Subtracting Real Numbers

Goal

Subtract real numbers using the subtraction rule.

Key Words

• term

What is the change in a stock's value?

The daily change in the price of a company's stock can be calculated by subtracting one day's closing price from the previous day's closing price. In Example 5 you will see that this change can be positive or negative.

Some addition expressions can be evaluated using subtraction.

ADDITION PROBLEM	EQUIVALENT SUBTRACTION PROBLEM
$5 + (-3) = 2$	$5 - 3 = 2$
$-2 + (-6) = -8$	$-2 - 6 = -8$

Adding the opposite of a number is equivalent to subtracting the number.

SUBTRACTION RULE

To subtract b from a, add the opposite of b to a.

$$a - b = a + (-b)$$ **Example:** $3 - 5 = 3 + (-5)$

The result is the difference of a and b.

EXAMPLE 1 Use the Subtraction Rule

Find the difference.

a. $10 - 11$ **b.** $11 - 10$ **c.** $-4 - (-9)$

Solution

Student Help

▶**STUDY TIP**
In Example 1 notice that $10 - 11 \neq 11 - 10$. Subtraction is *not* commutative. The order of the numbers affects the answer.

a. $10 - 11 = 10 + (-11)$ Add the opposite of 11.
$\qquad\quad = -1$ Use rules of addition.

b. $11 - 10 = 11 + (-10)$ Add the opposite of 10.
$\qquad\quad = 1$ Use rules of addition.

c. $-4 - (-9) = -4 + 9$ Add the opposite of -9.
$\qquad\qquad\; = 5$ Use rules of addition.

You can change subtractions to additions by "adding the opposite" as a first step in evaluating an expression.

EXAMPLE 2 Expressions with More than One Subtraction

Evaluate the expression $3 - (-4) - \frac{1}{2}$.

Solution

$$3 - (-4) - \frac{1}{2} = 3 + 4 + \left(-\frac{1}{2}\right) \qquad \text{Add the opposites of } -4 \text{ and } \frac{1}{2}.$$

$$= 7 + \left(-\frac{1}{2}\right) \qquad \text{Add 3 and 4.}$$

$$= 6\frac{1}{2} \qquad \text{Add 7 and } -\frac{1}{2}.$$

Checkpoint ✓ *Use the Subtraction Rule*

Use the subtraction rule to find the difference.

1. $-3 - 5$ **2.** $12.7 - 10$ **3.** $1 - (-2) - 6$ **4.** $7 - \frac{2}{3} - \frac{5}{3}$

EXAMPLE 3 Evaluate a Function

Evaluate the function $y = -5 - x$ when $x = -2, -1, 0,$ and 1. Organize your results in a table.

Solution

Input	Function	Output
$x = -2$	$y = -5 - (-2)$	$y = -3$
$x = -1$	$y = -5 - (-1)$	$y = -4$
$x = 0$	$y = -5 - 0$	$y = -5$
$x = 1$	$y = -5 - 1$	$y = -6$

Checkpoint ✓ *Evaluate a Function*

5. Evaluate the function $y = 4 - x$ when $x = -3, -1, 1,$ and 3. Organize your results in a table.

TERMS OF AN EXPRESSION When an expression is written as a sum, the parts that are added are the **terms** of the expression. For instance, you can write $-5 - x$ as the sum $-5 + (-x)$. The terms are -5 and $-x$. You can use the subtraction rule to write an expression as a sum of terms.

EXAMPLE 4 Find the Terms of an Expression

Find the terms of $-9 - 2x$.

Solution Use the subtraction rule to rewrite the difference as a sum.

$$-9 - 2x = -9 + (-2x)$$

ANSWER ▶ The terms of the expression are -9 and $-2x$.

Checkpoint ✓ *Find the Terms of an Expression*

Find the terms of the expression.

6. $x - 3$ **7.** $-2 - 5x$ **8.** $-4 + 6x$ **9.** $7x + 2$

Link to
History

STOCK MARKET When the New York Stock Exchange opened in 1792, it reported stock prices as fractions. Stock prices began to be reported as decimals in the early 2000's.

EXAMPLE 5 Subtract Real Numbers

STOCK MARKET The daily closing prices for a company's stock are given in the table. Find the change in the closing price since the previous day.

