4.1 Solve One- and Two-Step Linear Equations

Strand
Modelling Linear Relations

Student Text Pages
154–162

Suggested Timing
80–160 min

Tools
- calculators
- grid paper
- rulers

Related Resources
BLM 4.1.1 Practice: Solve One- and Two-Step Linear Equations
BLM 4.1.2 Achievement Check Rubric
BLM A3 Communication General Scoring Rubric
BLM G1 Grid Paper

Specific Expectations

Manipulating and Solving Algebraic Equations

In this section, students will

ML1.01 solve first-degree equations involving one variable, including equations with fractional coefficients (e.g., using the balance analogy, computer algebra systems, paper and pencil)

ML1.02 determine the value of a variable in the first degree, using a formula (i.e., by isolating the variable and then substituting known values; by substituting known values and then solving for the variable) (e.g., in analytic geometry, in measurement)

Link to Get Ready

The Get Ready questions on algebraic expressions, evaluating expressions, and algebra tiles provides the needed skills for this section. Have students complete questions 3, 5, and 6 of the Get Ready before proceeding with Section 4.1.

Warm-Up

1. Read each sentence. Identify the mathematical operation.
- **a)** The sum of two numbers is 15.
- **b)** The difference between two numbers is 31.
- **c)** After increasing a number by a factor of 7, the result is 105.
- **d)** After decreasing a number by a factor of 5, the result is 12.

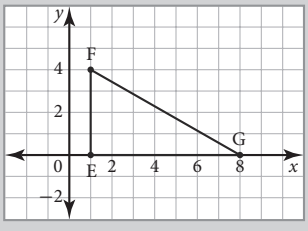
2. a) Use grid paper. Plot the points E(1, 0), F(1, 4), and G(8, 0) on the same axes.
- **b)** What shape is formed when the three points are connected?
- **c)** Find the area of the shape.

3. a) Use grid paper. Plot the points A(3, 7), B(7, 15), C(3, 15), and D(7, 7) on the same axes.
- **b)** What shape is formed when these four points are joined together?

Warm-Up Answers

1. a) addition **b)** subtraction **c)** multiplication **d)** division

2. a)



b) a right triangle

c) 14 square units

Common Errors

- Some students may have forgotten the concept of slope when looking at Example 3.

R_x Have students refer back to Chapter 3, Section 3.4 for help on this concept.

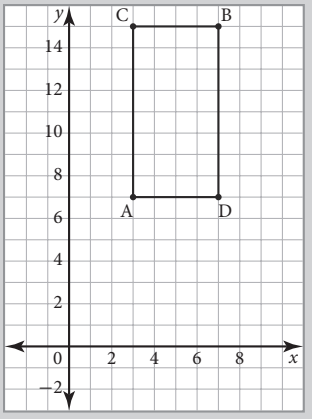
Ongoing Assessment

- Consider using Practise the Concepts question 9 in a class discussion, and assess students' communication skills. You may wish to use **BLM A3 Communication General Scoring Rubric** to assist you in assessing your students.
- While students are working on the Investigate, circulate to see how well each works with a partner. This may be an opportunity to begin observing and recording the individual student's learning skills: group work, work habits, organization, and initiative.

Accommodations

Motor/Visual—Provide enlarged grid paper for students when graphing with paper and pencil.

3. a)



b) a rectangle

Teaching Suggestions

Warm-Up

- Write the Warm-Up questions on the board or on an overhead. Have students complete the questions independently. Then, discuss the solutions as a class. (5–10 min)
- You may wish to use **BLM G1 Grid Paper** for this activity.

Section Opener

- Read the first two paragraphs in the Section Opener to the class. Ask students to raise their hands if they have gone bungee jumping or know someone who has. Xtreme Skyflyer at Canada's Wonderland is a bungee jump-style ride that takes riders through a 170-ft pendulum swing. Ask students if they know of any weight restrictions on the rides at Canada's Wonderland. You may wish to have interested students research on the Internet for more information on amusement park bungee jump-style rides.
- A heavier bungee jumper might have two bungee cords attached. As a class, discuss how this would change the graph.

