

Getting Ready to Teach Unit 6

Learning Path in the Common Core Standards

In this unit, children work toward building fluency with addition and subtraction within 1,000 and mastering all addition and subtraction word problem subtypes.

Visual models and real world situations are used throughout the unit to help children understand the meaning of addition and subtraction.

Help Children Avoid Common Errors

Math Expressions gives children opportunities to analyze and correct errors, explaining why the reasoning was flawed.

In this unit we use Puzzled Penguin to show typical errors that children make. Children enjoy teaching Puzzled Penguin the correct way, why this way is correct, and why Puzzled Penguin made the error. Common errors are presented in the Puzzled Penguin feature in the following lessons:

- ▶ **Lesson 3:** Comparing the first digit in two numbers rather than the correct place values
- ▶ **Lesson 6:** Incorrectly lining up the place values when adding
- ▶ **Lesson 11:** Incorrectly recording ungrouping in subtraction
- ▶ **Lesson 14:** Using extra information that is given in a word problem and drawing the wrong diagram for the word problem given

In addition to Puzzled Penguin, there are other suggestions listed in the Teacher Edition to help you watch for situations that may lead to common errors. As a part of the Unit Test Teacher Edition pages, you will find a common error and prescription listed for each test item.

Math Expressions VOCABULARY

As you teach this unit, emphasize understanding of these terms.

- ungroup
- New Groups Above
- New Groups Below

See the *Teacher Glossary*.



Numbers to 1,000

Lessons

1

2

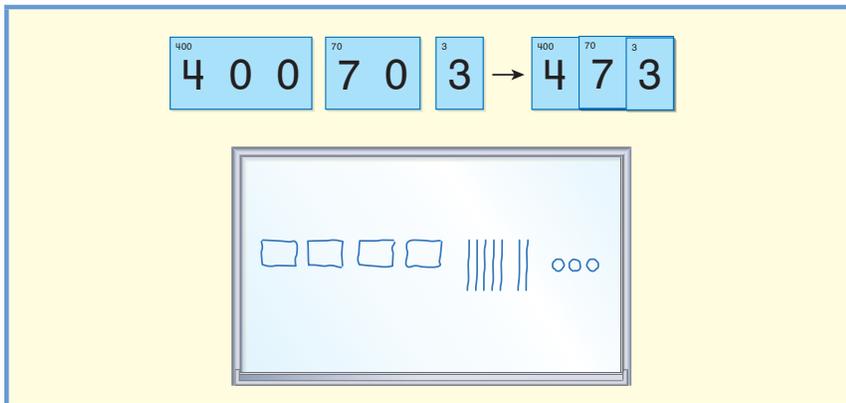
3

4

Counting Money Children build on their understanding of the number of pennies in a dollar to count by 100s to 10 hundreds, or 1,000. This activity introduces children to their work with counting to 1,000 and adding and subtracting within 1,000 in this unit.

Represent 3-Digit Numbers As children work in this unit, they will represent numbers with drawings of boxes, stick, and circles; with Secret Code Cards; and numerically in standard and expanded form. They have used all of the methods to represent 2-digit numbers and 3-digit numbers to 200 in earlier units. They now expand their understanding to represent any number through 1,000.

For example, to represent 473, children can use both Secret Code Cards and math drawings. By using both methods, children reinforce their understanding of the structure of numbers and the base-ten place value system and build their ability to write numbers in expanded form.



Support with Quick Practice Four Quick Practice routines (Add or Subtract 100, Add Over the 100, Mentally Add 10, and Mentally Subtract 10) that provide practice in building addition and subtraction fluency and mental math are introduced in Lessons 2 and 4. If the children in your class need extra support, use these whenever you have a few extra minutes, such as just before lunch or recess.

from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON NUMBER AND OPERATIONS IN BASE TEN

Understand Place Value

Representations such as manipulative materials, math drawings and layered three-digit place value cards afford connections between written three-digit numbers and hundreds, tens, and ones. Number words and numbers written in base-ten numerals and as sums of their base-ten units can be connected with representations in drawings and place value cards, and by saying numbers aloud and in terms of their base-ten units, e.g., 456 is “Four hundred fifty six” and “four hundreds five tens six ones.”

