Number and Operations in Base Ten

2.NBT.B*

Cluster B

Use place value understanding and properties of operations to add and subtract.

**STANDARD 5**

2.NBT.B.5: Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

**STANDARD 6**

2.NBT.B.6: Add up to four two-digit numbers using strategies based on place value and properties of operations.

**STANDARD 7**

2.NBT.B.7: 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 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.

**STANDARD 8**

2.NBT.B.8: Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.

**STANDARD 9**

2.NBT.B.9: Explain why addition and subtraction strategies work, using place value and the properties of operations.

*Major cluster

Number and Operations in Base Ten 2.NBT.B

Cluster B: Use place value understanding and properties of operations to add and subtract.

Grade 2 Overview

This cluster focuses on applying place value understanding and properties of addition and subtraction. Students apply various strategies based on number sense, mental mathematics, and the relationship between addition and subtraction to extended addition and subtraction examples and problem situations with sums to 100. Students also begin to explore adding and subtracting two-digit numbers, using concrete representations including composing and decomposing ones, tens, and hundreds to regroup when necessary. The cluster culminates with the expectation that students can explain their reasoning based on place value, strategies, and number sense.

Standard for Mathematical Practice

SFMP 1. Make sense of problems and persevere in solving them.
SFMP 2. Reason abstractly and quantitatively.
SFMP 3. Construct viable arguments and critique the reasoning of others.
SFMP 4. Model with mathematics.
SFMP 5. Use appropriate tools strategically.
SFMP 6. Attend to precision.
SFMP 7. Look for and make use of structure.
SFMP 8. Look for and express regularity in repeated reasoning.

Students should have opportunities to demonstrate all of the standards for mathematical practice throughout this cluster. Problems given in meaningful contexts will help students to apply their understanding of when to add or subtract as well as when to estimate to determine if their answer is reasonable. Abstract and quantitative reasoning are demonstrated as students apply appropriate strategies (Table 3) and connect physical models to abstract symbols. Although many of these situations are best modeled using the place value representations from previous clusters, strategies such as counting using benchmark numbers (i.e., tens and hundreds) may be more efficient. Students attend to precision as they describe their reasoning and compare it to alternate approaches of their classmates. The structure of place value and the relationship among places is critical to understanding the processes of addition and subtraction.

Related Content Standards:

1.OAA.1 1.OAA.2 1.NBT.C.4 1.NBT.C.5 1.NBT.C.6 2.OAA.1 2.NBT.A.1 3.NBT.A.1 3.NBT.A.3
STANDARD 5 (2.NBT.B.5)

Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

In first grade, students used various representations to add with sums to 100 and to subtract multiples of 10 from multiples of 10. In second grade, they review these models and focus on computing mentally or in writing using various strategies. Previous work with place value and physical models can be extended to include more examples with composing tens in addition and decomposing tens in subtraction. Note the careful scaffolding of examples for students in Table 3. Include problems that provide a context for adding or subtracting as often as possible. Equations should be written both horizontally and vertically. Students use number sense and a variety of strategies that make sense to them to add and subtract. Encourage students to make estimates before adding or subtracting to determine if their answers are reasonable. Note that students are not expected to use the standard algorithm for addition and subtraction until Grade 4.

What the TEACHER does:

- Review addition with sums to 100, giving students problem contexts to model addition using concrete materials, such as linking cubes, ten frames, and bundling straws on place value charts. Make explicit connections between models and written equations.
- Scaffold the level of complexity as students work to make sense out of adding two 2-digit numbers and make generalizations about what is happening. Note that understanding develops over time. Encourage students to use a variety of strategies and explain their thinking (Table 3).
- When completing examples requiring regrouping (composing numbers from ones to tens) provide ample experience with place value materials. Make explicit connections with ways to write equations for these examples.

What the STUDENTS do:

- Solve addition examples with sums to 100, using a variety of strategies including physical models, mental computation, using benchmark numbers, place value charts, number lines, and hundreds chart.
- Use mental computation strategies to develop conceptual understanding and number sense adding 2-digit numbers.
- Explain their reasoning to classmates.
- Listen to the explanations of classmates and compare their strategies to those of others.
- Use physical models and place to explore subtraction with sums to 100.
- Explore other strategies for subtraction using benchmark numbers, number lines, and the hundreds chart.
- Write equations for subtraction with sums to 100.
- Explain their reasoning to classmates.

Add two 2-digit numbers, regrouping tens to ones.

