COMBINING LIKE TERMS

Algebraic expressions can also be simplified by combining (adding or subtracting) terms that have the same variable(s) raised to the same powers, into one term. The skill of combining like terms is necessary for solving equations. For additional information, see the Math Notes box in Lesson 6.2.4 of the *Core Connections, Course 1* text, Lesson 4.3.2 of the *Core Connections, Course 2* text, or Lesson 2.1.3 of the *Core Connections, Course 3* text. For additional examples and practice, see the *Core Connections, Course 2* Checkpoint 7A materials.

Example 1

Combine like terms to simplify the expression $3x + 5x + 7x$.

All these terms have x as the variable, so they are combined into one term, $15x$.

Example 2

Simplify the expression $3x + 12 + 7x + 5$.

The terms with x can be combined. The terms without variables (the constants) can also be combined.

$3x + 12 + 7x + 5$

$3x + 7x + 12 + 5$

$10x + 17$

Note that in the simplified form the term with the variable is listed before the constant term.

Example 3

Simplify the expression $5x + 4x^2 + 10 + 2x^2 + 2x - 6 + x - 1$.

$5x + 4x^2 + 10 + 2x^2 + 2x - 6 + x - 1$

$4x^2 + 2x^2 + 5x + 2x + x + 10 - 6 - 1$

$6x^2 + 8x + 3$

Note that terms with the same variable but with different exponents are not combined and are listed in order of decreasing power of the variable, in simplified form, with the constant term last.

Example 4

The algebra tiles, as shown in the *Perimeter Using Algebra Tiles* section, are used to model how to combine like terms.

The large square represents x^2, the rectangle represents x, and the small square represents one. We can only combine tiles that are alike: large squares with large squares, rectangles with rectangles, and small squares with small squares. If we want to combine:
$2x^2 + 3x + 4$ and $3x^2 + 5x + 7$, visualize the tiles to help combine the like terms:

$2x^2$ (2 large squares) + $3x$ (3 rectangles) + 4 (4 small squares)
+ $3x^2$ (3 large squares) + $5x$ (5 rectangles) + 7 (7 small squares)

The combination of the two sets of tiles, written algebraically, is: $5x^2 + 8x + 11$.

Example 5

Sometimes it is helpful to take an expression that is written horizontally, circle the terms with their signs, and rewrite *like* terms in vertical columns before you combine them:

$$(2x^2 - 5x + 6) + (3x^2 + 4x - 9)$$

$$2x^2 \quad - 5x \quad + 6 \quad + \quad 3x^2 \quad + 4x \quad - 9$$

$$\begin{array}{rrr} 2x^2 & -5x & +6 \\ +\,3x^2 & +4x & -9 \\ \hline 5x^2 & -\ x & -3 \end{array}$$

This procedure may make it easier to identify the terms as well as the sign of each term.

Problems

Combine the following sets of terms.

1. $(2x^2 + 6x + 10) + (4x^2 + 2x + 3)$
2. $(3x^2 + x + 4) + (x^2 + 4x + 7)$
3. $(8x^2 + 3) + (4x^2 + 5x + 4)$
4. $(4x^2 + 6x + 5) - (3x^2 + 2x + 4)$
5. $(4x^2 - 7x + 3) + (2x^2 - 2x - 5)$
6. $(3x^2 - 7x) - (x^2 + 3x - 9)$
7. $(5x + 6) + (-5x^2 + 6x - 2)$
8. $2x^2 + 3x + x^2 + 4x - 3x^2 + 2$
9. $3c^2 + 4c + 7x - 12 + (-4c^2) + 9 - 6x$
10. $2a^2 + 3a^3 - 4a^2 + 6a + 12 - 4a + 2$

Answers

1. $6x^2 + 8x + 13$
2. $4x^2 + 5x + 11$
3. $12x^2 + 5x + 7$
4. $x^2 + 4x + 1$
5. $6x^2 - 9x - 2$
6. $2x^2 - 10x + 9$
7. $-5x^2 + 11x + 4$
8. $7x + 2$
9. $-c^2 + 4c + x - 3$
10. $3a^3 - 2a^2 + 2a + 14$