Section 1.4 Subtracting Real Numbers

Objectives
In this section, you will learn to:

- Identify the opposite of a number.
- Evaluate a double negative.
- Write subtraction as addition.
- Subtract integers.
- Add and subtract signed fractions.
- Add and subtract signed decimals.
- Solve applications involving signed numbers.

To successfully complete this section, you need to understand:

- The Commutative Property of Addition (1.1)
- Adding real numbers (1.3)
- Adding and subtracting fractions (R.6)

INTRODUCTION

You have been doing subtraction for a long time. In the world of math we call subtraction *finding the difference*. What you might not know is that subtraction is really another form of addition. This section introduces subtraction in a new way, especially as it relates to positive and negative numbers.

THE FIRST THREE MEANINGS OF THE DASH

You have recognized this dash '–' for many years as the subtraction sign, or minus sign. More recently you have seen it used as the negative sign. There is a third meaning that will prove to be very valuable to your understanding of algebra: the dash also means "the opposite of."

Here are three ways the dash is used:
1. as a minus sign, as in 9 – 4 is "9 *minus* 4."
2. as a negative sign, as in -6 is "*negative* 6."
3. as *the opposite of*, as in -4 is "*the opposite of* 4."

Let's apply this third meaning of the dash.

Example 1: Rewrite the outer negative sign as "the opposite of" the number within the parentheses. Also, state its value as we might normally say it.

a) -(+7) b) -(-5) c) -(8)

Answer:

a) -(+7) means <u>the opposite of +7</u>, which is <u>-7</u>.

b) -(-5) means <u>the opposite of -5</u>, which is <u>5</u>.

c) -(8) means <u>the opposite of 8</u>, which is <u>-8</u>.

You Try It 1 Rewrite the outer negative sign as "the opposite of" the number within the parentheses. Also, state its value as we might normally say it. Use Example 1 as a guide.

a) -(+3) means ______________________________ , which is _______ .

b) -(-1) means ______________________________ , which is _______ .

c) -(-12) means ______________________________ , which is _______ .

d) -(16) means ______________________________ , which is _______ .

THE DOUBLE NEGATIVE

From the previous example and exercise, we can recognize that the opposite of a negative number is a positive number. When written using the dashes, the opposite of -5 becomes -(-5), and this has the value of +5.

The notation -(-5) is an example of a **double negative**. When two negative signs—two minus signs, two dashes—are next to each other (possibly separated by a parenthesis) then the number can be rewritten as a positive number. In other words, the two negative signs can be replaced by a single positive sign or plus sign.

In these cases, parentheses are usually quite helpful. For example, in --5, the meaning of the dashes might not be clear, so we separate the dashes with parentheses: -(-5). This is *the opposite of -5*.

Example 2: Rewrite each double negative as a positive.

a) -(-9) b) -(-4)

Procedure: To emphasize the fact that a double negative is equivalent to a positive, write a + in front of the positive number.

Answer: a) **+**9 (or just 9) b) **+**4 (or just 4)

It's also appropriate to write a double negative with two plus signs, as in

-(-4) = **+**(**+**4).

You Try It 2 Rewrite each double negative as a positive. Use Example 2 as a guide.

a) -(-15) b) -(-59) c) -(-1)

We'll return to the double negative in a moment. First, though, let's look at how subtraction can be thought of as addition.

WRITING SUBTRACTION AS ADDITION

We know that $7 - 4 = 3$, and we have recently learned that $7 + (-4) = 3$ as well. That is, $7 - 4 = 7 + (-4)$. This is a simple example of how we can write subtraction as addition.

> Subtraction can be rewritten as addition, as *adding the opposite*.
>
> Symbolically, this is written: $a - b = a + (-b)$

Note: The advantage of being able to write subtraction this way is that we do not need to learn any rules for subtracting signed numbers. Instead, we write subtraction as *adding the opposite* and use the rules of addition established in Section 1.3.

