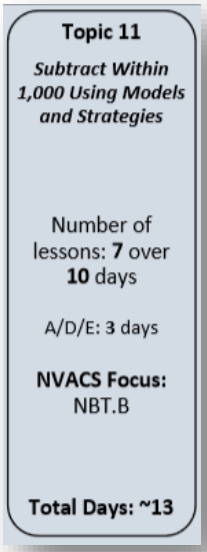
Grade 2 Topic 11: Subtract Within 1,000 Using Models and Strategies



2nd Grade Curriculum Pacing Framework: Balanced Calendar

Big Conceptual Idea: K-5 Progression on Number and Operations in Base Ten (pp. 8-11)

Prior to instruction, view the Topic 11 Professional Development Video located in Pearson Realize online. Read the Teacher's Edition (TE): Cluster Overview/Math Background pages (pp. 583A-583E), the Topic Planner (pp.635A-635C), the Topic Performance Assessments (pp. 685-686A) all 7 lessons.

Mathematical Background: Read Cluster Overview (TE, pp. 583A-583E)	Topic Essential Question: What are strategies for subtracting numbers to 1,000? *Reference Answering the Topic Essential Question (TE, pp. 683-684) for key elements of answers to the Essential Question.*

The lesson map for this topic is as follows:

11-1	11-2	11-3	11-4	11-5	11-6	11-7	Assessment

3 A/D/E days used strategically throughout the topic.

Instructional note:

The big idea of Topic 11 focuses on using models and strategies to subtract within 100.

> *…there is no need to separate place-value instruction from computation instruction. Children's efforts with the invention of their own computation strategies will both enhance their understanding of place value and provide a firm foundation for flexible methods of computation (Van de Walle, Karp, Lovin, Bay-Williams, 2014, p.176).*
>
> *It is not necessary to wait for students to fully develop place-value understandings before giving them opportunities to solve problems with two- and three-digit numbers. When such problems arise in interesting contexts, students can often invent ways to solve them that incorporate and deepen their understanding of place value, especially when students have the opportunities to discuss and explain their invented strategies and approaches (National Council of Teachers of Mathematics, 2000, p.83).*

Topics 10-11 compose a major cluster focused on the big idea of the base-10 numeration system through addition and subtraction within 1,000. Focus instruction on Nevada Academic Content Standards (NVACS, 2010) cluster 2.NBT.B.

> *2.NBT.B Use place value understanding and properties of operations to add and subtract.*
>
> *7. Add and subtract within 1,000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.*
>
> *8. Mentally add 10 or 100 to a give number 100-900, and mentally subtract 10 or 100 from a given number 100-900.*
>
> *9. Explain why addition and subtraction strategies work, using place value and the properties of operations.*

This work builds upon understandings developed in Topics 3-5 and Topic 9. The structure of the base-10 numeration system uses digits 0-9, groups of 10, and place value- the value of a digit is determined by its place. As noted in the quote above and excerpted here, "it is not necessary to wait for students to fully develop place-value understandings before giving them opportunities to solve problems with two- and three-digit numbers" (National Council of Teachers of Mathematics, 2000, p.83). In fact, when students invent addition and subtraction strategies that require the composition (put together) and decomposition (take apart) of numbers, they are developing place-value understanding while simultaneously developing computational understanding.

