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.

$$7 - 3 = 4,$$
$$\text{but } 3 - 7 = -4,$$
$$\text{so } 7 - 3 \neq 3 - 7$$

CAUTION 2 Subtraction is *not* associative.

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

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
$$13 - 9 - 8 + 5 = 13 - 9 - 8 + 5$$
$$= \underbrace{13 + (-9)} + (-8) + 5$$
$$= \underbrace{4 + (-8)} + 5$$
$$= \underbrace{-4 + 5}$$
$$= 1$$

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

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