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1–4 Sums and Differences

Objective: To review the rules for adding and subtracting real numbers.

Vocabulary

Rules for addition

1. When adding two numbers with the *same sign,* you add the absolute values of the numbers and keep the sign.
   Example: $-6 + (-3) = -(|-6| + |-3|) = -(6 + 3) = -9$
2. When adding two numbers with *opposite signs,* you subtract the *lesser* absolute value from the *greater* absolute value and keep the sign of the greater absolute value. Example: $4 + -9 = -(|-9| - |4|) = -(9 - 4) = -5$

Rule for subtraction To subtract a number, add its opposite: $a - b = a + (-b)$.
Examples: $4 - (-7) = 4 + 7 = 11$ $\quad -6 - 11 = -6 + (-11) = -17$

Distributive property (of multiplication over subtraction)
Example: $4(5 - 2) = 4 \cdot 5 - 4 \cdot 2 = 12$

Similar terms (or like terms) Terms with the same variables and exponents.
Examples: $5xy^2$ and $9xy^2$ are similar terms, but $6ab$ and $4ab^2$ are not.

Example 1 Simplify: **a.** $-13 + (-40)$ **b.** $-3.4 + 7.2$ **c.** $-14 - 28$

Solution

a. Use the *same sign* rule for addition. The answer will be negative.
$-13 + (-40) = -(|-13| + |-40|) = -(13 + 40) = -53$

b. Use the *opposite signs* rule for addition. The answer will be positive since 7.2 has the greater absolute value.
$-3.4 + 7.2 = |7.2| - |-3.4| = 7.2 - 3.4 = 3.8$

c. Use the rule for subtraction; add the opposite of 28.
$-14 - 28 = -14 + (-28) = -(14 + 28) = -42$

Simplify.

1. $-52 + 17$ **2.** $-27 - 14$ **3.** $12 - (-33)$ **4.** $-16 + (-36)$

5. $-96 - (-28)$ **6.** $0 - (-23.1)$ **7.** $-22.7 - (-22.7)$ **8.** $-16.5 - 12.5$

Example 2 Simplify: **a.** $-17 + 15 - 19 + 31$ **b.** $(3 - 5) - (7 - 2)$

Solution

a. *Method 1:* Add left to right.

$$\underbrace{-17 + 15} - 19 + 31$$
$$\underbrace{-2 - 19} + 31$$
$$\underbrace{-21 + 31}$$
$$10$$

Method 2: Group the negative terms and the positive terms.

$$-17 + 15 - 19 + 31$$
$$\underbrace{(-17 - 19)} + \underbrace{(15 + 31)}$$
$$\underbrace{-36 + 46}$$
$$10$$

b. Be sure to perform the operations inside parentheses first.
$(3 - 5) - (7 - 2) = -2 - 5 = -2 + (-5) = -7$

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1–4 Sums and Differences *(continued)*

Simplify.

9. $-18 - 19 + 12$

10. $-2 + 8 - 6 + 3$

11. $-12 + 3 + (-4) + 7$

12. $1 - (3 - 4) + (7 - 8)$

13. $3 - (5 + 1) - (1 - 4)$

14. $-6 - (12 - 20) + (6 - 10)$

15. $(-15 - 20) + [8 + (-3) - (-5)]$

16. $[-5 + (-17)] - (3 - 7 + 2)$

17. $|2 - 6| + |8 - 20|$

18. $|-21 - 3| - |8 + (-12)|$

Example 3 Multiply: **a.** $3(7x - 2y)$

b. $\frac{3}{4}(8x - 4y + 20)$

Solution Apply the distributive property.

a. $3(7x - 2y) = 3(7x) - 3(2y)$

$= 21x - 6y$

b. $\frac{3}{4}(8x - 4y + 20) = \frac{3}{4}(8x) - \frac{3}{4}(4y) + \frac{3}{4}(20)$

$= 6x - 3y + 15$

Multiply.

19. $5(2x + 1)$

20. $5(6 - y)$

21. $2(x - 8y)$

22. $\frac{2}{3}(6x - 3y)$

23. $\frac{1}{2}(10x - 4y - 2)$

24. $\frac{3}{5}(5x + 10y - 20)$

Example 4 Simplify by combining similar terms.

a. $3(2x + 3y) - 5x$ **b.** $(2r + 5s - 3) + 3(r - 2s - 4)$

Solution

a. $3(2x + 3y) - 5x = 6x + 9y - 5x$ Use the distributive property.

$= 9y + [6x - 5x]$ Group similar terms.

$= 9y + (6 - 5)x$ Use the distributive property.

$= 9y + x$ Simplify what is in parentheses.

b. $(2r + 5s - 3) + 3(r - 2s - 4)$

$= 2r + 5s - 3 + 3r - 6s - 12$ Use the distributive property.

$= [2r + 3r] + [5s - 6s] - 3 - 12$ Group similar terms.

$= (2 + 3)r + (5 - 6)s - 15$ Use the distributive property.

$= 5r - s - 15$ Simplify what is in parentheses.

Simplify by combining similar terms.

25. $19t + 3(8 + t)$

26. $2(3y - 5) - 18y$

27. $7(g - 2) + 8(g + 3)$

28. $3(9 - y) + 5(1 - y)$

29. $5d - 8 - 2d - 8$

30. $7x - 3y - 12x - (-5)y$

31. $(-6m - 3n + 2) + 5(m - 2n + 1)$

32. $4(3m - 6n) + 2(2m + 5n - 3)$