Let's look at writing subtraction as addition. This means changing two things: change the operation to addition and change the second number to its opposite.

> **Note:** Subtracting a negative number is an example of the double negative. In such a case, both dashes (the minus sign and the negative sign) can be written as plus signs, as shown in Example 3, parts c) and d).

Example 3: Rewrite each subtraction as addition and evaluate.

a) $6 - 2$ b) $-1 - 7$ c) $5 - (-6)$ d) $-9 - (-2)$

Procedure: For each of these, the operation will become addition and the second number will become its opposite.

Answer:

a) $6 - 2 = \underline{6 + (-2)} = \underline{+4}$.

b) $-1 - 7 = \underline{-1 + (-7)} = \underline{-8}$.

c) $5 - (-6) = \underline{5 + (+6)} = \underline{+11}$.

d) $-9 - (-2) = \underline{-9 + (+2)} = \underline{-7}$.

<u>You Try It 3</u> Rewrite each subtraction as addition. Then, evaluate the sum. Use Example 3 as a guide.

a) $12 - 5$ = _____________ = ____ .

b) $6 - (-4)$ = _____________ = ____ .

c) $4 - 10$ = _____________ = ____ .

d) $-3 - (-9)$ = _____________ = ____ .

e) $-5 - 3$ = _____________ = ____ .

f) $-12 - (-2)$ = _____________ = ____ .

g) $-6 - (-6)$ = _____________ = ____ .

h) $0 - 7$ = _____________ = ____ .

If an expression contains more than two integers, then we can write each subtraction as adding the opposite and then use the Commutative Property and add the positive numbers separately from the negative numbers.

Example 4:	Evaluate the expression. $2 - 3 + 4 - (-5)$
Procedure:	First write each subtraction as addition. Then use the Commutative Property to get the positive number(s) together and the negative number(s) together.
Answer:	$2 - 3 + 4 - (-5)$ — Change all subtraction to adding the opposite.
	$= 2 + (-3) + 4 + (+5)$ — Group the three positive numbers together and add.
	$= 2 + 4 + 5 + (-3)$ — $2 + 4 + 5 = 11$
	$= 11 + (-3)$ — Add 11 and -3.
	$= 8$

You Try It 4 Evaluate each expression. Use Example 4 as a guide.

a) $6 + (-4) - (-9) - 1$

b) $-5 - (-6) + 7 - 3$

c) $-8 + 3 - 5 - (-7)$

d) $1 + (-3) - (-5) - 11$

Guidelines for Adding and Subtracting Real Numbers: A Summary

Our work with real numbers thus far leads us to these guidelines on how to add and subtract two signed numbers:

Action	Examples
1. Subtraction: Change subtraction to addition: *add the opposite*.	a) $3 - 5 \rightarrow 3 + (-5)$ b) $-4 - (-7) \rightarrow -4 + 7$
2. Addition of two integers with the same sign: i) The resulting sum will have the same sign. ii) Add the numerical values of each number.	a) $2 + 8$ — Both positive — $2 + 8 = \mathbf{10}$ b) $-1 + (-6)$ — Both negative — $-1 + (-6) = \mathbf{-7}$

3. **Addition of two integers with different signs:** i) (optional) Write the larger-valued number first. ii) The sign of the sum is the same as the sign of the larger-valued number. iii) Subtract the two numerical values: larger numerical value − smaller numerical value.	a) 3 + (-8) -8 + 3 Larger-valued number is negative 8 − 3 = 5 so ... -8 + 3 = **-5**	b) -2 + 11 11 + (-2) Larger-valued number is positive 11 − 2 = 9 so ... 11 + (-2) = **+9**

Example 5: Evaluate.

a) 29 − 42 b) 37 + (-25) c) -47 + (-19) d) 12 − (-38)

Procedure: Change all subtraction (if any) to addition. Apply the guidelines in the summary to find the sum.