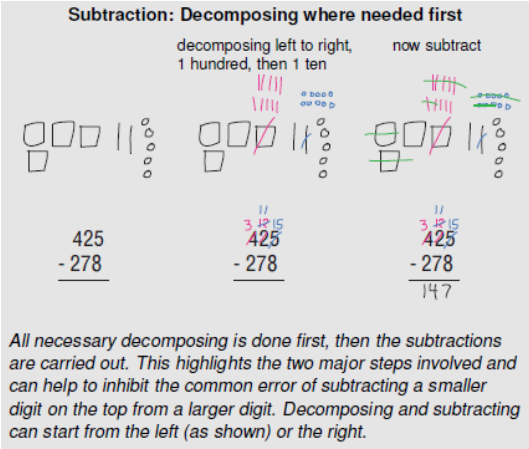
In kindergarten and first grade, students work with patterns in numbers to 100, and begin to understand a group of ten objects as a unit. That is, they understand ten as both ten ones and one ten. In second grade, students extend these place value understandings to three-digit numbers, understanding 100 as a bundle of ten tens and as a "hundred". To foster this development, the use of groupable models, models that allow students to see 100 as 10 groups of ten or 100 singles (connecting cubes, beads in a jar, linked paper clips, etc.) are essential. Groupable models allow children to move from a count-by-ones approach, to constructing

groups/units, thereby imposing their mathematical understandings onto the model. Students' own construction of this knowledge is important and effective. On the contrary, telling students that a pre-grouped model, such as a hundreds flat, is worth 100 singles or 10 tens is ineffective. When considering language, help students connect standard language, "one hundred thirty-five", to base-ten language, "1 hundred 3 tens 5 ones; 1 group of a hundred 3 groups of ten 5 ones, etc". Also, it is recommended that for EL learners, you choose a single variation of base-ten language to use consistently. This will aid students in connecting the base-ten language to standard language (Van de Walle, et al., 2014, p. 178).

Topics 10-11 are mirrored topics, as the strategies used for addition in Topic 10 are later used for subtraction in Topic 11. Focus planning conversations to go beyond *what* strategies are used to *why* those strategies are important for students' development of the big idea. Reference the progression document linked at the top of this document, and lesson level instructional notes for content to support these conversations. In both topics, students will work with algorithms. The authors of enVisionmath2.0 placed the algorithms in sequence with other strategies, with the intent that students connect their understanding of place value strategies to construct meaning of the algorithms. They also intended for students to see algorithms as one of many strategies for addition and subtraction, not the pinnacle of addition and subtraction strategies.

As NVACS 2.NBT.B.7 states, "Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; *relate the strategy to a written method*. Understand in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds." Knowing that our trajectory is building toward the expectation that students will relate strategies to a written method when subtracting within 1,000, we can view the lessons in Topic 11 as building on to subtraction strategies in Topic 5.

Just as with addition within 1,000 in Topic 10, we should offer opportunities for students to construct meaning of the algorithms, but we should not expect all students to transition to use of the U.S. Traditional standard algorithm in second grade. The progression documents recommend that students' solutions that involve subtraction as an unknown-addend problem through count-on or add-on strategies continue to be discussed. It goes on to state that the major focus for subtraction within 1000 "needs to be on methods that lead toward fluency or are sufficient for fluency" (Reference the example below). (CCSWT, 2015, p.10).



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 Practice 1: MP.1 Make sense of problems and persevere in solving them

Focus on opportunities for students to develop MP.1 behaviors. This is the focus of the Math Practices and Problem Solving lesson 11-7. Reference the Teacher's Edition (pp. F23-F23A) and the *Nevada Academic Content Standards for Mathematical Practice*.

Note: The purpose of the curriculum guides is for additional considerations. Therefore, not all components may have additional notes included in this guide.

Essential Academic Vocabulary Use these words consistently during instruction.	
New Academic Vocabulary: (First time explicitly taught)	Review Academic Vocabulary: (Vocabulary explicitly taught in prior grades or topics)
	break apart *compensation* *digit* *equals, =* *hundred* *mental math* *ones* *open number line* *partial sum* place-value chart *regroup* *sum* *tens* *thousand*

Additional terminology that students may need support with: *algorithm, models, patterns, standard algorithm, unit*

*Collaborative Team Conversations (CTC)

Consider using ***one*** of the following as part of the formative assessment process at the lesson level to **collect student work** to analyze for evidence of mathematical understanding:

Guiding question: "Are students developing conceptual understanding of subtraction through the use of models such as base 10 blocks, number lines, etc.?"