Date	Aug. 23	Aug. 24	Aug. 25	Aug. 26	Aug. 27
Closing Price	21.38	21.25	21.38	20.69	20.06
Change	———	?	?	?	?

Solution Subtract the previous day's closing price from the closing price for the current day.

DATE	CLOSING PRICE	CHANGE
Aug. 23	21.38	———
Aug. 24	21.25	$21.25 - 21.38 = -0.13$
Aug. 25	21.38	$21.38 - 21.25 = 0.13$
Aug. 26	20.69	$20.69 - 21.38 = -0.69$
Aug. 27	20.06	$20.06 - 20.69 = -0.63$

Checkpoint ✓ *Subtract Real Numbers*

10. The daily closing prices for a company's stock are given in the table. Find the change in the closing price since the previous day.

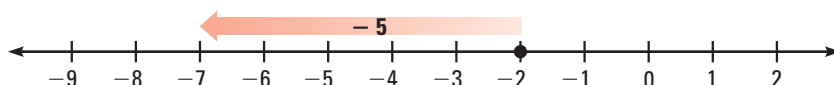| Date	Nov. 10	Nov. 11	Nov. 12	Nov. 13	Nov. 14
Closing Price	46.75	47.44	47.31	47.75	48.75
Change	———	?	?	?	?

2.4 Exercises

Guided Practice

Vocabulary Check

1. Complete: In an expression that is written as a sum, the parts that are added are called the __?__ of the expression.

2. Is $7x$ a term of the expression $4y - 7x - 9$? Explain.

Skill Check

3. Use the number line to complete this statement: $-2 - 5 = $ **?**

Find the difference.

4. $4 - 5$ **5.** $0 - (-7)$ **6.** $-2 - 8.7$

Evaluate the expression.

7. $2 - (-3) - 6$ **8.** $-3 - 2 - (-5)$ **9.** $6 - 2 - \dfrac{1}{2}$

10. Evaluate the function $y = 10 - x$, when $x = -5, -1, 1$ and 5. Organize your results in a table.

Find the terms of the expression.

11. $12 - 5x$ **12.** $5w - 8$ **13.** $-12y + 6$

Practice and Applications

SUBTRACTION RULE **Find the difference.**

14. $4 - 9$ **15.** $6 - (-3)$ **16.** $-8 - (-5)$ **17.** $-2 - 9$

18. $-10 - 5$ **19.** $25 - (-14)$ **20.** $-10 - (-42)$ **21.** $95 - 59$

22. $-3 - 1.7$ **23.** $5.4 - (-3.8)$ **24.** $9.6 - 6.5$ **25.** $-2.2 - (-1)$

26. $\dfrac{4}{3} - \dfrac{7}{3}$ **27.** $\dfrac{3}{4} - \left(-\dfrac{9}{4}\right)$ **28.** $-\dfrac{5}{8} - \left(-\dfrac{3}{8}\right)$ **29.** $-4 - \dfrac{1}{2}$

EVALUATING EXPRESSIONS **Evaluate the expression.**

30. $-1 - 5 - 8$ **31.** $2 - (-4) - 7$ **32.** $4 - (-3) - (-5)$

33. $46 - 17 - (-2)$ **34.** $-15 - 16 - 81$ **35.** $11 - (-23) - 77$

36. $-8 - 3.1 - 6.2$ **37.** $2.3 - (-9.5) - 1.6$ **38.** $8.4 - 5.2 - (-4.7)$

39. $\dfrac{5}{7} - \dfrac{4}{7} - \left(-\dfrac{6}{7}\right)$ **40.** $-\dfrac{4}{9} - \dfrac{2}{9} - \dfrac{5}{9}$ **41.** $\dfrac{7}{10} - \left(-\dfrac{3}{10}\right) - \left(-\dfrac{1}{10}\right)$

EVALUATING FUNCTIONS Evaluate the function when $x = -2, -1, 0,$ and 1. Organize your results in a table.

42. $y = x - 8$ **43.** $y = 12 - x$ **44.** $y = -x - (-5)$

45. $y = -8.5 - x$ **46.** $y = -x - 12.1$ **47.** $y = x - \dfrac{1}{2}$

FINDING TERMS Find the terms of the expression.