Answer:

a) 29 − 42	First, rewrite as addition: 29 + (-42).
= 29 + (-42)	The signs are different; write the larger-valued number first.
= -42 + 29	Find the difference: 42 – 29 = 13.
= -13	The result is negative: -13.
b) 37 + (-25)	The signs are different; no need to rewrite it as addition; find the difference: 37 – 25 = 12.
= +12 (or 12)	The result is positive: +12.
c) -47 + (-19)	The signs are the same; they are both negative.
= -66	Add the numerical values: 47 + 19 = 66; the result is negative.
d) 12 − (-38)	First, rewrite subtraction as addition: 12 +(+38).
= 12 + (+38)	The signs are the same; they are both positive.
= +50 (or 50)	Add the numerical values: 12 + 38 = 50; the result is positive.

You Try It 5 Evaluate. Use Example 5 as a guide.

a) 33 + (-95) b) -21 + 68 c) 65 – (-15) d) -76 – 48

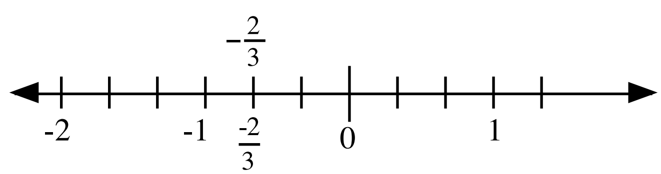
ADDING AND SUBTRACTING SIGNED FRACTIONS

A negative fraction, such as $-\frac{2}{3}$, is typically represented in one of two ways:

1. With a negative sign in front of the fraction, as $-\frac{2}{3}$, or
2. With a negative sign in the numerator of the fraction, as $\frac{-2}{3}$.

We can see that these two numbers are located at the same place on the number line. We can write

$$-\frac{2}{3} = \frac{-2}{3}$$



Representing negative fractions correctly is helpful when adding and subtracting fractions.

To add fractions, they must first have common denominators: $\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$. If one or both of the fractions is negative, then we must apply the rules of adding integers. We use the numerators to determine which is the larger-valued fraction.

Example 6: Evaluate. Simplify completely.

a) $-\frac{5}{7} + \frac{-4}{7}$ b) $\frac{9}{11} + \left(-\frac{7}{11}\right)$

Procedure: If a fraction is negative, write the negative sign in the numerator. Apply the guidelines to find the sum.

Answer:

a) $-\frac{5}{7} + \frac{-4}{7}$ First, place the negative of the first fraction in the numerator.

$= \frac{-5}{7} + \frac{-4}{7}$ The fractions have a common denominator of 7 and can be combined into one fraction which also has a denominator of 7.

$= \frac{-5 + (-4)}{7}$ $-5 + (-4) = -9$.

$= \frac{-9}{7} \quad \left(\text{or } -\frac{9}{7}\right)$ The negative can remain in the numerator or can be placed in front of the fraction.

a) $\frac{9}{11} + \left(-\frac{7}{11}\right)$ First, place the negative of the second fraction in the numerator.

$= \frac{9}{11} + \frac{-7}{11}$ The fractions have a common denominator of 11 and can be combined into one fraction.

$= \frac{9 + (-7)}{11}$ $9 + (-7) = 2$.

$= \frac{2}{11}$

You Try It 6 Evaluate. Use Example 6 as a guide.

a) $-\frac{8}{15} + \frac{19}{15}$ b) $-\frac{2}{9} + \left(-\frac{11}{9}\right)$ c) $\frac{12}{15} + \left(-\frac{5}{15}\right)$

SUBTRACTING SIGNED FRACTIONS

To subtract signed fractions, we change subtraction to adding the opposite and then apply the rules of addition. For example, $\frac{1}{15} - \frac{8}{15}$ can first be written as $\frac{1}{15} + \frac{-8}{15}$.

