

The Distributive Property shows how to express sums and products in two ways:
 $a(b + c) = ab + ac$. This can also be written $(b + c)a = ab + ac$.

Factored form
 $a(b + c)$

Distributed form
 $a(b) + a(c)$

Simplified form
 $ab + ac$

To simplify: Multiply each term on the inside of the parentheses by the term on the outside.
 Combine terms if possible.

For additional information, see the Math Notes box in Lesson 3.2.5 of the *Core Connections, Course 3* text.

Example 1

$$\begin{aligned} 2(47) &= 2(40 + 7) \\ &= (2 \cdot 40) + (2 \cdot 7) \\ &= 80 + 14 = 94 \end{aligned}$$

Example 2

$$\begin{aligned} 3(x + 4) &= (3 \cdot x) + (3 \cdot 4) \\ &= 3x + 12 \end{aligned}$$

Example 3

$$\begin{aligned} 4(x + 3y + 1) &= (4 \cdot x) + (4 \cdot 3y) + 4(1) \\ &= 4x + 12y + 4 \end{aligned}$$

Problems

Simplify each expression below by applying the Distributive Property.

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|------------------------|------------------------|-----------------|-----------------|
| 1. $6(9 + 4)$ | 2. $4(9 + 8)$ | 3. $7(8 + 6)$ | 4. $5(7 + 4)$ |
| 5. $3(27) = 3(20 + 7)$ | 6. $6(46) = 6(40 + 6)$ | 7. $8(43)$ | 8. $6(78)$ |
| 9. $3(x + 6)$ | 10. $5(x + 7)$ | 11. $8(x - 4)$ | 12. $6(x - 10)$ |
| 13. $(8 + x)4$ | 14. $(2 + x)5$ | 15. $-7(x + 1)$ | 16. $-4(y + 3)$ |
| 17. $-3(y - 5)$ | 18. $-5(b - 4)$ | 19. $-(x + 6)$ | 20. $-(x + 7)$ |
| 21. $-(x - 4)$ | 22. $-(-x - 3)$ | 23. $x(x + 3)$ | 24. $4x(x + 2)$ |
| 25. $-x(5x - 7)$ | 26. $-x(2x - 6)$ | | |

Answers

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|---|---|-------------------|---------------------|
| 1. $(6 \cdot 9) + (6 \cdot 4) = 54 + 24 = 78$ | 2. $(4 \cdot 9) + (4 \cdot 8) = 36 + 32 = 68$ | | |
| 3. $56 + 42 = 98$ | 4. $35 + 20 = 55$ | 5. $60 + 21 = 81$ | 6. $240 + 36 = 276$ |
| 7. $320 + 24 = 344$ | 8. $420 + 48 = 468$ | 9. $3x + 18$ | 10. $5x + 35$ |
| 11. $8x - 32$ | 12. $6x - 60$ | 13. $4x + 32$ | 14. $5x + 10$ |
| 15. $-7x - 7$ | 16. $-4y - 12$ | 17. $-3y + 15$ | 18. $-5b + 20$ |
| 19. $-x - 6$ | 20. $-x - 7$ | 21. $-x + 4$ | 22. $x + 3$ |
| 23. $x^2 + 3x$ | 24. $4x^2 + 8x$ | 25. $-5x^2 + 7x$ | 26. $-2x^2 + 6x$ |

When the Distributive Property is used to reverse, it is called factoring. Factoring changes a sum of terms (no parentheses) to a product (with parentheses).

$$ab + ac = a(b + c)$$

To factor: Write the common factor of all the terms outside of the parentheses. Place the remaining factors of each of the original terms inside of the parentheses.

Example 4

$$\begin{aligned}4x + 8 &= 4 \cdot x + 4 \cdot 2 \\ &= 4(x + 2)\end{aligned}$$

Example 5

$$\begin{aligned}6x^2 - 9x &= 3x \cdot 2x - 3x \cdot 3 \\ &= 3x(2x - 3)\end{aligned}$$

Example 6

$$\begin{aligned}6x + 12y + 3 &= 3 \cdot 2x + 3 \cdot 4y + 3 \cdot 1 \\ &= 3(2x + 4y + 1)\end{aligned}$$

Problems

Factor each expression below by using the Distributive Property in reverse.

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|--------------------|--------------------|------------------------|--------------------|
| 1. $6x + 12$ | 2. $5y - 10$ | 3. $8x + 20z$ | 4. $x^2 + xy$ |
| 5. $8m + 24$ | 6. $16y + 40$ | 7. $8m - 2$ | 8. $25y - 10$ |
| 9. $2x^2 - 10x$ | 10. $21x^2 - 63$ | 11. $21x^2 - 63x$ | 12. $15y + 35$ |
| 13. $4x + 4y + 4z$ | 14. $6x + 12y + 6$ | 15. $14x^2 - 49x + 28$ | 16. $x^2 - x + xy$ |

Answers

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|--------------------|---------------------|------------------------|--------------------|
| 1. $6(x + 2)$ | 2. $5(y - 2)$ | 3. $4(2x + 5z)$ | 4. $x(x + y)$ |
| 5. $8(m + 3)$ | 6. $8(2y + 5)$ | 7. $2(4m - 1)$ | 8. $5(5y - 2)$ |
| 9. $2x(x - 5)$ | 10. $21(x^2 - 3)$ | 11. $21x(x - 3)$ | 12. $5(3y + 7)$ |
| 13. $4(x + y + z)$ | 14. $6(x + 2y + 1)$ | 15. $7(2x^2 - 7x + 4)$ | 16. $x(x - 1 + y)$ |