5.1 Solve Linear Systems by Graphing

Strand
Modelling Linear Relations

Student Text Pages
198–204

Suggested Timing
80–160 min

Tools
- graphing calculators
- grid paper
- rulers

Related Resources
BLM 5.1.1 Practice: Solve Linear Systems by Graphing
BLM 5.1.2 Achievement Check Rubric
BLM A2 Thinking General Scoring Rubric
BLM G1 Grid Paper

Specific Expectations

Solving and Interpreting Systems of Linear Equations

In this section, students will

ML3.01 determine graphically the point of intersection of two linear relations (e.g., using graph paper, using technology)

Link to Get Ready

The Get Ready segment Graph Linear Relations provides the needed skills for this section. You may wish to have students complete Get Ready questions 5 and 6 before proceeding with Section 5.1.

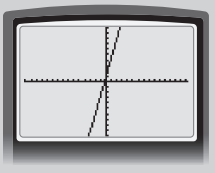
Warm-Up

1. Graph each linear relation, using a graphing calculator.

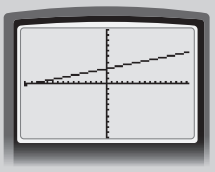
a) $y = 3.5x + 1.05$ **b)** $y = 0.2x + 2.75$ **c)** $y = 0.5x + 1.5$

Warm-Up Answers

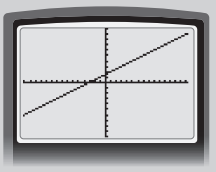
1. a)



b)



c)



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)
- Review as a class the processes and keystrokes for graphing lines on a graphing calculator, then discuss the solutions.

Section Opener

- Read the opening paragraph aloud to students. Ask students if any of them belong to a gym that charges a membership fee. Ask about payment plans versus a flat fee for the year. Discuss reasons for choosing one gym membership over another.

Investigate

- You may wish to have students work with a partner or in small groups.
- Ask groups to present their results to the class.
- Discuss the meaning of the terms *linear system* and *point of intersection.*
- Use **BLM 5.1.1 Practice: Solve Linear Systems by Graphing** for extra practice or remediation.

Common Errors

- Some students may use the subtraction key instead of the negative key when entering the values for the window.

R_x Be sure to tell students to use the (−) key beside the enter button.

- Some students may only substitute into one of the equations when checking the solution.

R_x Remind students that the point must satisfy both equations.

- Some students may not move the values appropriately when solving for y in question 8.

R_x Have students work with a partner and check each other's work. Alternatively, put the correct solution on the board or on an overhead as students are working through the question. Point out the correct method for moving values from one side of an equation to the other.

Ongoing Assessment

- While students are working on the Investigate, circulate and see how well each works within a group. This may be an opportunity to begin observing and recording the individual students' learning skills: group work, work habits, organization, and initiative.
- You may wish to assign Discuss the Concepts questions as a journal activity and collect it at the end of class. You can use this to evaluate students' understanding.
- You may wish to assign question 7 or 9 for students to hand in as a formative assessment. This will allow you to see each student's work and ensure that proper form and solutions are being used by each of your students. You may wish to use **BLM A2 Thinking General Scoring Rubric** to assist you in assessing your students.

Investigate Answers (pages 198–199)

1. Trip Taxi: $y = 0.2x + 2.5$, Comfort Taxi: $y = 0.5x$

2. Trip Taxi; The total cost for Trip Taxi is \$4.90, and the total cost for Comfort Taxi is \$6.00.

3. Trip Taxi; The total cost for Trip Taxi is \$9.50, and the total cost for Comfort Taxi is \$17.50.

4. The lines intersect at (4.166, 8.333); the total cost is the same for both companies for a trip of $8\frac{1}{3}$ km.

5. I substituted the values for x and y from question 4 into the equations from question 1 and checked that the right side of each equation equalled the left side.

6. No other points lie on both lines because no other values for x and y are true for both equations.

7. The point of intersection is the only point that lies on both lines (The coordinates of the point of intersection satisfies both of the equations that describe the lines).