In subtracting a negative fraction, there is a double negative: the subtraction sign and the negative sign. When this occurs, we change the expression to adding a positive fraction. This can appear in one of two ways:

The negative sign in front of the fraction: The negative sign in the numerator:

$\dfrac{4}{15} - \left(-\dfrac{7}{15}\right)$ Change subtraction to adding the opposite.

$= \dfrac{4}{15} + \left(+\dfrac{7}{15}\right)$ The fractions have a common denominator.

$= \dfrac{4 + 7}{15}$ $4 + 7 = 11$.

$= \dfrac{11}{15}$

$-\dfrac{1}{7} - \dfrac{-3}{7}$ Change subtraction to adding the opposite.

$= \dfrac{-1}{7} + \dfrac{+3}{7}$ The fractions have a common denominator.

$= \dfrac{-1 + 3}{7}$ $-1 + 3 = 2$.

$= \dfrac{2}{7}$

Example 7: Evaluate.

a) $\dfrac{11}{21} - \dfrac{16}{21}$ b) $-\dfrac{1}{9} - \dfrac{-5}{9}$

Procedure: Change subtraction to adding the opposite. Apply the guidelines to find the sum.

Answer:

a) $\dfrac{11}{21} - \dfrac{16}{21}$ First, write the subtraction as adding the opposite. Place the negative in the numerator of the second fraction.

$= \dfrac{11}{21} + \dfrac{-16}{21}$ The fractions have a common denominator.

$= \dfrac{11 + (-16)}{21}$ $11 + (-16) = -5$.

$= \dfrac{-5}{21}$ We can keep this with the negative in the numerator or write it in front of the fraction, $-\dfrac{5}{21}$.

b) $-\dfrac{1}{9} - \dfrac{-5}{9}$ Write the subtraction as adding the opposite. This makes the numerator of the second fraction positive.

$= -\dfrac{1}{9} + \dfrac{+5}{9}$ Place the negative in the numerator of the first fraction and combine.

$= \dfrac{-1 + 5}{9}$ $-1 + 5 = 4$.

$= \dfrac{4}{9}$

You Try It 7 Evaluate. Use Example 7 as a guide.

a) $-\frac{7}{9} - \left(-\frac{11}{9}\right)$ b) $-\frac{3}{15} - \frac{19}{15}$ c) $\frac{8}{20} - \frac{15}{20}$

ADDING AND SUBTRACTING UNLIKE FRACTIONS

Whether adding or subtracting fractions, if they have different denominators, we must first identify the least common denominator (LCD) and build up each fraction appropriately. We do so by multiplying by a fractional form of 1, such as $\frac{2}{2}$ or $\frac{5}{5}$. Multiplying by 1 does not change the value of the fraction, including whether it is positive or negative.

> **Note:**
>
> Recall (Sec. 1.1) that 1 is the multiplicative identity and $a \cdot 1 = a$.

For example, $-\frac{2}{3} \cdot \frac{5}{5} = -\frac{10}{15}$ (still negative) .

Example 8: Evaluate. Simplify completely.

a) $-\frac{1}{6} + \frac{4}{9}$ b) $-\frac{2}{3} - \frac{-1}{5}$

Procedure: If the fractions do not yet have common denominators, then find the LCD and build up each fraction as necessary. Apply the guidelines to find the sum.

Answer:

a) $-\frac{1}{6} + \frac{4}{9}$ The LCD is 18. Multiply the first fraction by $\frac{3}{3}$ and the second fraction by $\frac{2}{2}$.

$= -\frac{1}{6} \cdot \frac{3}{3} + \frac{4}{9} \cdot \frac{2}{2}$ Multiply each pair of fractions.

$= -\frac{3}{18} + \frac{8}{18}$ Place the negative in the numerator of the first fraction and combine.

$= \frac{-3+8}{18}$ $-3 + 8 = 5$

$= \frac{5}{18}$

b) $-\frac{2}{3} - \frac{-1}{5}$ Write the subtraction as adding the opposite. This makes the numerator of the second fraction positive.

