document discusses the ways students can make sense of these methods in relation to concepts of place value. Also implicit in performing such calculations is learning the counting sequence from 100 to 1,000; see the *Progression* document, p. 8.

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: place value concepts; single-digit sums; regrouping in addition; and reasoning about addends, sums, and differences.

Extending the task

How might students drive the conversation further?

- Students could use a written subtraction method to verify directly that 946 - 678 = 268.
- Students could look for correspondences in a piece of written work for 678 + 268 = 946 and a piece of written work for 946 - 678 = 268. (Decomposition steps in the subtraction calculation can be connected to composition steps in the addition calculation.)

Curriculum connection (continued)

2. Thinking about the curriculum unit you identified, at what point in the unit might a task like 2:10 help students converge toward grade-level thinking about the important mathematics in the task? What factors would you consider in choosing when to use such a task in the unit?*

† Common Core Standards Writing Team. (2015, March 6). *Progressions for the Common Core State Standards in Mathematics (draft). Grades K–5, Number and Operations in Base Ten*. Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

* Math Milestones™ tasks are not designed for summative assessment. Used formatively, the tasks can reveal and promote student thinking.

- Students could be given a true equation, something impressive like 82,734 - 23,789 = 58,945; assuming this is true, what must be the result of subtracting 82,734 - 58,945 = ? (Check using a calculator to see if the reasoning worked!)

Related Math Milestones tasks

2:2

2:2 (1) True or false?
(a) 2 hundreds + 3 ones > 5 tens + 9 ones
(b) 9 tens + 2 hundreds + 4 ones < 924
(c) 456 < 5 hundreds

(2) Write the number that makes each statement true.
(a) 7 ones + 5 hundreds = ____
(b) 14 tens = ____
(c) 90 + 300 + 4 = ____

2:5

2:5 Write the value of each sum. Use as much time as you need. If you "just knew it," then draw a check mark, like this: 2 + 2 4✓

Click here for student handout 2:5

2:8

2:8 Write the number that makes each equation true. Use as much time as you need.

Click here for student handout 2:8

2:3

2:3 Write the sums and differences.

36	72	64	82
+ 45	− 17	+ 27	− 55

The place value ideas necessary for calculating three-digit sums and differences are the subject of task **2:2 Place Value to Hundreds**. Tasks **2:5 Sums of Single-Digit Numbers** and **2:8 Fluency within the Addition Table** involve the single-digit sums and related differences upon which multi-digit addition and subtraction algorithms are built. Two-digit sums and differences are addressed from a fluency perspective in task **2:3 Fluency within 100 (Add/Subtract)**.

3:14

3:14 Write the sums and differences.

With pencil and paper

351	264	625	831
+ 472	+ 438	− 261	− 444

Mentally
800 − 300
240 + 540
365 − 165
612 − 13

4:14

4:14 540,909 + 87,808 − 5,864 + 2,556 = ?

In later grades, task **3:14 Fluency within 1000 (Add/Subtract)** involves three-digit sums and differences, some chosen for pencil-and-paper calculation, others chosen for mental calculation. Task **4:14 Fluency with Multi-Digit Sums and Differences** marks the culmination of the progression for multi-digit addition and subtraction.

1:10

1:10 Write the sum. 37 + 46

1:8

1:8 90 − 40 = ____
9 apples − 4 apples = ____ (number) ____ (unit)
9 cups − 4 cups = ____ (number) ____ (unit)
9 tens − 4 tens = ____ (number) ____ (unit)

1:9

1:9 Write the missing numbers.
4 + 5 = ____ 7 − 4 = ____
10 − 8 = ____ 2 + 6 = ____
4 + ____ = 10 7 + ____ = 10

1:11

1:11 Write the missing numbers. Tell how you got the answers.
8 + 5 = ____ 8 − ____ = 2
13 − 4 = ____ ____ − 5 = 4
7 + 4 = 10 + ____ 6 + ____ = 12

In earlier grades, task **1:10 Two-Digit Addition** is a procedural task involving a sum of two two-digit numbers. Task **1:8 Subtracting Units** portrays a two-digit subtraction problem as a matter of subtracting two single-digit numbers of tens units. Sums of single-digit numbers and related differences are involved in tasks **1:9 Fluency within Ten** and **1:11 Using Properties and Relationships**.

2:10 Three-Digit Addition/Subtraction

Teacher Notes

Anticipating and responding to student thinking about the task

Imagine how students might think about the task, and what you might see and hear while they work.

On this page, you can write your thoughts on the following questions.

Solution Paths

- What solution paths might you expect to see?
- What representations might you see? What correspondences between those representations might be noticed by students (or be worth pointing out to students) and discussed by them?
- What misconceptions or partial understandings might be revealed as students work on the task? How could you respond to these positively and productively?

Language

- What might you expect to hear from students engaged with the task? What does that language reveal about their mathematical thinking, and how might you respond to different ways of thinking?
- If students are using early English or using multiple languages in an integrated communication system, how might you help their classmates see those mathematical ideas as valuable?
- Even when using nascent language, students are thinking and communicating their thinking. What might it look like to respond positively and productively to the mathematics in their thinking before giving feedback on the language used?

Identity, Agency, and Belonging

- How can you engage students' interests, experiences, or funds of knowledge?
- How can you build students' self-confidence as learners, thinkers, and doers of mathematics?
- What choices are there for a student to make in the task? How can you build students' agency to the point where they notice and make these choices to solve problems?
- How might one use feedback to build student agency? Where might there be opportunities to build students' self-confidence?