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<table>
<thead>
<tr>
<th>tens</th>
<th>ones</th>
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<td>36</td>
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</tr>
<tr>
<td>25</td>
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</tbody>
</table>

5 tens 11 ones =
6 tens 1 one
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- Provide experiences using open number lines and the hundreds chart, using benchmarks of tens to help students develop strategies for adding.

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2-digit + 2-digit (regrouping)

36 + 25 = 61
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What the TEACHER does (continued):

- Facilitate conversations and activities in which students explain their thinking.
- Present a variety of subtraction problems using sums to 100 that provide students with opportunities to apply properties and their understanding of place value with concrete materials, mental computation strategies, and models such as open number lines and benchmarks. Scaffold the complexity of examples as described on Table 3.

\[
\begin{align*}
& \text{2 digit - 2 digit} & (\text{regroup tens to ones}) \\
& 52 - 24 & -10 \\
& -2 - 7 & -10 \\
& 28 & 42 \\
& 32 & 52 \\
& 52 - 24 = 28
\end{align*}
\]

- Ask students to model subtraction examples using various strategies.
- Pose questions that help students to explain their work and their reasoning.

Addressing Student Misconceptions and Common Errors

Second-grade students do not need to have facility using the standard algorithm adding and subtracting. They should focus their work on developing and using efficient strategies that make sense. Although some students may be ready to write equations, composing tens when regrouping in addition and decomposing tens when regrouping in subtracting may be challenging to other students. Concrete representations, number lines, and hundreds charts will help students to develop a deeper understanding of the process of regrouping than only following rote procedures.
STANDARD 6 (2.NBT.B.6)

Add up to four two-digit numbers using strategies based on place value and properties of operations.

This standard extends the work from 2.NBT.B.5 to adding strings of two-digit numbers with up to four addends. Students apply understanding of place value, mental mathematics strategies, and properties of addition.

What the TEACHER does:
- Provide students with problem situations in which they add three 2-digit numbers using concrete materials, place value charts, and mental mathematics strategies that include using the commutative, associative, and identity properties.
- Extend this work to adding strings of four 2-digit numbers using similar strategies.

What the STUDENTS do:
- Use a variety of strategies to add up to four 2-digit numbers.
  - Example: 24 + 17 + 33
    - Associative property:
      - Add 17 + 33 to get 50. Add 24 to 50 which equals 74
    - Place value:
      - Add the tens 20 + 10 + 30 = 60
      - Add the ones 4 + 7 + 3 = 14
      - Add the two sums 60 + 14 = 74
- Explain their thinking to classmates.
- Listen to the reasoning of others and find similarities with their own strategies.

Addressing Student Misconceptions and Common Errors

Students who struggle with adding strings of numbers should begin with three addends with no regrouping. If necessary, they can use physical models to help keep track of the sums. Move to examples using four addends with no regrouping. As students are ready, include examples with regrouping. Encourage students to use strategies that make sense to them. Help students using inefficient strategies to make connections to more efficient strategies. Note that some strategies are more difficult to follow when written out and make more sense when explained orally.
STANDARD 7 (2.NBT.B.7)

Add and subtract within 100, 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.

This standard extends the work of standard 2.NBT.B.6 to sums to 1,000 including adding and subtracting. Students need ample experience with physical models building on previous place value understanding. Table 3 shows scaffolding ideas for regrouping (composing in addition and decomposing in subtraction). While many students will be ready to transfer understanding to written equations, work with the standard algorithm is not an expectation until Grade 4.

What the TEACHER does:
- Provide problem contexts to have students model addition with sums to 1,000 using concrete materials, such as bundling straws, with place value charts.
- Use the progression of examples (Table 3) to scaffold level of complexity as students work to make sense adding two-digit numbers to three-digit numbers then move to adding three-digit numbers to three-digit numbers (Table 3).
- Note that understanding develops over time. Be sure that students have ample experiences with concrete representations and place value charts for each type of problem before moving on.

What the STUDENTS do:
- Model addition examples using concrete materials, then pictures, and finally numerals.
- Use mental and written computation strategies to develop conceptual understanding and number sense around adding two-digit numbers and three-digit numbers with sums to 1,000 (Table 3).
- Use estimation strategies to determine if their answers are reasonable.
- Explain their reasoning to classmates.
- Listen to the reasoning of classmates and compare strategies.
- Model subtraction examples using concrete materials, pictures, and finally numerals.
- Use mental and written computation strategies to develop conceptual understanding and number sense around subtracting two-digit numbers and three-digit numbers with sums to 1,000 (Table 3).
- Use estimation strategies to determine if their answers are reasonable.
- Explain their reasoning to classmates.
- Listen to the reasoning of classmates and compare strategies.

