Numbers and Operations

★ Module 2 ★

Whole Number Operations

Lesson 1
Large Numbers: Addition

Teacher Notes 2.1

Objective

- Develop and use a variety of algorithms with computational fluency to perform whole number operations using addition (up to five-digit numbers), including **real world problems**.

power talk send

Prerequisites

Adding whole numbers
Identifying place value

Vocabulary

Partial Sums Method
Column Addition Method
Addend
Sum
Partial Sum
Standard Method of Addition
Place Value

Get Started

- Ask students to use six different digits to create two three-digit numbers that can be added without regrouping and then ask them to find the sums.
- Ask for volunteers to give their numbers and sums and to discuss how they knew they did not need to regroup. **No sum of a place value was 10 or greater.**
- Ask students if they know any other words for regrouping. **Carrying, borrowing, etc.**
- Tell students that this lesson will introduce them to different methods that can be used for adding and regrouping large whole numbers.

Expand Their Horizons

In Subtopic 1, students use place values to create partial sums. It may be helpful to remind students that the digits in a number are not just the value of the digit itself, but also the place that the digit holds. For example, in the number 6,735 the six has a value of 6,000 because it is in the thousands place. It signifies that there are six "thousands" in that number. Teachers may reinforce this by writing numbers in expanded form.

1

Before students begin adding, ask them to write each of the addends in their expanded form with place values. This will help them see how numbers are being added.

$$2{,}289 = 2{,}000 + 200 + 80 + 9$$
$$1{,}327 = 1{,}000 + 300 + 20 + 7$$

Then, they add the place values for each place.

Common Error Alert:

If the same number of digits is not presented in each addend, make sure that students align the items from right to left. They should start aligning with the last place value for addition.

2

Note that there are four digits in the first addend and three digits in the second addend. Remind students that they should look carefully at each problem and identify the number of digits before working with place values. Because there is no thousands place in the second addend, the partial sums for thousands is the place value of the thousands in the first addend.

Additional Examples

1. **Kiley earned 2,515 points towards a prize at an arcade last month. This month she has earned 1,288 points. How many points has she earned in both months?**

   Write each number in expanded form and then add the place values.

   2,000 + 500 + 10 + 5
   1,000 + 200 + 80 + 8

   Partial Sums
   3,000 + 700 + 90 + 13
   Total Sum
   Kiley earned 3,803 points.

2. **Scott found a two volume unabridged dictionary in the library. The first volume had 2,678 pages, and the second volume had 2,560 pages. How many total pages does the set have?**

   Write each number in expanded form and then add the place values.

   2,000 + 600 + 70 + 8
   2,000 + 500 + 60 + 0

   Partial Sums
   4,000 + 1100 + 130 + 8
   Total Sum
   The set has 5,238 pages.

Expand Their Horizons

Subtopic 2 introduces the algorithm for Column Addition. This method requires students to write the addends in columns separated by vertical lines.

Students will add the digits for one column at a time and will write the individual sums. Then, working left to right, they will adjust each place value answer for any column sum 10 or greater. Remind students that our numbering system is called base ten because 10 is the value where a new place is added. It may be helpful to walk them through: 10 ones = one ten; 10 tens = one hundred; 10 hundreds = one thousand.

3 Remind students to make each place value column adjustment separately as indicated in the lesson. Sometimes if they rush, they can make careless errors because they do not make all the necessary adjustments.

4 Teachers may want to point out to students that although the addends have only three digits, the sum has four because the sum of the digits in the hundreds column and the adjustment from the tens column was 15, which is greater than 10. They may also want to point out that although "15 hundred" is correct and is often used in speech, the answer is usually said as "one thousand, five hundred" identifying the correct place value for the digits.

Additional Examples

1. Juju has $575 in a savings account for college. She deposited the $645 she received from her grandmother. What is the new balance of her savings account?

Write the two addends in column formation and add the columns. Make adjustments as needed.

	5	7	5
+	6	4	5
	11	11	10
	11	12	0
	12	2	0
1	2	2	0

Juju has a balance of $1,220.

2. A pine tree farm has 2,456 adult trees and 1,282 saplings. How many total pine trees are on the farm?

Write the two addends in column formation and add the columns. Make adjustments as needed.

	2	4	5	6
+	1	2	8	2
	3	6	13	8
	3	7	3	8

3,738 pine trees

Expand Their Horizons

In this subtopic, students will use base ten blocks and regroup within place values to add numbers.

Students can use actual base ten blocks to model problems. If blocks are unavailable, students may sketch blocks on paper.

Common Error Alert:

When sketching blocks, some students may believe it necessary to meticulously sketch the exact number of blocks. Explain to them that it is unnecessary to sketch one hundred blocks to create a hundreds-block. They may use a blank square to represent hundreds (☐), a line to represent tens (|), and dots to represent ones (•). With this method, ☐ ☐ | ••• may be used to sketch the value 213.

Students may need to be reminded to check the total number of blocks in each place value and, if necessary, to exchange 10 blocks of one place for one block of the next greater place to adjust and to model the entire sum in as few blocks as necessary.

In this method, students will note adjustments to place values during the addition process by writing the number of place values being adjusted or regrouped above the numbers. Remind them that these marks are their only method of accounting for the regrouping process, so they should write them down rather than try to remember them as they add the next column.

5 Remind students to set out the blocks for each addend before trying to combine them. Check that they line up each block type in rows of 10, so that it is easier to see when regrouping is required.

6 Remind students that they can check their work using one of the previous methods taught—Partial Sums or Column Addition.

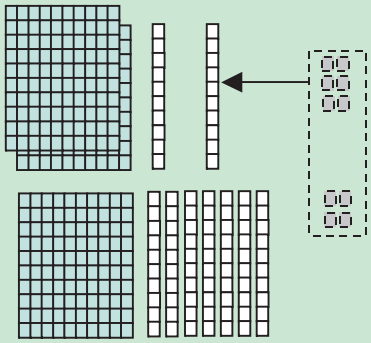
Common Error Alert:

Students often skip the step of writing down the place value they are regrouping in the correct column. Remind them that this notation should be made in the proper place value column.

Additional Examples

1. **216 + 174**

Set out place value blocks for each sum.



The 10 ones-blocks regroup into one tens-block, so the sum is 390.

2.
$$\begin{array}{r} 625 \\ +\ 182 \\ \hline \end{array}$$

Beginning at the ones column and moving to the left, add and regroup along columns.

$$\begin{array}{r} {\scriptstyle 1} \\ 625 \\ +\ 182 \\ \hline 807 \end{array}$$

Look Beyond

The development and use of alternate addition algorithms help students develop number sense, particularly with the concept of place value. Some students may find these alternate algorithms easier to understand and to learn than the traditional methods.

Connections

An algorithm is a procedure for solving a mathematical problem. Numerical analysis is one area of mathematics that relies heavily on the use of algorithms. Algorithms are also used in computer science.

A computer program is an algorithm, which is a series of steps to solve a problem. One branch of computer science deals with the analysis of algorithms. Analysis of algorithms is concerned with estimating the efficiency or complexity of an algorithm to determine the most suitable method of solving a particular problem.