

ALGEBRAIC EXPRESSIONS AND EQUATIONS: COMBINING LIKE TERMS USING ADDITION AND SUBTRACTION*

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Abstract

This module is from Fundamentals of Mathematics by Denny Burzynski and Wade Ellis, Jr. This module discusses how to combine like terms using addition and subtraction. By the end of the module students should be able to combine like terms in an algebraic expression.

1 Section Overview

- Combining Like Terms

2 Combining Like Terms

From our examination of terms in here¹, we know that **like terms** are terms in which the variable parts are identical. Like terms is an appropriate name since terms with identical variable parts and different numerical coefficients represent different amounts of the same quantity. When we are dealing with quantities of the same type, we may combine them using addition and subtraction.

Simplifying an Algebraic Expression

An algebraic expression may be **simplified** by combining like terms.

This concept is illustrated in the following examples.

1. $8 \text{ records} + 5 \text{ records} = 13 \text{ records}$.
Eight and 5 of the same type give 13 of that type. We have combined quantities of the same type.
2. $8 \text{ records} + 5 \text{ records} + 3 \text{ tapes} = 13 \text{ records} + 3 \text{ tapes}$. Eight and 5 of the same type give 13 of that type. Thus, we have 13 of one type and 3 of another type. We have combined only quantities of the same type.
3. Suppose we let the letter x represent "record." Then, $8x + 5x = 13x$. The terms $8x$ and $5x$ are like terms. So, 8 and 5 of the same type give 13 of that type. We have combined like terms.

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¹"Algebraic Expressions and Equations: Algebraic Expressions" <<http://cnx.org/content/m35038/latest/>>

4. Suppose we let the letter x represent "record" and y represent "tape." Then, $8x + 5x + 3y = 13x + 5y$
 We have combined only the like terms.

After observing the problems in these examples, we can suggest a method for simplifying an algebraic expression by combining like terms.

Combining Like Terms

Like terms may be combined by adding or subtracting their coefficients and affixing the result to the common variable.

2.1 Sample Set A

Simplify each expression by combining like terms.

Example 1

$2m + 6m - 4m$. All three terms are alike. Combine their coefficients and affix this result to m :
 $2 + 6 - 4 = 4$.
 Thus, $2m + 6m - 4m = 4m$.

Example 2

$5x + 2y - 9y$. The terms $2y$ and $-9y$ are like terms. Combine their coefficients: $2 - 9 = -7$.
 Thus, $5x + 2y - 9y = 5x - 7y$.

Example 3

$-3a + 2b - 5a + a + 6b$. The like terms are
 $\underbrace{-3a, -5a, a}_{-3-5+1=-7} \quad \underbrace{2b, 6b}_{2+6=8}$
 $\quad \quad \quad -7a \quad \quad \quad 8b$
 Thus, $-3a + 2b - 5a + a + 6b = -7a + 8b$.

Example 4

$r - 2s + 7s + 3r - 4r - 5s$. The like terms are
 $\underbrace{r, 3r, -4r}_{1+3-4=0} \quad \underbrace{-2s, 7s, -5s}_{-2+7-5=0}$
 $\quad \quad \quad 0r \quad \quad \quad 0s$
 $\quad \quad \quad \underbrace{0r + 0s = 0}$

Thus, $r - 2s + 7s + 3r - 4r - 5s = 0$.

2.2 Practice Set A

Simplify each expression by combining like terms.

Exercise 1

$4x + 3x + 6x$

(Solution on p. 5.)

Exercise 2

$5a + 8b + 6a - 2b$

(Solution on p. 5.)

Exercise 3

$10m - 6n - 2n - m + n$

(Solution on p. 5.)

Exercise 4

$16a + 6m + 2r - 3r - 18a + m - 7m$

(Solution on p. 5.)

Exercise 5

$5h - 8k + 2h - 7h + 3k + 5k$

(Solution on p. 5.)

3 Exercises

Simplify each expression by combining like terms.

Exercise 6

$$4a + 7a$$

(Solution on p. 5.)

Exercise 7

$$3m + 5m$$

Exercise 8

$$6h - 2h$$

(Solution on p. 5.)