Compare Numbers Comparing numbers is an important prerequisite skill for understanding when it is necessary to regroup in subtraction. In Unit 2, children used the symbols $<$, $>$, and $=$ to show relationships between numbers up to 200. Now they will use them to compare any 3-digit numbers.

Write $<$, $>$, or $=$.

$$1. 635 < 735$$

$$2. 527 = 527$$

$$3. 820 > 518$$

$$4. 327 < 372$$

$$5. 975 < 987$$

$$6. 321 < 567$$

Children have used both representations and place value comparisons to compare numbers through 200, and they will build on this knowledge as they discuss and explain methods for comparing numbers. It should now be easier for children to compare numbers using place value, but if it is still difficult for some children, suggest that they use math drawings or Secret Code Cards to represent the numbers before they write the comparison symbol.

You may need to guide children to see that the most efficient way to compare numbers is to start at the leftmost place value and compare the values of the digits in each place moving from left to right, but let children who remember and understand the process explain it to those who do not. Peer teaching can often be more powerful than a teacher's explanation. Some children may also find it helpful to first write each number in expanded form and then compare the hundreds, the tens, and the ones in that order.

from THE PROGRESSIONS FOR
THE COMMON CORE STATE
STANDARDS ON NUMBER AND
OPERATIONS IN BASE TEN

Understand place value Comparing magnitudes of two-digit numbers draws on the understanding that 1 ten is greater than any amount of ones represented by a one-digit number. Comparing magnitudes of three-digit numbers draws on the understanding that 1 hundred (the smallest three-digit number) is greater than any amount of tens and ones represented by a two-digit number. For this reason, three-digit numbers are compared by first inspecting the hundreds place (e.g. $845 > 799$; $849 < 855$).

Adding to 1,000

Lessons

5

6

7

8

In these lessons, children build on methods of adding that they learned and used in Unit 2.

Proof Drawings and Secret Code Cards At first, children use proof drawings to add, and later they use them to verify their work. Because they can relate each step in a proof drawing to a step in a numerical method, children build understanding of addition with multidigit numbers.

The following example shows how to use a proof drawing to find the total of $456 + 278$.

from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON NUMBER AND OPERATIONS IN BASE TEN

Use place value understanding and properties of operations to add and subtract Students become fluent in two-digit addition. Representations such as manipulative materials and drawings may be used to support reasoning and explanations about addition with three-digit numbers.

$456 + 278 = \square$

6 hundreds 1 new hundred
2 tens

1 new ten
4 ones

$7 \text{ hundreds} + 3 \text{ tens} + 4 \text{ ones} = 734$

Children may also use Secret Code Cards to add and then make proof drawings to solidify their understanding of an addition.

$200 + 20 = 220$

Numerical Methods In Unit 2, children learned three methods for adding 2-digit numbers: Show All Totals, New Groups Below, and New Groups Above. In this unit, they extend these methods to working with 3-digit numbers.

The following examples show how these methods are used to find $456 + 278$, the example illustrated before for a proof drawing. It is useful to compare the drawing and the three methods. As children work with these methods, encourage discussion, especially if children develop similar methods of their own. Emphasize what happens in a method when a new ten or new hundred is formed.

Show All Totals	New Groups Below	New Groups Above
$\begin{array}{r} 456 \\ + 278 \\ \hline 600 \\ 120 \\ \hline 14 \\ \hline 734 \end{array}$	$\begin{array}{r} 456 \\ + 278 \\ \hline 734 \end{array}$	$\begin{array}{r} 456 \\ + 278 \\ \hline 734 \end{array}$

Add Up to Find an Unknown Addend In Lesson 8, children review the Adding Up method for finding an unknown addend and use it for problems with numbers within 1,000. This method is built on the inverse relationship between addition and subtraction. Although many children think of Unknown Addend problems as subtraction problems, adding up is an efficient way to find an unknown addend. How children use this method depends on their number sense and ability to compose and decompose numbers. The following examples show three ways to find the unknown addend in $156 + \square = 734$.

