Lesson 2 | Operations and Whole Numbers

Problem Solving: Horizontal Bar Graphs

Operations and Whole Numbers

Vocabulary

traditional algorithm
partial sum
partial product

What role does place value have in whole number operations?

Often, we learn to add, subtract, multiply, and divide whole numbers using **traditional algorithms**. These operations involve regrouping. Let's review these algorithms.

Addition	Subtraction	Multiplication	Division
437 + 129	804 − 361	361 × 3	9)378

We use traditional algorithms because they are fast or efficient. But it is easy to get lost and make mistakes. Traditional algorithms do not show us the role of place value for each operation. Let's look at these same algorithms to see the value of the numbers we are carrying, borrowing, multiplying or dividing.

Remember, an algorithm is a set of rules.

Addition

We add 10, not 1.

$$\begin{array}{r} {\scriptstyle 1} \\ 437 \\ +\ 129 \\ \hline 566 \end{array}$$

Subtraction

We borrow 10 tens, not 1.

$$\begin{array}{r} {\scriptstyle 7\ 10} \\ 8\cancel{0}4 \\ -\ 361 \\ \hline 443 \end{array}$$

Multiplication

We multiply 300, 60, and 1 by 3, not 3 and 6.

$$\begin{array}{r} 361 \\ \times\ \ 3 \\ \hline 1{,}083 \end{array}$$

Division

We divide 9 into 370, not 37.

$$\begin{array}{r} 42 \\ 9\overline{)378} \end{array}$$

How does expanded form help us see place value?

We have learned that whole-number operations are also written in expanded form. There's less chance of making mistakes using the expanded algorithm. It clearly shows the place value for each digit. Let's compare the traditional algorithm for addition with the expanded, or **partial sums**, method.

Example 1

Use place value to add whole numbers.

We are not adding 1.

$$\begin{array}{r} {\scriptstyle 1} \\ 328 \\ +\ 465 \\ \hline 793 \end{array}$$

$\rightarrow$

	¹⁰	
300	20	8
+ 400	60	5
700	90	3

We are adding 10.

In traditional algorithms, it's not clear that we are adding a 10 or 100 because we just write a 1.

The expanded form shows how place value works. Place value becomes very important when we have to regroup, or "borrow," numbers. We might make mistakes if we don't think about place value.

Example 2

Use place value to subtract whole numbers.

We are not borrowing 1.

$$\begin{array}{r} {\scriptstyle 8\ 1} \\ 3\cancel{9}5 \\ -\ 257 \\ \hline 138 \end{array}$$

$\rightarrow$

We are borrowing 10.

	⁸⁰	¹⁵
300	~~90~~	~~5~~
− 200	50	7
100	30	8

We do not use the expanded method for everyday computation because it is not efficient. But it is important to compare this method to the traditional method. It reminds us what we are doing when we regroup numbers.

Let's compare the traditional algorithm for multiplication with the expanded method. Another name for the expanded method is the **partial product** method.

Example 3

Use place value to multiply whole numbers.

$$\begin{array}{r} 256 \\ \times \quad 3 \\ \hline 18 \\ 150 \\ +\,600 \\ \hline 768 \end{array}$$

We are not multiplying 2, 5, and 6 by 3.

→

	200	50	6
×			3
			18
			150
+			600
			768

We are multiplying 200, 50, and 6 by 3.

The result is the same for both algorithms.

The traditional method is quicker and more efficient. But it does not clearly show what number we multiply by because we can't see the place value. Place value is much clearer with the partial product method, but it has more steps.

These whole-number operations are important to understand as we begin to learn about other types of numbers. We will have a lot of practice with whole-number operations so we can become more efficient.

Apply Skills
Turn to ***Interactive Text***, page 5.

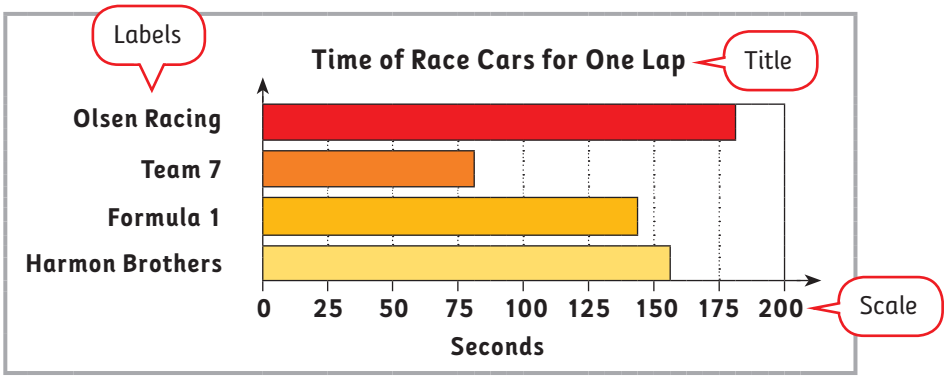
mBook Reinforce Understanding
Use the ***mBook Study Guide*** to review lesson concepts.

Problem Solving: Horizontal Bar Graphs

How do horizontal bar graphs differ from vertical bar graphs?

Horizontal bar graphs work just like vertical bar graphs, but the placement of the data is different. The scale is horizontal and is numbered across the bottom. The labels go down the left side.

The following graph shows the speed of four race cars during one lap of a race. The number of seconds it takes to get around the track is shown on the horizontal axis. The team names are on the vertical axis.



Problem-Solving Activity
Turn to ***Interactive Text***, page 6.

mBook Reinforce Understanding
Use the ***mBook Study Guide*** to review lesson concepts.

Homework

Activity 1

Solve each problem using expanded math.

1. $45 + 26$

2. $378 + 183$

3. $230 - 191$

4. 96×3

Activity 2

Fill in the missing numbers in the table.

Starting Number	_____ • 10	_____ • 100	_____ • 1,000
6,000	600 • 10	60 • 100	6 • 1,000
8,000	(a)	(b)	(c)
(d)	900 • 10	(e)	(f)
(g)	(h)	70 • 100	(i)
(j)	(k)	(l)	3 • 1,000

Activity 3 • Distributed Practice

Solve.

1. $469 + 237$

2. $172 - 96$

3. 47×19

4. 267×8

5. $9\overline{)459}$

6. $237 - 119$

7. $317 + 185$

8. $7\overline{)252}$