Whole Numbers

1

SECTION 1.4

Subtraction with Whole Numbers

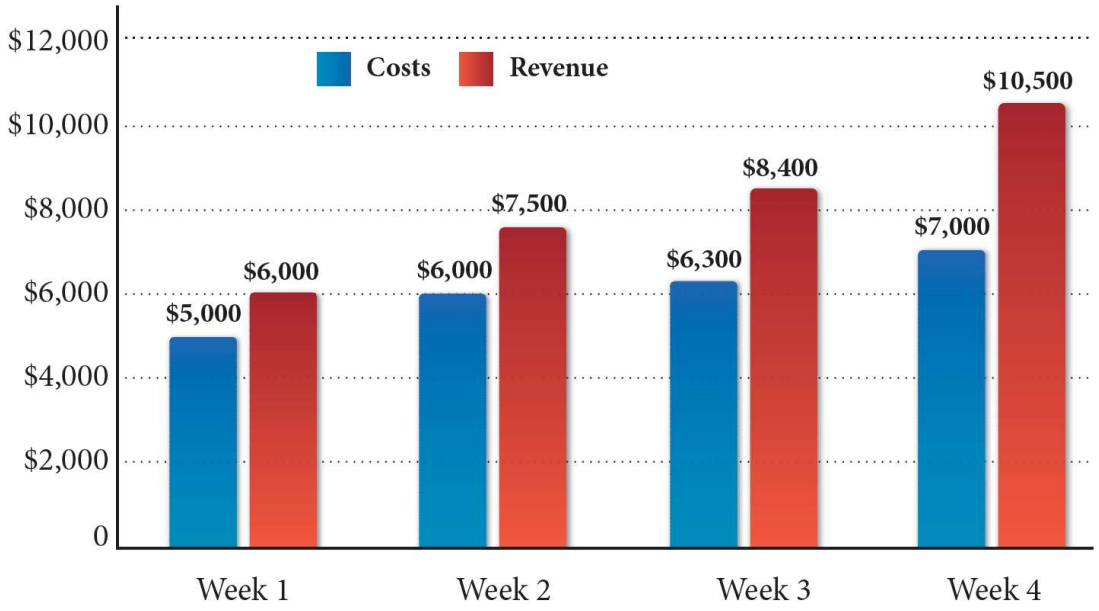
Objectives

- **A** Understand the notation and vocabulary of subtraction.
- **B** Subtract whole numbers.
- **C** Subtraction with borrowing.

Subtraction with Whole Numbers

In business, *subtraction* is used to calculate profit. Profit is found by subtracting costs from revenue.

The following double bar chart shows the costs and revenue of the Baby Steps Shoe Company during one 4-week period.



Subtraction with Whole Numbers

To find the profit for Week 1, we subtract the costs from the revenue, as follows:

Profit = $6,000 – $5,000

Profit = $1,000

Subtraction is the opposite operation of addition.

If you understand addition and can work simple addition problems quickly and accurately, then subtraction shouldn't be difficult for you.

A Vocabulary

Vocabulary

The word *difference* always indicates subtraction.

We can state this in symbols by letting the letters a and b represent numbers.

Definition

The **difference** of two numbers a and b is $a - b$.

Vocabulary

Table 1 gives some word statements involving subtraction and their mathematical equivalents written in symbols.

TABLE 1

In English	In Symbols
The difference of 9 and 1	$9 - 1$
The difference of 1 and 9	$1 - 9$
The difference of m and 4	$m - 4$
The difference of x and y	$x - y$
3 subtracted from 8	$8 - 3$
2 subtracted from t	$t - 2$
The difference of 7 and 4 is 3.	$7 - 4 = 3$
The difference of 9 and 3 is 6.	$9 - 3 = 6$

B The Meaning of Subtraction

The Meaning of Subtraction

When we want to subtract 3 from 8, we write

$8 - 3$, 8 subtract 3, or 8 minus 3

The answer we are looking for here is the difference between 8 and 3, or the number we add to 3 to get 8.

That is:

$8 - 3 = ?$ is the same as $? + 3 = 8$

In both cases we are looking for the number we add to 3 to get 8.

The Meaning of Subtraction

The number we are looking for is 5.