Examples

- Write the Examples on the board or on an overhead, and work through them as a class. Alternatively, have students complete the Examples independently or in small groups before reviewing them as a class.
- Discuss with students the importance of the scale they will use (the window setting). Elicit from students the possible window settings to choose from for these examples. Review how to change the setting if students see a screen that does not show the point they want.
- For Example 1, remind students to rearrange the first equation into $y = mx + b$ form. The rearrangement allows the equation to be easily entered into a graphing calculator. Have students check their solutions by entering the coordinates in the original equations.
- For Example 2, ensure students see the connection between the geometric interpretation of the solution (the point at which the two lines cross) and the algebraic interpretation (the coordinates of the point that satisfy both equations).

Key Concepts

- Ensure that students are comfortable using a graphing calculator. In addition, ensure students are able to explain the connection between the point at which the two lines cross and the coordinates of the point that satisfy both the equations that describe the lines.

Discuss the Concepts

- Have students read the questions and record their solutions before starting a class discussion.
- Alternatively, you may wish to have students complete D1 on their own and then work through D2 and D3 as a class.

Discuss the Concepts Suggested Answers (page 201)

D1. a) Answers will vary. Sample answer: Solving a system of equations means finding the coordinates of the point where the two lines intersect.

b) Answers will vary but should be similar.

D2. Yes. Parallel lines do not intersect, so there is no solution.

D3. Answers will vary. Sample answer: I would graph the lines and find the coordinates of the point of intersection.

Accommodations

ESL—Have ESL students think about the words in their own language that relate to the ones used in this example. You may wish to put ESL and non-ESL students together to compare the words to see if there are any similarities. You might wish to record some of the terms for the class to learn as well. Examples such as *slope*, *point*, *intersection*, *coordinates*, and *system* might be good ones to use.

Gifted and Enrichment—Challenge students to come up with additional taxi company charges and find their respective intersection points.

Spatial—Let students use graphing calculators for all examples in this section.

Visual—You may wish to provide a photocopy of the question to allow students to use a highlighter to help them with these word problems.

Practise the Concepts (A)

- Encourage students to refer back to the Examples before asking for assistance.
- Encourage students to keep **BLM 5.CO.1 Literacy Link: Venn Diagram** handy for reference.
- Remind students to clear the two equations between questions when using graphing calculators. You may wish to have students use **BLM G1 Grid Paper** for some of the graphing questions.
- You may wish to split the class into two groups. Assign one group the questions on the left half of the page, and the other group, the questions on the right half of the page. Then, have groups present their work to the class.

Apply the Concepts (B)

- Some students may need a review of how to write equations that represent information given in words. Remind students to start by stating what each variable represents. Some students may wish to choose variables that are the same as the first letter in the word or term represented by the variable.
- For question 7, discuss reasonable values for rentals and dinners at different halls. You may wish to have students research on the Internet the various charges for halls in your area.
- Question 9c) is a Literacy Connect. As a class, discuss some student responses. Also, discuss whether there are other factors, such as reliability or quality of work, which might affect the hiring choice. 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 10 is an Achievement Check question. It can be used as a diagnostic or formative assessment, or assigned as a small summative assessment piece. You may wish to use **BLM 5.1.2 Achievement Check Rubric** to assist you in assessing your students.
- Question 13 links to the Chapter Problem. Remind students to keep the solution to this question handy as the methods they used may help them with the Chapter Problem Wrap-Up. Have students read the MathConnect before they do part c). Discuss as a class non-monetary factors an event organizer might use to decide if an event was successful, such as the amount of organizational effort expended compared to revenue.

Achievement Check Answers (page 203)

10. The intersections show where the cost of two fitness programs is the same for a given number of hours. I would advise a person to first decide how many hours (x) he or she is likely to spend at a fitness facility and then use the graph to determine the lowest cost by finding the least y-value for the given x-value.

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.