Lesson	Evidence	Look for
11-6	*Solve & Share* (student work samples)	Focus CTC around the big idea: • student strategies and models • understand relationship between different strategies • explanation of why strategy works
11-7	*Quick Check* (digital platform) Items 1, 2, and 3	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".

Learning Cycle Assessments (summative)	*Topic Assessments* SE pp. 683-686	Use *Scoring Guide* TE pp. 683-686

Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 11-1: Subtract 10 And 100		
2.NBT.B.8 2.NBT.B.9 MP.1 MP.2 MP.4 MP.7	Access Prior Learning: In first grade, (1.NBT.C.5) given a 2-digit number, students found 10 more or 10 less without counting. In lesson 10-1, second grade students add 10 and 100 to 3-digit numbers using place value patterns and mental math. Developing the Big Idea: In this lesson, students are *developing* understanding of subtracting 10 or 100 from 3-digit numbers using place value patterns and mental math.	Students can use basic facts to help them mentally solve problems when subtracting by 10 and 100. Using place value blocks will reinforce conceptual understanding that the tens digit goes down by 1 when subtracting ten, and that the hundreds digit goes down by 1 when subtracting 100. Topic Opener: Consider limiting the *Topic Opener* to discussion of the *Topic Essential Question* (TE, p. 635), *Review What You Know* (TE, p. 636), and *Vocabulary Review Activity* (TE, p. 636) for the word *decrease* only. Post the essential question and student strategies on your math focus wall. Solve & Share: Some students may need support with the term "harvested" in order to make sense of the problem. Child-watch for students who are able to use place value patterns to answer the questions efficiently. The use of place value blocks and place value mats can provide support for students who have difficulty solving the problem by reasoning about place value patterns. Visual Learning: Encourage students to generalize their understanding by identifying another equation that demonstrates the pattern in the animation. For example, when the animation shows that subtracting 10 makes the tens digit go down by 1, ask students to use a whiteboard and marker to write another equation for which this also applies (e.g., 534 – 10 = 524). Students may also *-continues on next page-*