- Encourage students to use a variety of strategies and explain their thinking.

<table>
<thead>
<tr>
<th>hundreds</th>
<th>tens</th>
<th>ones</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>143</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 hundreds</td>
<td>12 tens</td>
<td>9 ones</td>
</tr>
<tr>
<td>4 hundreds</td>
<td>2 tens</td>
<td>9 ones</td>
</tr>
</tbody>
</table>

3 digit + 3 digit (regroup tens to hundreds)
296 + 143

286

143

3 hundreds
12 tens
9 ones

4 hundreds
2 tens
9 ones

429
What the TEACHER does (continued):

- Provide experiences using open number lines and benchmark numbers to help students develop strategies for adding.

- Pose questions that require students to think about the process they are using to add, making connections to place value.
- Facilitate conversations or activities in which students explain their thinking.
- Provide problem contexts to have students model subtraction with sums to 1,000, using concrete materials, such as bundling straws, with place value charts.
- Use the progression of examples to scaffold level of complexity as students work to make sense subtracting two-digit numbers from three-digit numbers and move to subtracting three-digit numbers from three-digit numbers (Table 3).
- Note that understanding develops over time. Be sure that students have ample experiences with concrete representations and place value charts for each type of problem before moving on.

<table>
<thead>
<tr>
<th>hundreds</th>
<th>tens</th>
<th>ones</th>
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<tr>
<td>252</td>
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</tbody>
</table>

- Encourage students to use a variety of strategies and explain their thinking.
- Provide experiences using open number lines and benchmark numbers to help students develop strategies for subtraction.

- Pose questions that require students to think about the process they are using to subtract, making connections to place value.
- Facilitate conversations or activities in which students explain their thinking.
Addressing Student Misconceptions and Common Errors

Students who do not know basic facts may be inaccurate in computation. Although those students should continue to work on facts, physical models will help in accurate addition and subtraction. Be sure that all students have ample experience with adding physical models on place value charts, using benchmark numbers (hundreds, tens, and ones) on an open number line. Make explicit connections from written physical models and strategies to written formats.

Although regrouping (composing hundreds from tens and tens from ones) when adding two 3-digit numbers and (decomposing from hundreds to tens and from tens to ones) when subtracting two 3-digit numbers is included in this standard, it is appropriate for students to use physical models for these examples and explain their reasoning. Explicit connections to written equations will help students make the transition from concrete and pictorial representations to symbolic notations.
STANDARD 8 (2.NBT.B.8)

Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.

This standard builds on students’ work with place value and requires them to understand and apply the concept of ten and hundred by mentally adding or subtracting 10 or 100. Extended hundreds charts and open number lines are good models for this standard.

What the TEACHER does:
- Give the students a variety of situations in which they need to add or subtract 10 or 100 from a given number. For example,
  - The second grade class has collected 256 paper clips for its make-a-thousand project. Lucy brings in a box of 100 paper clips to add to the collection. How many paper clips do they now have?
  - John finds 10 more paper clips on the floor. How many paper clips do they now have?
- Ask students to explain their thinking. Appropriate answers might include
  - I started at 256 on the open number line. I jumped 100 more and ended at 356.
  - I know to start at 356 on the open number line. I counted up 10 more steps and ended at 366.
- Provide games and activities in which students have a number and need to find 10 or 100 more, or 10 or 100 less, than a given number.
- Ask students to explain their strategies.

What the STUDENTS do:
- Use a variety of materials and strategies to add or subtract 10 or 100 from a three-digit number in the range of 100 to 900.
- Explain their reasoning using place value understanding and patterns.
- Mentally calculate finding 10 or 100 more or 10 or 100 less than a given number.

Addressing Student Misconceptions and Common Errors

Second graders should see the pattern of adding (or subtracting) 1 to the digit in the tens place when adding (or subtracting) 10. A similar pattern of adding (or subtracting) 1 to the digit in the hundreds place occurs when adding (or subtracting) 100. Students may find this confusing when they are adding 10 to numbers that have the digit 9 in the tens place or subtracting 10 from numbers that have the digit 0 in the tens place. Using a number line or portions of a hundreds chart will help them to visualize what happens when they are working with these numbers. If necessary, composing (to add) and decomposing (to subtract) with concrete materials will also help students to understand the concept.