48. $-4 - y$ **49.** $-x - 7$ **50.** $-3x + 6$

51. $9 - 28x$ **52.** $-10 + 4b$ **53.** $a - 5$

54. STOCK MARKET The daily closing prices for a company's stock are given in the table. Find the change in the closing price since the previous day.

Date	Sept. 11	Sept. 12	Sept. 13	Sept. 14	Sept. 15
Closing Price	101.31	103.19	105.75	104.44	102.19
Change	———	?	?	?	?

55. SUBMARINE DEPTH A submarine is at a depth of 725 feet below sea level. Five minutes later it is at a depth of 450 feet below sea level. What is the change in depth of the submarine? Did it go up or down?
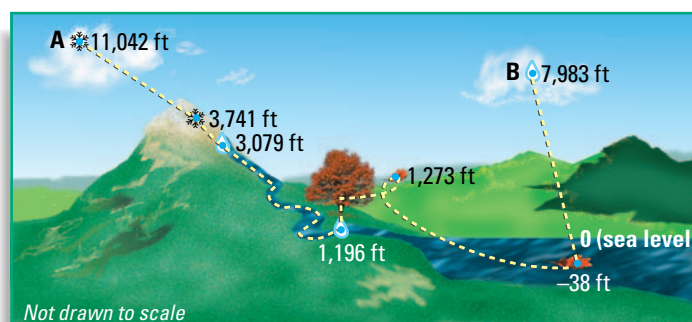
Science Link In Exercises 56 and 57, use the diagram below which shows the journey of a water molecule from A to B.

56. Find the change in elevation from each point to the next point.

57. Using your answers from Exercise 56, write an expression using addition and subtraction that models the change in elevation of the water molecule during its journey. Then evaluate the expression.

CHALLENGE Determine whether the statement is *true* or *false*. Use the subtraction rule or a number line to support your answer.

58. If you subtract a negative number from a positive number, the result is always a positive number.

59. If you subtract a positive number from a negative number, the result is always a negative number.

60. MULTIPLE CHOICE What does $5 - \left(-\frac{1}{3}\right) + \frac{2}{3}$ equal?

(A) 4   (B) $4\frac{2}{3}$ (C) $5\frac{1}{3}$ (D) 6

61. MULTIPLE CHOICE What does $-x - 7$ equal when $x = -1$?

(F) -8 (G) -6 (H) 6   (J) 8

62. MULTIPLE CHOICE Which of the following is *not* a term of the expression $-12x - 2y + 1$?

(A) $-12x$ (B) $2y$ (C) $-2y$ (D) 1

63. MULTIPLE CHOICE For a correct answer on a game show, a positive amount is added to a player's score. For an incorrect answer, a negative amount is added. If a player has a score of -100 and incorrectly answers a 300 point question, what is the player's new score?

(F) -400 (G) -200 (H) 200   (J) 400

Mixed Review

NUMERICAL EXPRESSIONS Evaluate the expression. *(Lesson 1.3)*

64. $9 - 2 \cdot 2 - 3$ **65.** $1 \cdot 10 + 5 \cdot 5$ **66.** $8^2 + 6 - 7$

67. $4 \cdot 2^3 + 9$ **68.** $4 \cdot (12 \div 6) - 5$ **69.** $(10 - 2) \cdot 7 + 8$

SPORTS The table below gives the number of male and female participants in high school sports for three school years. Based on the table, explain whether the statement is *true* or *false*. *(Lesson 1.7)*

High School Sports Participants (millions)			
Year	1994–95	1995–96	1996–97
Male	3.54	3.63	3.71
Female	2.24	2.37	2.24

DATA UPDATE of Statistical Abstract of the United States data at www.mcdougallittell.com

70. There were more than six million total participants during 1994–1995.

71. There were about six million participants in the 1996–1997 school year.

GRAPHING Graph the numbers on a number line. *(Lesson 2.1)*

72. $-1, 9, 3$ **73.** $-8, 4, -2$ **74.** $6, -5, 0$

75. $6.5, 2, -4.3$ **76.** $7, 0.5, -9.1$ **77.** $\frac{3}{4}, -\frac{3}{4}, 1$

Maintaining Skills

MULTIPLYING DECIMALS Multiply. *(Skills Review p. 759)*

78. 5×0.25 **79.** 0.1×0.4 **80.** 0.004×4.2

81. 1.69×0.02 **82.** 3.6×0.3 **83.** 9.4×2.04