$= -\frac{2}{3} + \frac{+1}{5}$ The LCD is 15. Multiply each fraction appropriately to get common denominators.

$= -\frac{2}{3}\cdot\frac{5}{5} + \frac{1}{5}\cdot\frac{3}{3}$ Multiply.

$= -\frac{10}{15} + \frac{3}{15}$ Place the negative in the numerator of the first fraction and combine.

$= \frac{-10 + 3}{15}$ $-10 + 3 = -7$

$= \frac{-7}{15}$ or $-\frac{7}{15}$

You Try It 8 Evaluate. Use Example 8 as a guide.

a) $-\frac{1}{8} + \frac{1}{2}$

b) $-\frac{5}{6} - \frac{-1}{4}$

c) $\frac{2}{5} - \frac{3}{4}$

Think About It 1 How can you determine whether the sum $-\frac{5}{12} + \frac{4}{9}$ will be positive or negative?

____

ADDING AND SUBTRACTING SIGNED DECIMALS

To add positive and negative decimals, we use the same rules as for adding integers. Whether adding or subtracting decimals, it is always best for each decimal to have the same number of decimal digits, as we see in Example 9.

Example 9: Evaluate.

a) $2.9 - 4.2$ b) $0.37 + (-0.2)$ c) $1.02 - (-0.38)$ d) $-0.047 + (-0.19)$

Procedure: Change all subtraction (if any) to addition. Apply the guidelines to find the sum.

Answer:

a) $2.9 - 4.2$ — The decimals have the same number of decimal places. Change subtraction to adding the opposite.

$= 2.9 + (-4.2)$ — (Optional) Write the larger-valued number first.

$= -4.2 + 2.9$ — The signs are different; find the difference. →

$$\begin{array}{r} 4.2 \\ \underline{-\ 2.9} \\ 1.3 \end{array}$$

$= -1.3$ — The larger-valued number is negative so the result is *negative*.

b) $0.37 + (-0.2)$ — Write -0.2 as -0.20 so each decimal has two decimal digits.

$0.37 + (-0.20)$ — The signs are different; find the difference. →

$$\begin{array}{r} 0.37 \\ \underline{-\ 0.20} \\ 0.17 \end{array}$$

$= +0.17$ — The larger-valued number is positive so the result is *positive*.

c) $1.02 - (-0.38)$ — The decimals have the same number of decimal places. Change subtraction to addition: 1.02 +(+0.38).

$= 1.02 + (+0.38)$ — The signs are the same, and they are both *positive*.

$$\begin{array}{r} 1.02 \\ \underline{+\ 0.38} \\ 1.40 \end{array}$$

$= 1.40$ or 1.4

d) $-0.047 + (-0.19)$ — Write -0.19 as -0.190 so each decimal has three decimal digits.

$= -0.047 + (-0.190)$ — The signs are the same, and they are both *negative*.

$$\begin{array}{r} 0.047 \\ \underline{+\ 0.190} \\ 0.237 \end{array}$$

$= -0.237$

You Try It 9 Evaluate. Use Example 9 as a guide.

a) $-3.8 - 5.2$ b) $0.45 - (-0.29)$ c) $0.27 + (-1.6)$ d) $-0.08 + 0.059$

APPLICATIONS WITH REAL NUMBERS

Here are a few situations in which signed numbers are common:

Finances: For credit cards and checking accounts, purchases are represented by a negative amount called **debits**. Deposits and payments to an account are positive and are called **credits**. The word *debit* is related to *debt*, another negative amount.

Temperature: A rise in temperature means addition, and a drop in temperature means subtraction. During the winter, some northern areas get very cold at night, and the temperature is below 0, a negative amount. Even when the temperature rises, it can still be negative degrees during the day time.