Investigate

- Have students work in small groups.
- You may wish to have students make flow diagrams to provide a visual aid in solving the linear equation in question 3b).
- Ask groups to present their results to the class.
- Conduct a class discussion on the importance of opposite operations, which will be used throughout the chapter. Remind students that when a number is added and then subtracted from a value, the value does not change. For example, $x + 3 - 3$ equals x.
- Have students read the MathConnect after they finish question 2. You might wish to have students research the works of Muhammed ibn Musa al-Khowarizmi.
- Use **BLM 4.1.1 Practice: Solve One- and Two-Step Linear Equations** for extra practice or remediation.

Investigate Answers (pages 154–155)

1. Using the points (100, 60) and (200, 90) generates the equation $y = 0.3x + 30$.

a) The slope, m, represents the change in bungee cord length for each 1 lb change in weight.

b) The y-intercept, b, represents the length of the bungee cord when no weight is attached.

2. Answers will vary based on students' masses.

3. a) $150 = 0.3x + 30$

b) $x = 400$; I subtracted 30 from both sides and then divided by 0.3.

c) A person whose weight is close to 400 lbs should not be allowed to jump because real-world conditions may not be exactly like those described by the equation.

Examples

- Work through Examples as a class. Alternatively, have students complete the Examples independently or in small groups before reviewing them as a class.
- For Example 1, be sure to stress the use of opposite operations in eliminating quantities from one side of the equation. Students need to be clear on the operation in order to identify the opposite operation. Before students begin work on Example 1c), have them read the MathConnect on checking solutions.
- For Example 2 Method 1, some students may ask if they could have divided by 3 and then multiplied by 4. Remind students that the order in which multiplication and division are "undone" in a question like this one is unimportant, so either can be undone first.
- For Example 3, some students may need to review the slope y-intercept form of the equation of a linear relation. Part b) includes the use of graphing calculators. Discuss with students why the point where the lines intersect is the solution.

Key Concepts

- Have students refer to Example 2 for a class discussion of the Key Concepts.

Discuss the Concepts

- Have students read the questions and record their solutions before starting a class discussion.

Discuss the Concepts Suggested Answers (page 159)

D1. a) Start with 7, add 5, and divide by 3. The result is 4.

b) Start with -15, subtract 5, multiply by 4, and then divide by -1. The result is 80.

D2. Substitute $k = 5$ into each equation. Parts b) and c) give correct results.

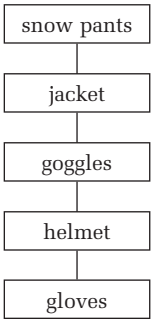
a) LS $\neq$ RS **b)** LS = RS **c)** LS = RS **d)** LS $\neq$ RS

Practise the Concepts (A)

- Encourage students to refer back to the Examples before asking for assistance.
- If students seem uncertain as to whether their answers are correct, have them substitute their answers into the original equation and check the left side equals the right side.
- Question 7 is an Achievement Check. It can be used as a form of diagnostic or formative assessment, or assigned as a small summative assessment piece. This provides an opportunity for formative or self-assessment, using **BLM 4.1.2 Achievement Check Rubric**.

Achievement Check (page 160)

7. a)



b) No, Drake has more than one way to undo the dressing. Following the flow chart in the opposite direction may be the easiest, however.

c) Flow charts describe order of operations well because a student cam follow steps from the opposite direction to undo operations. For instance, subtraction is used to undo addition.

Apply the Concepts (B)

- Question 11 is a Literacy Connect. The sports scenario may be unfamiliar to some students. Alternative questions include the order of operations for brushing teeth, putting gas in a car, grocery shopping, packing for a vacation, and making pancakes. Literacy Connect questions offer the opportunity to explore literacy issues in the mathematics classroom and within the context of mathematics. This supports general Think Literacy strategies. For more information visit http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy.
- Question 13 is a Chapter Problem. You may wish to first have students find the cost for 100 people at an event in the hall:

$C = 25(100) + 250$

$C = 2500 + 250$

$C = 2750$

Remind students to keep the solution to this question handy as it may help them with the Chapter Problem Wrap-Up.

Extend the Concepts (C)

- Assign the Extend the Concepts questions to students who are not being challenged by questions in Apply the Concepts.
- Extend the Concepts questions can be used as a diagnostic assessment for those students considering a university-level course in grade 11.