Topic C

Strategies for Decomposing a Ten

2.4B, 2.4C, 2.4D, 2.7C, 2.4A

Focus Standards:	2.4B	Add up to four two-digit numbers and subtract two-digit numbers using mental strategies and algorithms based on knowledge of place value and properties of operations.	
	2.4C	Solve one-step and multi-step word problems involving addition and subtraction within 1,000 using a variety of strategies based on place value, including algorithms.	
	2.4D	Generate and solve problem situations for a given mathematical number sentence involving addition and subtraction of whole numbers within 1,000.	
	2.7C	Represent and solve addition and subtraction word problems where unknowns may be any one of the terms in the problem.	
Instructional Days:	6		
Coherence	-Links from:	G1–M4	Place Value, Comparison, Addition and Subtraction to 40
	-Links to:	G2–M5	Addition and Subtraction within 1,000 with Word Problems within 1,000
		G3–M2	Place Value and Problem Solving with Units of Measure

Topic C parallels Topic B as students apply their understanding of place value strategies to the subtraction algorithm, moving from concrete to pictorial to abstract. It is important to note that the algorithm is introduced at this level and is connected deeply to the understanding of place value. Fluency with the algorithm, however, is a Grade 4 standard.
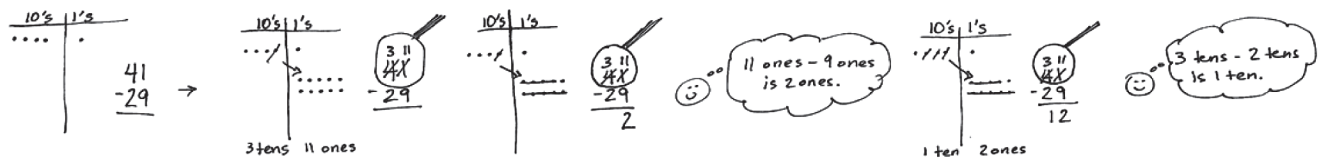
In Lesson 11, students use place value disks on a place value chart to subtract like units (e.g., 76 − 43 is 7 tens − 4 tens and 6 ones − 3 ones). They practice modeling the standard subtraction algorithm within 100 and learn to decompose 1 ten for 10 ones (e.g., in 76 − 47, students must recompose 7 tens 6 ones as 6 tens 16 ones). The use of manipulatives allows students to physically experience the renaming and understand the *why* behind recomposing a quantity.

Lesson 12 builds upon this understanding as students relate manipulatives to a written method, recording recompositions in vertical form. In subtraction, a common error is for students to switch the top and bottom digits in a given place when renaming is necessary. They perceive the digits as a column of unrelated numbers, rather than part of a larger total, and simply subtract the smaller from the larger. Hence, many students would solve 41 − 29 as 28 instead of understanding that they can take 9 ones from *41 ones*. To prevent this error and aid students in seeing the top number as the whole, students use a "magnifying

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glass" to examine the minuend. They draw a circle around the top number and add a handle (see image below). Before subtracting, they look inside the magnifying glass at the whole number and determine if each digit is big enough to subtract the number below it. If not, they decompose one of the next larger units to make ten of the unit they need. In Lesson 13, this is used in conjunction with the chip model (shown below); students record each change they make to their model while simultaneously using the algorithm.

In Lessons 14 and 15, students continue working with the chip model on their place value charts and follow the same procedure for decomposing a ten and relating it to vertical form. Here, however, students subtract a two-digit subtrahend from a three-digit minuend (e.g., 164 – 36). This provides practice working with and drawing three-digit numbers without the complexity of decomposing a hundred.

As in Topic A, Topic C closes with a lesson that focuses on one- and two-step word problems within 100. Students apply their place value reasoning, mental strategies, and understanding of compositions and decompositions to negotiate different problem types with unknowns in various positions. Because two different problem types (i.e., *add to, take from, put together/take apart, compare*) are often combined in two-step word problems, some quantities involve single-digit addends, especially when students are working with the more challenging comparison problems. Students are encouraged to be flexible in their thinking and to use drawings and/or models to explain their thinking. Students continue to use strip diagrams to solve word problems, relating the diagrams to a situation equation (e.g., 8 + _____ = 41) and rewriting it as a solution equation (e.g., 41 – 8 = ___), thus illustrating the relationship between operations. Students find success when using their mental strategies of making a multiple of 10 and counting on (e.g., 9, 10, 20, 30, 40, 41) as they experience the relationships between quantities within a context. Students are then presented with strip diagrams and asked to generate original problems and solve them using any method.

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A Teaching Sequence Toward Mastery of Strategies for Decomposing a Ten

Objective 1: Represent subtraction with and without the decomposition of 1 ten as 10 ones with manipulatives.
(Lesson 11)

Objective 2: Relate manipulative representations to a written method.
(Lesson 12)

Objective 3: Use math drawings to represent subtraction with and without decomposition and relate drawings to a written method.
(Lesson 13)

Objective 4: Represent subtraction with and without the decomposition when there is a three-digit minuend.
(Lessons 14–15)

Objective 5: Solve and create one- and two-step word problems within 100 using strategies based on place value.
(Lesson 16)

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