		be asked to identify a basic fact, which helped them to solve their equation. Additional time may need to be spent on the final frame of Visual Learning, which identifies situations when subtracting 10 changes the tens and hundreds digits (e.g., 500 – 10 = 490). Independent Practice/Math Practices and Problem Solving: As previously indicated, students do NOT need to do all of the problems in their Student Edition. However, ALL students NEED to have opportunities to solve problems at varying DOK levels. The *Independent Practice* page offers problems that support procedural skill and fluency. The *Math Practices and Problem Solving* page offers problems that support application. The *Quick Check* items (marked with a pink check) offer both opportunities. Have students complete these items first and continue on to other items as appropriate.
Lesson 11-2: Count Back To Subtract On An Open Number Line		
2.NBT.B.7 2.NBT.B.9 MP.4 MP.5 MP.7	Access Prior Learning: In Topics 3 and 5, second grade students used the open number line to model addition and subtraction with 2-digit numbers. In lessons 5-2 and 5-3, second grade students counted back on the open number line to subtract 2-digit numbers. Developing the Big Idea: In this lesson, students are *developing* understanding that when subtracting 3-digit numbers, the numbers can be broken apart into hundreds, tens and ones and subtracted using jumps on the open number line. Students will count back to subtract.	Open number lines help students keep track of their thinking and allow students to add/subtract by groups of hundreds, tens or ones. The use of an open number line supports place value understanding as it involves decomposing and composing numbers. It also supports students' number sense and computational fluency. Solve and Share: Child-watch for students who make jumps of hundreds, tens and ones. Ask all students to solve the problem two different ways and evaluate their strategies for efficiency. If students use inefficient methods to subtract on the open number line, ask, "How can jumps of hundreds and tens help you solve the problem more efficiently?" Also, child-watch for students who have trouble crossing into a new century, from 306 into the 200s. These students may need support with connecting their understanding of the repeated structure and patterns in our number system. Note: Students may make jumps in any order that makes sense with the numbers, thus they may jump down by ones then hundreds then tens. Visual Learning: Prior to interacting with the animation, give students time to solve the problem 580-232 by drawing an open number line on a whiteboard. Child-watch for evidence of students who increase their level of efficiency from the *Solve and Share*. Reference the "ways" in the *Visual Learning*, which progress from less efficient to more efficient. Highlight these reflective students during the discussion. Assess and Differentiate: Encourage students to use place value blocks to model the jumps on the open number line to strengthen conceptual understanding.
Lesson 11-3: Add Up To Subtract On An Open Number Line		
2.NBT.B.7 2.NBT.B.9 MP.2 MP.4 MP.6 MP.7 MP.8	Access Prior Learning: In lesson 5-4, second grade students used the open number line to model adding up by tens and ones to subtract 2-digit numbers. Developing the Big Idea: In this lesson, students are *developing* understanding of adding up by hundreds, tens and ones to subtract 3-digit numbers.	Think-addition strategies such as add up to subtract are powerful ways to solve subtraction problems. This strategy also supports students' use of place value with hundreds and tens. (Van de Walle, et al., 2014, p.215). Certain number combinations lend themselves to think-addition strategies. When the minuend and subtrahend are closer in value (20-17), it is more efficient to add up to subtract (18, 19, 20). Alternatively, when the minuend and subtrahend are further apart in value (20-3), it is more efficient to count back to subtract (19, 18, 17). Look for opportunities to engage students in conversations around the strategic selection of strategies based upon the numbers. Solve & Share: This is a *Put Together Addend Unknown* problem. Ask all students to solve the problem in two ways on the open number line, and to evaluate the efficiency of each strategy. Child-watch for students who combine like place values to make bigger jumps (e.g., one jump of 20 instead of two jumps of 10). Also, child-watch for students who count back and for students who add up to subtract. If no students add up to subtract, plant the idea with a student by asking, "How can you add up to subtract on the open number line?" or "Can you start with the other number?" Share this student's strategy as a lead in to the *Visual Learning*. Visual Learning: Have students solve the problem, 482 - 247 using an open number line *before* showing and discussing the animation. By revisiting the use of addition to check subtraction in the animation, students' understanding of the inverse relationship between addition and subtraction is reinforced.

<table>
<tr><td colspan="3">Lesson 11-4: Subtract Using Mental Math</td></tr>
<tr>
<td>2.NBT.B.7

2.NBT.B.9

MP.1

MP.2

MP.3

MP.7</td>
<td>Access Prior Learning:

In lesson 10-3, second grade students added 3-digit numbers using mental math strategies. In lesson 11-2, second grade students counted back on the open number line to subtract 2-digit numbers.

Developing the Big Idea:

In this lesson, students are developing understanding of mental math strategies for subtracting 3-digit numbers including, count back and friendlier numbers.</td>
<td>Possible 2-day lesson

Day 1:
Solve & Share:
To encourage the use of mental math strategies, have students think about the problem before picking up their pencil. Encourage them to use their paper to show the process they used in their minds to solve the problem. Child-watch for students who use place value understanding to simplify the problem from 335 – 302 to 35 – 2, or for students who think-addition (302 + __ = 335).

Visual Learning:
Prior to interacting with the animation, have students solve the problem, 372 – 123 using a strategy of choice. Child-watch for students who try a new or more efficient strategy than the one they used in the Solve and Share.

Independent Practice/Math Practices and Problem Solving:
Students solve the Quick Check items marked with pink checkmarks.