Exercise 9

$$11k - 8k$$

Exercise 10

$$5m + 3n - 2m$$

(Solution on p. 5.)

Exercise 11

$$7x - 6x + 3y$$

Exercise 12

$$14s + 3s - 8r + 7r$$

(Solution on p. 5.)

Exercise 13

$$-5m - 3n + 2m + 6n$$

Exercise 14

$$7h + 3a - 10k + 6a - 2h - 5k - 3k$$

(Solution on p. 5.)

Exercise 15

$$4x - 8y - 3z + x - y - z - 3y - 2z$$

Exercise 16

$$11w + 3x - 6w - 5w + 8x - 11x$$

(Solution on p. 5.)

Exercise 17

$$15r - 6s + 2r + 8s - 6r - 7s - s - 2r$$

Exercise 18

$$|-7| m + |6| m + |-3| m$$

(Solution on p. 5.)

Exercise 19

$$|-2| x + |-8| x + |10| x$$

Exercise 20

$$(-4 + 1)k + (6 - 3)k + (12 - 4)h + (5 + 2)k$$

(Solution on p. 5.)

Exercise 21

$$(-5 + 3)a - (2 + 5)b - (3 + 8)b$$

Exercise 22

$$5\star + 2\Delta + 3\Delta - 8\star$$

(Solution on p. 5.)

Exercise 23

$$9\boxtimes + 10\boxplus - 11\boxtimes - 12\boxplus$$

Exercise 24

$$16x - 12y + 5x + 7 - 5x - 16 - 3y$$

(Solution on p. 5.)

Exercise 25

$$-3y + 4z - 11 - 3z - 2y + 5 - 4(8 - 3)$$

3.1 Exercises for Review

Exercise 26

(here²) Convert $\frac{24}{11}$ to a mixed number

(*Solution on p. 5.*)

Exercise 27

(here³) Determine the missing numerator: $\frac{3}{8} = \frac{?}{64}$.

Exercise 28

(here⁴) Simplify $\frac{\frac{5}{6} - \frac{1}{4}}{\frac{1}{12}}$.

(*Solution on p. 5.*)

Exercise 29

(here⁵) Convert $\frac{5}{16}$ to a percent.

Exercise 30

(here⁶) In the expression $6k$, how many k 's are there?

(*Solution on p. 5.*)

²"Introduction to Fractions and Multiplication and Division of Fractions: Proper Fractions, Improper Fractions, and Mixed Numbers" <<http://cnx.org/content/m34912/latest/>>

³"Introduction to Fractions and Multiplication and Division of Fractions: Equivalent Fractions, Reducing Fractions to Lowest Terms, and Raising Fractions to Higher Terms" <<http://cnx.org/content/m34927/latest/>>

⁴"Addition and Subtraction of Fractions, Comparing Fractions, and Complex Fractions: Complex Fractions" <<http://cnx.org/content/m34941/latest/>>

⁵"Ratios and Rates: Percent" <<http://cnx.org/content/m34983/latest/>>

⁶"Algebraic Expressions and Equations: Algebraic Expressions" <<http://cnx.org/content/m35038/latest/>>

Solutions to Exercises in this Module

Solution to Exercise (p. 2)

$$13x$$

Solution to Exercise (p. 2)

$$11a + 6b$$

Solution to Exercise (p. 2)

$$9m - 7n$$

Solution to Exercise (p. 2)

$$-2a - r$$

Solution to Exercise (p. 2)

$$0$$

Solution to Exercise (p. 3)

$$11a$$

Solution to Exercise (p. 3)

$$4h$$

Solution to Exercise (p. 3)

$$3m + 3n$$

Solution to Exercise (p. 3)

$$17s - r$$

Solution to Exercise (p. 3)

$$5h + 9a - 18k$$

Solution to Exercise (p. 3)

$$0$$

Solution to Exercise (p. 3)

$$16m$$

Solution to Exercise (p. 3)

$$8h + 7k$$

Solution to Exercise (p. 3)

$$5\Delta - 3\star$$

Solution to Exercise (p. 3)

$$16x - 15y - 9$$

Solution to Exercise (p. 4)

$$2\frac{2}{11}$$

Solution to Exercise (p. 4)

$$7$$

Solution to Exercise (p. 4)

$$6$$