

## 2-4 Subtracting Real Numbers

**Objective:** To subtract real numbers and to simplify expressions involving differences.

### Definition of Subtraction

To subtract a real number  $b$ , add the opposite of  $b$ .

$$a - b = a + (-b)$$

For example,  $3 - 9 = 3 + (-9) = -6$ .

**Example 1** Simplify:    a.  $2 - 7$     b.  $-6 - 3$     c.  $-2 - (-8)$

**Solution**

a.  $2 - 7 = 2 + (-7) = -5$   
 b.  $-6 - 3 = -6 + (-3) = -9$   
 c.  $-2 - (-8) = -2 + 8 = 6$

**CAUTION 1** Subtraction is *not* commutative.

$$\begin{aligned} 7 - 3 &= 4, \\ \text{but } 3 - 7 &= -4, \\ \text{so } 7 - 3 &\neq 3 - 7 \end{aligned}$$

**CAUTION 2** Subtraction is *not* associative.

$$\begin{aligned} (7 - 3) - 2 &= 4 - 2 = 2, \\ \text{but } 7 - (3 - 2) &= 7 - 1 = 6, \\ \text{so } (7 - 3) - 2 &\neq 7 - (3 - 2) \end{aligned}$$

**Simplify.**

- |                             |                             |                   |
|-----------------------------|-----------------------------|-------------------|
| 1. $25 - 9$                 | 2. $17 - 11$                | 3. $9 - 13$       |
| 4. $6 - 16$                 | 5. $0 - 5$                  | 6. $0 - (-3)$     |
| 7. $-12 - 0$                | 8. $-8 - 1$                 | 9. $3 - (-3)$     |
| 10. $7 - (-5)$              | 11. $-8 - (-3)$             | 12. $36 - 216$    |
| 13. $143 - 270$             | 14. $36 - (-34)$            | 15. $-25 - (-24)$ |
| 16. $-15 - (-3)$            | 17. $-3 - (-15)$            |                   |
| 18. $-17 - (-8)$            | 19. $-2.3 - 3.5$            |                   |
| 20. $-4.2 - 5.6$            | 21. $2.65 - (-2.35)$        |                   |
| 22. $-15$ decreased by 5    | 23. $-8$ decreased by $-14$ |                   |
| 24. 18 less than $-2$       | 25. 10 less than $-6$       |                   |
| 26. $56 - (45 - 32)$        | 27. $125 - (160 - 35)$      |                   |
| 28. $214 - (54 - 66)$       | 29. $167 - (20 - 45)$       |                   |
| 30. $(25 - 32) - (44 - 55)$ | 31. $(46 - 50) - (65 - 40)$ |                   |
| 32. $(2 - 7) - (-12 + 15)$  | 33. $(32 - 24) - (-6 + 9)$  |                   |

**2-4 Subtracting Real Numbers** (continued)**Example 2** Simplify  $13 - 9 - 8 + 5$ .

**Solution**

$$\begin{aligned}
 13 - 9 - 8 + 5 &= 13 - 9 - 8 + 5 \\
 &= \underbrace{13 + (-9)}_4 + (-8) + 5 \\
 &= \underbrace{4 + (-8)}_{-4} + 5 \\
 &= \underbrace{-4 + 5}_1 \\
 &= 1
 \end{aligned}$$

**Simplify.**

34.  $3 - 4 + 7 - 15 + 21$

35.  $14 - 12 + 11 + 3 - 20$

36.  $-5 - 18 + 6 - 7 + 10$

37.  $-9 - 21 + 3 - 8 + 30$

**Example 3** Simplify: a.  $-(x - 5)$  b.  $-(3 - y)$  c.  $-(-2 + a)$ **Solution** To find the opposite of a sum or a difference, you change the sign of each term of the sum or difference.

a.  $-(x - 5) = -x + 5$       b.  $-(3 - y) = -3 + y$

c.  $-(-2 + a) = 2 - a$

**Simplify.**

38.  $-(x + 2)$

39.  $-(4 - y)$

40.  $-(-7 + a)$

41.  $-(x - 3)$

42.  $-(y - 5)$

43.  $-(8 - x)$

44.  $-(b - 6)$

45.  $-(2 + n)$

**Example 4** Simplify  $8 - (x + 3)$ .

**Solution**

$$\begin{aligned}
 8 - (x + 3) &= 8 - x - 3 && \text{Change the sign of each term of } x + 3. \\
 &= (8 - 3) - x && \text{Regroup the terms.} \\
 &= 5 - x && \text{Simplify.}
 \end{aligned}$$

**Simplify.**

46.  $6 - (y + 4)$

47.  $4 - (q - 6)$

48.  $x - (x + 2)$

49.  $n - (-3 + n)$

**Mixed Review Exercises**

1.  $|-6| + |2|$

2.  $17 \cdot 2 \cdot 3 \cdot 5$

3.  $2 + 6x + 5y + 8$

4.  $\left|-\frac{3}{4}\right| - \left|-\frac{1}{4}\right|$

5.  $-\frac{3}{2} + \left(-\frac{5}{2}\right)$

6.  $1\frac{1}{4} + \left(-3\frac{3}{4}\right)$

7.  $[5 + (-9)] + 7$

8.  $3.4 - 0.5 + (-1.4)$

9.  $-4 + [-6 + (-2)]$

10.  $-2.4 + 8.3 + (-3.6)$

11.  $-27 + (-28) + 18 + 47$

12.  $2 + (-3) + (-10) + (-x)$