Day 2:
Facilitate a lesson using a string of numbers intentionally structured to promote student use of mental math strategies. These strings are intended to develop students' use of mental math, but do not require students to only solve the problems in their heads. Instead, focus on their ability to examine the numbers and select an appropriate and efficient way to solve the problem. As students verbally explain their thinking, make a written record so that students can "see" the strategy using an open number line. This becomes a picture for the class to discuss. Relying only on verbal explanations will limit access for children to understand (Fosnot, 2007, p.7). Look for evidence of students' use of a variety of strategies and their ability to examine the numbers before selecting a strategy. For example, child-watch for students who identify think-addition, or add up to subtract as an appropriate strategy for the first two problems, but opt to count back for the third and fourth problems.
2006 - 1999
1999 - 1987
1992 - 8
52 - 6
54 - 29
63 - 38
172 - 45
174 - 89
Consider asking students to select one problem from the string and write an explanation of why their strategy of choice was appropriate for that problem.

Independent Practice/Math Practices and Problem Solving
Select additional items for students to solve.

Assess and Differentiate:
In the Intervention Activity, "Subtracting a Step at a Time", encourage students to use place value blocks to model.</td>
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<tr><td colspan="3">Lesson 11-5: Use Models To Subtract</td></tr>
<tr>
<td>2.NBT.B.7
2.NBT.B.9

MP.1
MP.4
MP.5
MP.8</td>
<td>Access Prior Learning:
In this topic, second grade students used place value understanding to subtract 3-digit numbers.

Developing the Big Idea:
In this lesson, students are developing understanding of the standard subtraction algorithm. Students progress from concrete to symbolic work with the algorithm. They also regroup ones, tens and hundreds.</td>
<td>Possible 2-day lesson

As indicated in the Instructional Note at the beginning of this document, we should offer opportunities for students to construct meaning of algorithms, but we should not expect all students to transition to use of the U.S. Traditional standard algorithm in second grade. The Progression Documents recommend that students' solutions that involve subtraction as an unknown-addend problem through count-on or add-on strategies continue to be discussed. It goes on to state that that the major focus for subtraction within 1000 "needs to be on methods that lead toward fluency or are sufficient for fluency" (Reference the example below). (CCSWT, 2015, p.10).

Day 1:
Solve & Share:
Continue to encourage use of place-value blocks and place-value mats. Also, consider offering a blank workspace to allow students to strategically select a subtraction strategy.

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		Visual Learning: Have students solve the problem in the animation using concrete place value blocks or drawings and a place value mat. Have students work in pairs during the animation. One student should model with place value blocks, and the other partner should record the step (Van de Walle, et al., 2014, p.219). Trade roles when solving the *Guided Practice* problems. Independent Practice/Math Practices and Problem Solving: Have students solve the *Quick Check* items marked with pink checkmarks. Encourage students to try the standard algorithm, AND use a second strategy of choice to check for accuracy. Connecting strategies to the algorithm will support students in sense making. Offering students a blank workspace is also helpful. Assess and Differentiate: Support and extend students through the *Intervention Activity* and *On-Level* and *Advanced Activity Centers.* Day 2: Solve & Share: Select a problem, such as item 6 (438 – 162 = ___) from *Independent Practice* and structure it as a *Solve & Share*. Placing these numbers in a word problem will provide context and support student understanding. Encourage students to model with place value blocks and try the standard algorithm. Continue to allow and encourage the use of other strategies as well. Independent Practice/Math Practices and Problem Solving: Select additional items for students to solve. Encourage students to try the standard algorithm, AND use a second strategy of choice to check for accuracy. Connecting strategies to the algorithm will support students in sense making. Offering students a blank workspace is also helpful. Assess and Differentiate: Continue to support and extend students through the *Intervention Activity* and *On-Level* and *Advanced Activity Centers.*
Lesson 11-6: Explain Subtraction Strategies		
2.NBT.B.9 2.NBT.B.7 MP.2 MP.3 MP.4	Access Prior Learning: In Topic 5, second grade students used several subtraction strategies to subtract 2-digit numbers. Throughout this topic, second grade students have used subtraction strategies and algorithms to subtract 3-digit numbers. Securing the Big Idea: In this lesson, students are *securing* understanding of subtraction strategies with 3-digit numbers. Students will select a strategy and explain why it works using place value and properties of operations.	Possible 2-day lesson Day 1: Solve & Share: Ask students to solve the problem with two different strategies, and then encourage them to evaluate which was more efficient. As students explain their strategies, encourage them to use precise academic vocabulary, referring to the math focus wall as needed. Select and sequence the share to include a variety of student strategies that increase in efficiency. Visual Learning: Have students solve the problem, 437 – 245 = ___, before viewing and discussing the animation. Child-watch for students who choose a more efficient strategy than the one they used in the *Solve and Share*. Independent Practice/Math Practices and Problem Solving: Have students solve the *Quick Check* items marked with pink checkmarks. Day 2: Solve & Share: Select a problem, such as item 3, (464 – 155= ___) from *Independent Practice* and structure it as a *Solve & Share*, placing emphasis on students' explanation of *why* their strategy works. Placing these numbers in a word problem will provide context and support student understanding. See the note above from Day 1 regarding the Solve & Share. Child-watch for student growth in their strategic selection of efficient strategies, as well as their flexibility with multiple strategies. Independent Practice/Math Practices and Problem Solving: Select additional items for students to solve. Assess and Differentiate: Use the Intervention Activity and Topic 11 game to support and extend students. Ensure that all students have the opportunity to play the game. *CTC: *Solve & Share* (student work samples)