$\begin{array}{l} 156 + \square = 734 \\ + 4 \text{ is } 160 \\ + 40 \text{ is } 200 \\ + 534 \text{ is } 734 \\ \hline \boxed{578} \end{array}$	$\begin{array}{l} 156 + \square = 734 \\ + 4 \text{ is } 160 \\ + 40 \text{ is } 200 \\ + 500 \text{ is } 700 \\ + 34 \text{ is } 734 \\ \hline \boxed{578} \end{array}$	$\begin{array}{l} 734 \\ \swarrow \quad \searrow \\ 156 \quad 4 \text{ is } 160 \\ \quad \quad 40 \text{ is } 200 \\ \quad \quad 534 \text{ is } 734 \\ \hline \boxed{578} \end{array}$
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from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON NUMBER AND OPERATIONS IN BASE TEN

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

Students could also view $302 - 184$ as an unknown addend problem $184 + \square = 302$, thus drawing on the relationship between subtraction and addition. With this view, students can solve the problem by adding on to 184: first add 6 to make 190, then add 10 to make 200, next add 100 to make 300, and finally add 2 to make 302. They can then combine what they added on to find the answer to the subtraction problem: $6 + 10 + 100 + 2 = 118$. This strategy is especially useful in unknown addend situations.

3-Digit Subtraction

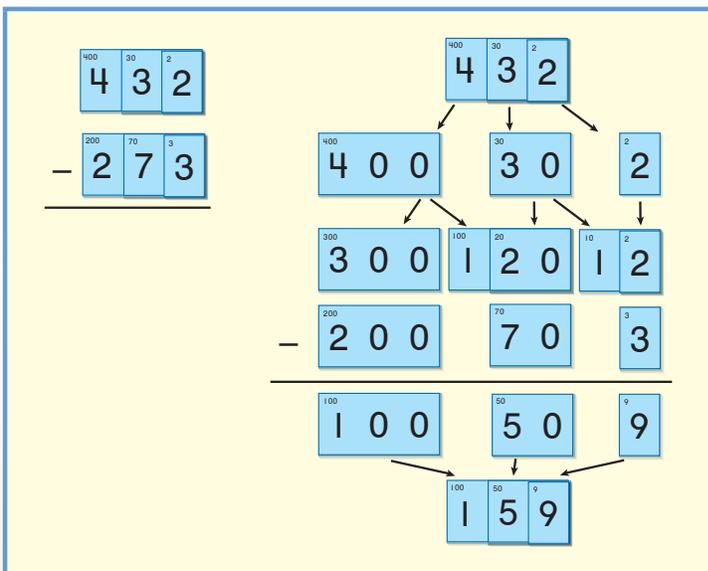
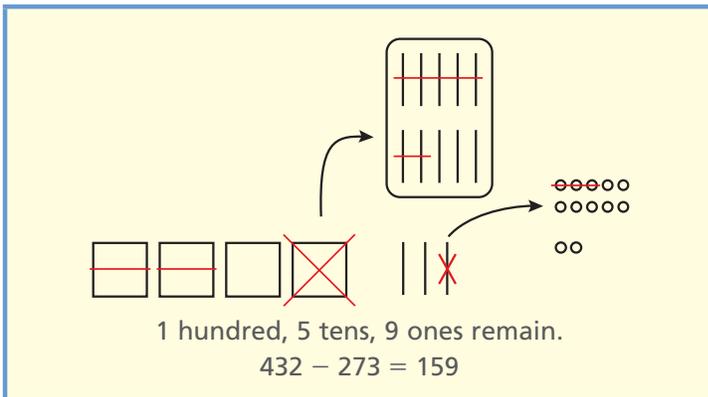
Lessons

- 9
- 10
- 11
- 12

In these lessons, children build on methods of subtracting that they learned and used in Unit 4.

Proof Drawings and Secret Code Cards Children may use proof drawings and Secret Code Cards to subtract. These tools help children move toward using numerical methods and can also be used to verify numerical methods.

The following examples show a proof drawing and Secret Code Cards that represent $432 - 273$.



Numerical Methods In Unit 4, children learned two methods for subtracting 2-digit numbers: Ungroup First and Expanded Method. In this unit, they extend these methods to working with 3-digit numbers.

The following examples show how these numerical methods are used to find $432 - 273$, the example shown with a proof drawing and with Secret Code Cards. It is useful to compare the drawing, the cards, and the numerical methods. As children work with these methods, encourage discussion of what happens when a number is ungrouped.

