3.5 Collect Like Terms

Strand:
Number Sense and Algebra

Student Text Pages
144 to 153

Suggested Timing
80 min

Tools
- algebra tiles

Related Resources
BLM 3.5.1 Practice: Collect Like Terms
BLM A8 Application General Scoring Rubric
BLM A9 Communication General Scoring Rubric

Mathematical Process Expectations Emphasis

- ☑ Problem Solving
- ☐ Reasoning and Proving
- ☐ Reflecting
- ☑ Selecting Tools and Computational Strategies
- ☑ Connecting
- ☑ Representing
- ☑ Communicating

Specific Expectations

Manipulating Expressions and Solving Equations

NA2.04 add and subtract polynomials with up to two variables [e.g., $(2x - 5) + (3x + 1)$, $(3x^2y + 2xy^2) + (4x^2y - 6xy^2)$], using a variety of tools (e.g., algebra tiles, computer algebra systems, paper and pencil);

Link to Get Ready

Understanding of all of the concepts in the Get Ready section is required by this point. Ensure that students have completed all of the Get Ready questions prior to working on this section.

Warm-Up

Distribute algebra tiles, and have students create the following models with them:

a) 3 **b)** $5x$ **c)** $2x^2$
d) $3x + 2$ **e)** $4x^2 + x$ **f)** $x^2 + 5x + 6$

Warm-Up Answers

a) 3 unit tiles
b) 5 x-tiles
c) 2 x^2-tiles
d) 3 x-tiles and 2 unit squares
e) 4 x^2-tiles and 1 x-tile
f) 1 x^2-tile, 5 x-tiles, and 6 unit squares

Teaching Suggestions

- The focus of this section is on identifying and collecting like terms. Have students use algebra tiles to help them in identifying likeness. Algebra tiles illustrate likeness properties effectively, for example, x-tiles look distinctly different from unit tiles.
- Example 1 shows how tiles can be used to model a problem that requires collecting two sets of like terms, before the algebraic terminology is formally introduced. Unit tiles represent fixed costs and x-tiles represent variable costs. The flexibility of the model is showcased as each x-tile actually represents $100. Draw connections to future work in Chapter 5, Section 5.2 Partial Variation.
- Example 2 focuses on identifying like terms. Use tiles in cases involving constants, x-terms and x^2-terms. Then, extend the concept into cases involving alternative and/or more complex variables.
- In Example 3, algebra tiles are useful in showing how to combine groups of like objects in order to add like terms. The tiles simply serve as counters representing different types of objects.

Common Errors

- Some students may misidentify terms with the same variables but different exponents as like terms.

R$_x$ Have students write out each variable part to see why the terms are unlike. Use tiles as an example to distinguish between x and x^2.

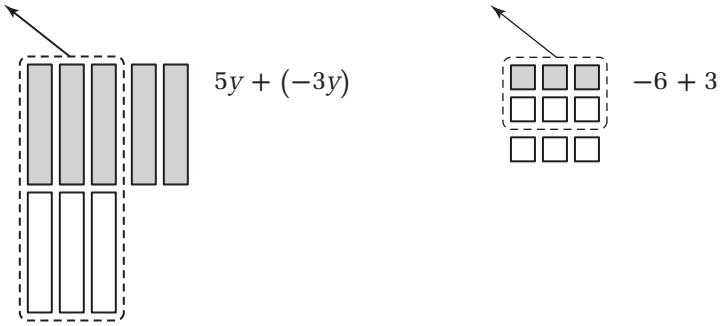
- Some students may change the variable part when collecting like terms, for example, $2x + 3x = 5x^2$.

R$_x$ Use tiles to illustrate that combining two groups of the same type of tile does not change the type of tile, only the number of them. Use substitution of values into both expressions above to verify that they are not generally equal (do not use $x = 0$).

Ongoing Assessment

- Chapter Problem question 14 can be used as an assessment tool.
- Communicate Your Understanding questions can be used as quizzes to assess students' Communication skills.