Altitude: Above sea level the altitude is positive; below sea level the altitude is negative.

The next few examples and exercises make use of adding and subtracting integers. For each, set up a numerical expression (using addition or subtraction) and then answer the question with a sentence.

FINANCES

Example 10: On her Macy's card, Julia has a debit of \$25 and makes a payment of \$44. What is the new balance of her account? Is this new balance a debit or a credit?

Procedure: A debit is a negative number (-\$25), and a payment on an account is a positive number (+\$44) added to the account. Numerically, it looks like this:

Answer: Numerical Expression: $-25 + 44 = 19$

Sentence: The new balance is \$19; this is a *credit*.

Example 11: On her Sears card, LaTrisha has a credit of \$65.17 and makes a purchase of \$103.45. What is the new balance of her account? Is this new balance a debit or a credit?

Procedure: The credit is positive (+\$65.17), and the purchase is a negative number (-\$103.45) *added* to the account: $65.17 + (-103.45)$.

Answer:

$65.17 + (-103.45)$ Rearrange this with the larger-valued number in front.

$= -103.45 + 65.17$ The result is negative. Subtract: $\begin{array}{r} 103.45 \\ \underline{-\ 65.17} \\ 38.28 \end{array}$

$= -38.28$

Sentence: The new balance is -\$38.28; this is a debit.

You Try It 10 Solve each application. Write a numerical expression, and write the answer in the form of a sentence. Use Examples 10 and 11 as guides.

a) Bonnie has a debit of \$32 on her Sears card. She likes to keep ahead by making larger-than-needed payments. Her most recent payment is for \$50. What is the new balance of her account? Is it a debit or a credit?

Numerical Expression:

Sentence: ____

b) Arturo has a credit balance of \$36.29 on his MasterCard. He uses this card to make a purchase for \$92.56. What is the new balance of his account? Is it a debit or a credit?

Numerical Expression:

Sentence: ____

TEMPERATURE

In the winter, the temperature in some northern states falls below 0°. Such temperatures are represented by negative numbers.

Example 12: If the temperature was -8° at 7:00 AM and then rose 15° by noon, what was the temperature at noon?

Procedure: Temperature *rising* means *adding* the amount of rise to the starting temperature.

Answer: Numerical expression: $-8 + 15 = 7$

Sentence: The temperature at noon was 7°.

Example 13: Janine was experimenting with a fast freezing technique that her company is developing. She started with water at a temperature of 15.8°C. In the experiment, within one minute the temperature fell 24.65°C. What was the water temperature after one minute?

Procedure: Temperature *falling* means *subtracting* the amount of fall from the starting temperature. Apply the techniques used in this section to evaluate.

Answer: Numerical expression: $15.8 - 24.65$

You finish it

Subtract: $15.8 - 24.65$

Sentence: After one minute, the temperature was -8.85°C.

You Try It 11 Solve each application. Write a numerical expression, and write the answer in the form of a sentence. Use Examples 12 and 13 as guides.

a) At 2:00 PM, the outside temperature was -3°. By 4:00 AM, the temperature had dropped 9°. What was the temperature at 4:00 AM?

Numerical Expression:

Sentence: ____

b) At midnight, the outside temperature was -11.6°. By noon, the temperature had risen 18.3°. What was the temperature at noon?

Numerical Expression:

Sentence: ____

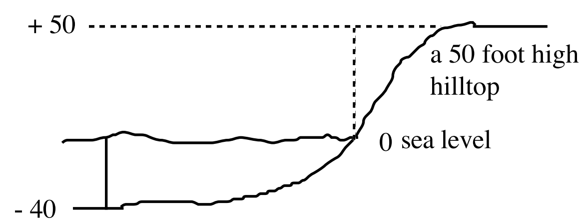
ALTITUDE

Altitude means how high or how low something is compared to sea level.

If a hilltop is 50 feet above sea level, then it has an altitude of 50 feet, or +50 feet.