Lesson 11-7: Math Practices And Problem Solving: Make Sense And Persevere		
2.NBT.B.7 2.NBT.B.9 MP.1 MP.2 MP.3 MP.8	Access Prior Learning: In first grade, students engaged in the Standards for Mathematical Practice including MP. 1 Make Sense of Problems and Persevere in Solving Them. Developing the Big Idea: In this lesson, students are *developing* understanding of Math Practice 1: Make Sense of Problems and Persevere in Solving Them by making sense of the problem, making a plan, and continuing to try when they get stuck.	Consider using the *Math Practice 1 Animation* on Pearson Realize Online for an example of MP.1 behaviors. Refer to the *Math Practices and Problem Solving Hand*book for ideas on developing, connecting and assessing MP.1 (TE, pp.F23-F23A). MP. 1 Behaviors: • Gives a good explanation of the problem • Thinks about a plan before jumping into the solution • Thinks of similar problems, tries special cases, or uses a simpler form of the problem • If needed, organizes data or uses representations to help make sense of the problem • Identifies likely strategies for solving the problem • Pauses when solving problems to make sure that the work being done makes sense • Make sure the answer makes sense before stopping work *CTC: *Quick Check* (digital platform)

References

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.

Council of Chief State School Officers. (2010). The Nevada Academic Content Standards. Retrieved from http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards_Instructional_Support/Nevada_Academic_Standards/Math_Documents/mathstandards.pdf.

Fosnot, C. T. (2007). *Ages and timelines: subtraction on the open number line.* Portsmouth, NH: Firsthand/Heinemann.

Van de Walle, J., Karp, K., Lovin, L., & Bay-Williams, J. (2014). *Teaching student-centered mathematics: Developmentally appropriate instruction for grades Pre-K-2* (2nd ed.). Boston, MA: Pearson.

3-Digit Subtraction Game

Materials:

- Place value mat (Blackline master included on the next page, one per player)
- Playing cards: Digits 0-9 cards only
- Tools to support strategies (Place value blocks, whiteboards, etc.)

Players: 2+

Object of the game: To collect the most cards

Directions:

1. Place the card deck face down on the table.
2. Each player draws 6 cards and builds two 3-digit numbers: a minuend (larger number) and a subtrahend (smaller number).
3. Players use a strategy of choice to find the difference by subtracting the smaller number from the larger number. Players explain their strategy and check each other's work for accuracy.
4. The player with the largest difference takes the cards. In the event of a tie, players draw one more card to subtract from their difference.
5. Play ends when there are not enough cards for both players to make two 3-digit numbers.
6. The player with the most cards wins.