- Example 4 has students subtract like terms using algebra tiles. The Take Away method is intuitively appealing when subtracting a lesser quantity, however, more sophisticated techniques are required when subtracting more than you start with. Students need a sound grasp of alternative representations of zero, using zero pairs (one or more pairs consisting of positive and negative unit or x-tiles).



- Students should be familiar with the concept of zero pairs from their work with integer tiles in elementary school, however depending on prior experiences with your students, you may wish to invest some time in consolidating understanding of this fundamental concept. You may wish to use **BLM 3.5.1 Practice: Collect Like Terms**.
- Example 5 uses a mixture of adding and subtracting techniques with manipulatives to simplify polynomial expressions, including those involving decimal coefficients. The intent is to consolidate understanding of these techniques in situations of increasing complexity, and to begin to prepare students for approaches requiring strictly symbolic reasoning.
- Example 6 moves students from concrete to abstract reasoning. By this point, students should realize that to collect like terms, they must add and/or subtract their coefficients. Various methods for identifying, reorganizing, and collecting like terms symbolically are illustrated here. A strong foundation in the addition and subtraction of integers is vital for student success here and in later algebraic work. You may wish to use **BLM 3.5.1 Practice: Collect Like Terms** as a remediation tool or for extra practice.
- Although algebra tiles are quite useful in developing initial conceptual understanding, the ultimate aim for the academic student is to be able to collect like terms efficiently without the use of manipulatives. However, it is important that the manipulatives not be treated or viewed as a crutch. Algebra tiles should be presented as one of many tools, neither inferior nor juvenile.

Communicate Your Understanding Responses (page 150)

C1. a) Like terms have exactly the same variable or variables. Unlike terms have different variables or different powers of the same variable.

b) Answers will vary. Like terms: $4g$ and $7g$, x^2 and $5x^2$; Unlike terms: $5x$ and $3y$, $8r^2$ and $3r$.

C2. a) They forgot to add one of the coefficients, the one x. The right side should be $6x$.

b) The sum of the coefficients should be the coefficient in front of the variable in the sum not an exponent. The right side should be $3y$.

c) The negative sign was omitted in the answer. The right side should be $-3m$.

d) $-2x - 2x = -4x$ not 0.

e) $x + x = 2x$; $x \times x$ would give x^2.

f) $3ab - 2b$ cannot be simplified as the terms are not like terms.

Accommodations

Visual—Encourage students to use different colours when adding like terms. For example: $4x + 3y + 3x + 5y = 7x + 8y$.

Perceptual—Provide students with algebra tiles to use when working through the questions.

Spatial—Allow students to use algebraic number lines when adding and subtracting like terms.

Memory—Remind students to use concrete examples, such as money, when adding like terms. For example $1 + $2 = $3.

Practise

Some of the early Practise questions require students to recognize that exponents must be identical on variables of like terms. As students conduct independent work, watch for this, since this is an important concept that is often misunderstood. Consider taking up the first couple of questions after students have had a few minutes to work on them. This should identify and correct misconceptions early on.

Connect and Apply

Provide students with algebra tiles. These may be particularly helpful when students build their algebraic models/expressions. Students might struggle in setting up algebraic models and expressions. Have students work with a partner for some of the questions.

For question 10, you may wish to use **BLM A8 Application General Scoring Rubric** to assist you in assessing your students.

You may wish to use **BLM A9 Communication General Scoring Rubric** to assist you in assessing your students in question 11.

Extend

Connections to measurement, geometry, and the Pythagorean theorem are required for questions 15 and 16. Students will need to recall properties of equilateral, isosceles, and right triangles. You may wish to use **BLM A9 Communication General Scoring Rubric** to assist you in assessing your students for questions 15 and 16.

Exercise Guide

Category	Question Number
Minimum (essential questions for all students to cover the expectations)	1–6, 7a), c), e), 8a), c), e), 9a), 10
Typical	1–13
Extension	15–18