If the ocean floor is 40 feet deep, then it is 40 feet below sea level and has an altitude of -40 feet.

Sea level has an altitude of 0 feet.



We use subtraction when finding the difference in altitudes: First altitude – Second altitude

Example 14:	Find the difference in altitude of a hill 50 feet above sea level and an ocean floor 40 feet below sea level.
Procedure:	Subtract *first altitude – second altitude*. In this case that's: hill – ocean floor.
Answer:	Numerical expression: $+50 - (-40) = 50 + (+40) = +90$
Sentence:	The difference in altitude is 90 feet.

Example 15:	Find the difference in altitude of a pier that is 2.7 meters above sea level and the ocean floor that is 4.59 meters below sea level.
Procedure:	To find the difference in altitude, subtract: pier – ocean floor.
Answer:	Numerical expression: $+2.7 - (-4.59)$ You finish it *Subtract:* $2.7 - (-4.59)$
Sentence:	The difference in altitude is 7.29 meters.

You Try It 12 Solve each application. Write a numerical expression, and write the answer in the form of a sentence. Use Examples 14 and 15 as guides.

a) Find the difference in altitude of an airplane 1,280 feet above sea level and a mountain peak 1,050 feet above sea level.

Numerical Expression:

Sentence: ____

b) Find the difference in altitude of a cliff 45 feet above sea level and an ocean floor 35 feet below sea level.

Numerical Expression:

Sentence:

____

c) Find the difference in altitude between the top of a lighthouse 23.6 meters above sea level and an undersea reef 40.56 meters below sea level.

Numerical Expression:

Sentence: ____

You Try It Answers

(Note: Positive answers may also be written with a plus sign in front.)

You Try It 1:
a) the opposite of +3; -3
b) the opposite of -1; 1
c) the opposite of -12; 12
d) the opposite of 16; -16

You Try It 2: a) +15 b) +59 c) +1

You Try It 3:
a) 12 + (-5); 7
b) 6 + (+4); 10
c) 4 + (-10); -6
d) -3 + (+9); 6
e) -5 + (-3); -8
f) -12 + (+2); -10
g) -6 + (+6); 0
h) 0 + (-7); -7

You Try It 4: a) 10 b) 5 c) -3 d) -8

You Try It 5: a) -62 b) 47 c) 80 d) -124

You Try It 6: a) $\frac{11}{15}$ b) $\frac{-13}{9}$ c) $\frac{7}{15}$

You Try It 7: a) $\frac{4}{9}$ b) $\frac{-22}{15}$ c) $\frac{-7}{20}$

You Try It 8: a) $\frac{3}{8}$ b) $\frac{-7}{12}$ c) $\frac{-7}{20}$

You Try It 9: a) -9.0 or -9 b) 0.74 c) -1.33 d) -0.021

You Try It 10:
a) -32 +50 = 18; The new balance is \$18; this is a credit.
b) 36.29 – 92.56 = -56.27; Art's new balance is -56.27; this is a debit.

You Try It 11:
a) -3 – 9 = -12; The temperature at 4:00 AM was -12°.
b) -11.6 + 18.3 = 6.7; The temperature at noon was 6.7°.

You Try It 12:
a) 1,280 – 1,050 = 230; The difference in altitude is 230 feet.
b) 45 – (-35) = 45 + (+35) = 80; The difference in altitude is 80 feet.
c) 23.6 – (-40.56) = 64.16; The difference in altitude is 64.16 meters.

Section 1.4 Exercises

Think Again.

1. Can the difference of two negative numbers ever be positive? Explain your answer or show an example that supports your answer.

2. How can you determine if the sum $-\frac{5}{12} + \frac{4}{9}$ will be positive or negative? *(Refer to Think About It 1)*

3. If a is a negative number, then what is $-a$? Show some examples that support your answer.

4. If a is a negative number, then what is $-(-a)$? Show some examples that support your answer.

Focus Exercises.