We have two ways to write the same statement.

Subtraction		Addition
8 – 3 = 5	or	5 + 3 = 8

For every subtraction problem, there is an equivalent addition problem.

The Meaning of Subtraction

Table 2 lists some examples.

TABLE 2

Subtraction		Addition
$7 - 3 = 4$	because	$4 + 3 = 7$
$9 - 7 = 2$	because	$2 + 7 = 9$
$10 - 4 = 6$	because	$6 + 4 = 10$
$15 - 8 = 7$	because	$7 + 8 = 15$

To subtract numbers with two or more digits, we align the numbers vertically and subtract in columns.

Example 1

Subtract: 376 – 241

Solution:

We write the problem vertically, aligning digits with the same place value.

Then we subtract in columns.

$$\begin{array}{r} 376 \\ -\ 241 \\ \hline 135 \end{array}$$

← Subtract the bottom number in each column from the number above it.

The Meaning of Subtraction

It is important to note that we always subtract the bottom number from the top number.

As you can see, subtraction problems like the ones in Examples 1 are fairly simple because the digits in the bottom numbers were smaller than the digits in the top numbers with which they aligned.

However, this will not always be the case, as we will now discuss.

C Subtraction with Borrowing

Subtraction with Borrowing

Subtraction must involve *borrowing* when the bottom digit in any column is larger than the digit above it.

In one sense, borrowing is the reverse of the carrying we did in addition.

Example 3

Subtract: 92 – 45

Solution:

We write the problem vertically with the place values of the digits showing:

$$\begin{array}{r} 92 = 9 \text{ tens} + 2 \text{ ones} \\ -\ 45 = 4 \text{ tens} + 5 \text{ ones} \\ \hline \end{array}$$

Look at the ones column. We cannot subtract immediately, because 5 is larger than 2.

Example 3 – *Solution*

cont'd

Instead, we borrow 1 ten from the 9 tens in the tens column.

We can rewrite the number 92 as

9 tens + 2 ones

= 8 tens + 1 tens + 2 ones

= 8 tens + 12 ones

Example 3 – *Solution*

Now we are in a position to subtract.

$$\begin{array}{rll} 92 = 9 \text{ tens} + 2 \text{ ones} & = & 8 \text{ tens} + 12 \text{ ones} \\ \underline{-\ 45} = \underline{4 \text{ tens} + 5 \text{ ones}} & = & \underline{4 \text{ tens} + \ \ 5 \text{ ones}} \\ & & 4 \text{ tens} + \ \ 7 \text{ ones} \end{array}$$

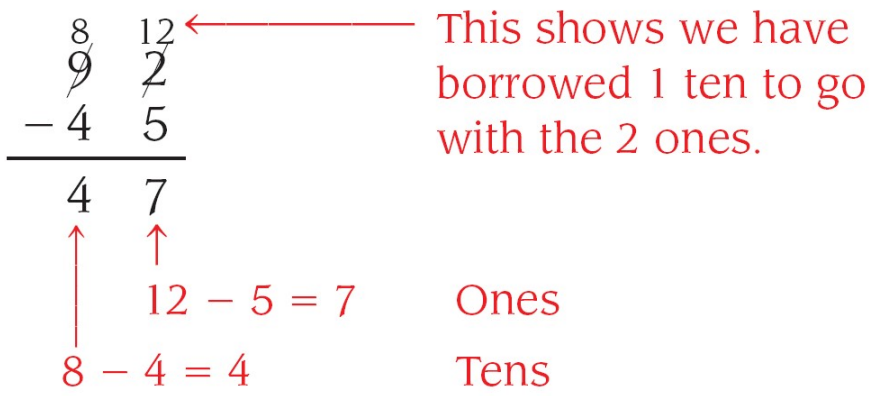
The result is 4 tens + 7 ones, which can be written in standard form as 47.

Writing the problem out in this way is more trouble than is actually necessary.

Example 3 – *Solution*

cont'd

The shorthand form of the same problem looks like this:



This shortcut form shows all the necessary work involved in subtraction with borrowing.

We will use it from now on.

Example 3 – *Solution*

cont'd

The borrowing that changed 9 tens + 2 ones into 8 tens + 12 ones can be visualized with money.