Notes
STANDARD 9 (2.NBT.B.9)

Explain why addition and subtraction strategies work, using place value and the properties of operations.1

1Explanations may be supported by drawings or objects

As students solidify their understanding of addition and subtraction to 1,000, they explain their strategies based on their knowledge of place value and the properties of addition and subtraction. Students demonstrate their understanding using place value materials, hundreds charts and extended hundreds charts, and open number lines. Although this is the last standard in this cluster, students should be expected to explain their thinking throughout the Number and Operations in Base Ten domain. Keep in mind fluency with a standard algorithm is not an expectation until Grade 4.

What the TEACHER does:

• Present a problem for students to solve. For example, the second graders placed 36 pumpkins on the fence for Halloween. The wind blew 17 off the fence. How many pumpkins were left on the fence?
• Give students time to solve the problem using concrete objects, pictures, numbers, and words.
• Ask students to show their work to their classmates and explain their thinking. Find a variety of strategies to share.
  o Student 1: I looked at the hundreds chart and started at 36. I went back 10 and landed on 26. I then went back 7 more. I ended up at 19. There were 19 pumpkins on the fence.
  o Student 2: I put out 3 tens and 6 ones on my place value chart. I took away 1 ten and then needed to take away 7 more. I had to unbundle 1 ten because I needed more ones. I had a total of 16 ones and took 7 ones away. When I counted, there were 19 straws left. So there were 19 pumpkins left on the fence.
  o Student 3: I used an open number line. I started at 17, jumped 10, and landed on 27. I jumped 3 more to get to 30. I jumped 6 more to get to 36. So I jumped 10 + 3 + 6 or 19 in all. There were 19 pumpkins left.

What the STUDENTS do:

• Solve addition and subtraction problems using objects, pictures, words, and numbers.
• Ask themselves if their answers make sense.
• Explain their thinking to classmates and the teacher.
• Compare their strategies with those of classmates.

Addressing Student Misconceptions and Common Errors

Some students may still struggle with solving word problems in a variety of situations. Support their thinking by asking what they know, what they want to find out, and how they might solve the problem. It is really important for these students to ask themselves if their answer is reasonable. You may need to help by reversing the situation for them. In the above example, ask if putting 19 pumpkins with the 17 that fell off the fence would be the 36 they started with. Giving students opportunities to explain their thinking, even when incorrect, provides opportunities for them to self-correct.

Notes

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Number and Operations in Base Ten
Cluster B: Use place value understanding and properties of operations to add and subtract.

**Standard: 2.NBT.B.8.** Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.

**Standards for Mathematical Practice:**
SFMP 2. Reason abstractly and quantitatively.
SFMP 6. Attend to precision.
SFMP 7. Look for and make use of structure.
SFMP 8. Look for and express regularity in repeated reasoning.

**Goal:**
Students continue to develop understanding of place value while making connections to efficient strategies for mentally adding or subtracting 10 or 100 to a given number from 100 to 900. Experiences are based on the structure of place value and regularity in repeated reasoning (patterns) as they use open number lines, place value charts, and hundreds charts to develop understanding.

**Planning:**
Materials: Place value chart to hundreds place, straws and rubber bands, hundreds chart, extended hundreds chart, open number lines, dice or spinners with digits 0 to 9, numeral cards from 0 to 9. Set up workstations around the classroom with either dice, spinners or cards, and various concrete materials. Include a recording worksheet (see next page).

**Sample Activity:**
Students work in pairs to play a game. They create a three-digit number using the dice, spinner, or cards and write that number down. They add 10 to the number and record their sum. They add 100 to the number and record their sum. Reverse the order of the original three digits and repeat by adding 10 and adding 100. A similar game can be played subtracting 10 and 100 from the original number.

**Questions/Prompts:**
What number will you make from the three digits you picked?
What digit is in the tens place?
What digit is in the tens place after you add 10 to the number?
What do you notice?
What digit is in the hundreds place?
What digit is in the hundreds place after you add 100 to the number?
What did you notice?

**Differentiating Instruction:**

*Struggling Students:* Students who need concrete models to complete this activity should have access to place value charts and bundled straws. Model the number with concrete materials. Watch to be certain they are putting 1 ten or 1 hundreds on the place value chart and counting correctly. If necessary, provide single-digit numeral cards to show the number in each place on the chart and then write that number on the recording sheet.

*Extension:* Some students may be ready to extend the activity to starting with four-digit numbers and adding 10, 100, or 1,000 to that number.
### Add 10 and 100 Recording Sheet

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<th>+ 100</th>
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### Subtract 10 and 100 Recording Sheet

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<thead>
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<th>- 100</th>
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