Evaluate each expression.

5. $7 - 5$	**6.** $2 - 11$	**7.** $5 - 11$
8. $-3 - 3$	**9.** $10 - 9$	**10.** $1 - 7$
11. $2 - (-5)$	**12.** $8 - (-1)$	**13.** $7 - (-5)$
14. $-1 - 4$	**15.** $2 + (-1)$	**16.** $-10 - (-10)$
17. $-4 - (-2)$	**18.** $-3 - (-9)$	**19.** $-15 - (-5)$
20. $9 + (-5)$	**21.** $5 - 4$	**22.** $-7 + (-6)$
23. $3 - (-51)$	**24.** $4 + (-1)$	**25.** $1 - 6$
26. $-5 + (-9)$	**27.** $-2 - 6$	**28.** $7 + (-2)$
29. $-80 - 50$	**30.** $-16 - 42$	**31.** $39 - 94$
32. $-57 - 8$	**33.** $59 - (-4)$	**34.** $94 - (-57)$
35. $5 - (-7) + 2$	**36.** $-2 - 9 - (-11)$	**37.** $9 - (-4) - 2$
38. $-2 + 4 - 7 + 3$	**39.** $-1 + 3 - (-10)$	**40.** $-12 + 6 - (-9) - 7$

For each, write a numerical expression and then evaluate. Also, write a sentence answering the question.

Finances:

41. The ATM showed Mike's checking account balance as -$237 at the end of the July. On the first day of August, his paycheck of $2,694 was automatically deposited. What was Mike's new account balance? Is it a debit or a credit?

42. Allison had $62 in her checking account when she wrote a check for $108. What is Allison's new account balance? Is it a debit or a credit?

43. Joni started the week with a checkbook balance of $114. On Monday, she wrote a check for $72. On Tuesday, she made a deposit of $33. On Wednesday, she wrote a check for $89. On Thursday, she wrote a check for $31, and on Friday she made a deposit of $215. What was Joni's account balance on Saturday?

44. Carter started the week with a checkbook balance of $45. On Monday, he wrote a check for $51. On Tuesday, he made a deposit of $23. On Wednesday, he wrote a check for $33. On Thursday, he wrote a check for $48, and on Friday he made a deposit of $93. What was Carter's account balance on Saturday?

Temperature:

45. At 8:00 AM the outside temperature was -11°. By 10:00 AM the temperature had risen 15°. What was the temperature at 10:00 AM?

46. This morning, the temperature was -17° C. By the afternoon, the temperature had risen 13° C. What was the new temperature?

47. Last night, the temperature was 5° F. By morning, the temperature had fallen 14° F. What was the new temperature?

48. At 9:00 PM the outside temperature was -1°. By 3:00 AM the next morning, the temperature had fallen 13°. What was the temperature at 3:00 AM?

Altitude:

49. Find the difference in altitude of a mountain 5,280 feet above sea level and a mountain 2,519 feet above sea level.

50. Find the difference in altitude of a hill 149 feet above sea level and an ocean floor 78 feet below sea level.

51. Find the difference in altitude of a mountain 4,638 feet above sea level and an ocean floor 784 feet below sea level.

52. Find the difference in altitude of an ocean floor 192 feet below sea level and an ocean canyon 397 feet below sea level.

Think Outside the Box.

53. If $5 \cdot 3$ is the sum of five 3's: $3 + 3 + 3 + 3 + 3$, then what is the value of $5 \cdot (-3)$? Explain your answer.

54. If -6 is the opposite of 6, then what is the value of $-6 \cdot 4$? Explain your answer.

Evaluate by first determining the value within the grouping symbols.

55. $(-4 + 9) \cdot [11 - (-6)]$

56. $[80 - (-44)] \div (-6 + 8)$

57. $[-8 - (-10)]^2$

58. $\sqrt{-12 - (-61)}$