<p style="text-align: center;">Left to Right Ungrouping</p> <div style="text-align: center;"> </div> <p style="text-align: center;">(Ungroup for more tens first and then for more ones.)</p>	<p style="text-align: center;">Right to Left Ungrouping</p> <div style="text-align: center;"> </div> <p style="text-align: center;">(Ungroup for more ones first and then for more tens.)</p> <p style="text-align: center;">Magnifying Glass View 3 hundreds + 12 tens + 12 ones = 432</p>
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from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON NUMBER AND OPERATIONS IN BASE TEN

Use place value understanding and properties of operations to add and subtract Students become fluent in two-digit subtraction. Representations such as manipulative materials and drawings may be used to support reasoning and explanations about subtraction with three-digit numbers.

Expanded Method

$$\begin{array}{r}
 432 = 400 + 30 + 2 \\
 - 273 = 200 + 70 + 3 \\
 \hline
 100 + 50 + 9 = 159
 \end{array}$$

Deciding When to Ungroup Children review how to decide when they need to ungroup to subtract. They discuss four examples to help guide their thinking.

$\begin{array}{r} 427 \\ - 165 \\ \hline \end{array}$	$\begin{array}{r} 423 \\ - 165 \\ \hline \end{array}$	$\begin{array}{r} 483 \\ - 165 \\ \hline \end{array}$	$\begin{array}{r} 487 \\ - 165 \\ \hline \end{array}$
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Be sure children understand that they can always ungroup in all places to subtract if they prefer, but they should realize that it is more efficient and less likely to cause errors to ungroup only where needed.

Subtract from Numbers with Zeros Children developed an understanding of subtracting from numbers with zeros in Unit 4 and now extend that understanding to subtracting from numbers through 1,000. Subtracting from numbers such as 900 also encourages children to ungroup from the left, a method that many children in our research project preferred.

Addition and Subtraction Fluency and Methods

Lessons



Fluency Achieving fluency with 2-digit addition is needed so that children can focus their attention on the meaning of a problem situation, decide what situation type a problem involves, and select a method for solving a problem rather than on concentrating on carrying out the steps of a computation.

PATH to FLUENCY In Lessons 3, 8, and 10 of this unit and in other units, sets of practice exercises in the Student Activity Book that have a Path to Fluency icon provide children with opportunities to build their skill in adding and subtracting within 100.

Methods Children use the relationships between addition and subtraction methods to help them make decisions about what operation to use and how and what to group or ungroup. They also use the inverse relationship to check their work, by adding to check subtraction exercises. Some children may realize that they can subtract to check an addition exercise.

from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON OPERATIONS AND ALGEBRAIC THINKING

Grade 2 The word *fluent* is used in the Standards to mean “fast and accurate.” Fluency in each grade involves a mixture of just knowing some answers, knowing some answers from patterns (e.g., “adding 0 yields the same number”), and knowing some answers from the use of strategies. It is important to push sensitively and encouragingly toward fluency of the designated numbers at each grade level, recognizing that fluency will be a mixture of these kinds of thinking which may differ across students.

Addition and Subtraction Word Problems

Lessons

5

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9

14

Throughout this level of *Math Expressions*, children use addition and subtraction to solve word problems. In an earlier unit, the various problem types described in the Common Core Standards were described. In this unit, children solve problems for all problem situation types involving addition and subtraction within 1,000. To review the problem types, see the sample problems for each problem type on page T8 of this Teacher's Edition.

An important aspect of solving problems in *Math Expressions*, and one that differentiates the program from many other programs, is the strong emphasis not only on solving problems but also on explaining, discussing, and questioning solutions to problems. In this unit, focus your work with problem solving on helping children ask good questions and give good explanations.

As you do this, be sure that children explain, discuss, and question several ways to represent situations (for example, drawings, Math Mountains, and equations) and methods chosen to find the solutions (for example, New Groups Below or Ungroup First).

Focus on Mathematical Practices

Lesson

15

The Standards for Mathematical Practice are included in every lesson of this unit. However, the last lesson in every unit focuses on all eight Mathematical Practices. In this lesson, children apply what they have learned about adding and subtracting within 1,000 to what they have learned about problem types to solve problems about art fairs and artists selling their work at art fairs.



from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON OPERATIONS AND ALGEBRAIC THINKING

Grade 2 Students in Grade 2 master all of the problem situations and all of their subtypes and language variants. The numbers in these problems involve addition and subtraction within 100. They represent these problems with diagrams and/or equations.