3.5 Graph Linear Relations by Hand

Strand
Modelling Linear Relations

Student Text Pages
138–145

Suggested Timing
75–150 min

Tools
- graphing calculators
- grid paper
- rulers

Related Resources
BLM 3.5.1 Practice: Graph Linear Relations by Hand
BLM 3.5.2 Achievement Check Rubric
BLM A9 Self-Assessment Recording Sheet
BLM G1 Grid Paper
BLM G4 Four-Quadrant Grid

Specific Expectations

Graphing and Writing Equations of Lines

In this section, students will

ML2.05 graph lines by hand, using a variety of techniques (e.g., graph using the y-intercept and slope; graph $2x + 3y = 6$ using the x- and y-intercepts)

Link to Get Ready

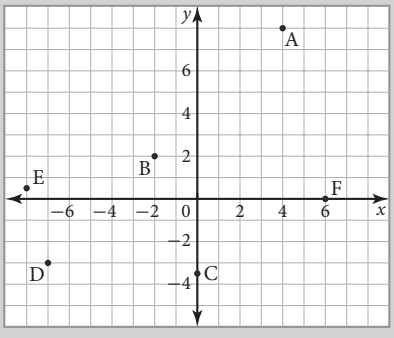
Students must be competent at plotting points correctly on a graph (Cartesian plane) if they are to generate graphs of linear relations by hand. Have students complete question 6 of the Get Ready before proceeding with Section 3.5.

Warm-Up

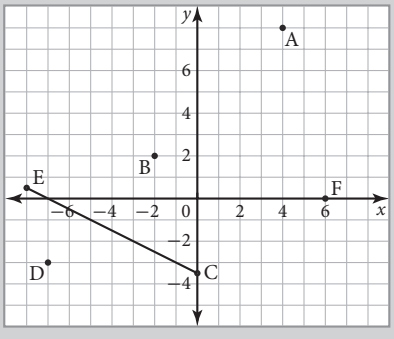
1. a) Plot the following points:
A (4, 8), B (−2, 2), C (0, −3.5), D (−7, −3), E (−8, 0.5), F (6, 0)
b) Determine the rise between A and B.
c) Determine the run between A and C.
d) Determine the rise and the run between D and F.
e) Draw a line between C and E, and calculate the slope of the line.

Warm-Up Answers

1. a)



b) 6
c) 4
d) 3; 13
e)



The slope CE is $-\frac{1}{2}$

Common Errors

- Some students may have difficulty following the instructions in the Investigate.

R_x Read through the instructions as a class, or have students work with a partner.

- Some students may have trouble drawing graphs accurately.

R_x Emphasize to students that accuracy is very important, and ensure students are using rulers and taking sufficient time and care to provide an accurate graph.

Ongoing Assessment

- This is a good section to concentrate on linking graphical and algebraic representations. Students need to be proficient at making accurate sketches for questions without taking too much time to make detailed graphs. You may wish to use or adapt **BLM A9 Self-Assessment Recording Sheet** to assist you in assessing your students.
- Assess students' ability to calculate slope in a real context in the Investigate activity.
- This section provides an opportunity to assess students' ability to graph effectively by hand or with technology, and to use technology to solve problems.
- Extend the Concepts (C) question 12 can be used as a diagnostic assessment for solving linear systems.

Accommodations

Language/ESL—Read the Investigate instructions to the class before students complete the activity.

Motor—For students who require assistance drawing accurate lines, provide graphing calculators to confirm (or refute) their drawings. Students may benefit from working with a partner.

Teaching Suggestions

Warm-Up

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

Section Opener

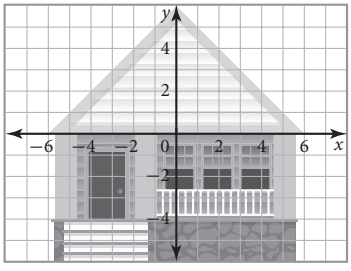
- Emphasize that being able to quickly sketch a graph using paper and pencil is still a very effective way of communicating mathematically.

Investigate

- Stress the practical application of the mathematics of this chapter.
- At this stage, students should be able to proceed independently.
- You may wish to use **BLM G1 Grid Paper** for this activity.
- Use **BLM 3.5.1 Practice: Graph Linear Relations by Hand** for extra practice or remediation.

Investigate Answers (page 138)

1.



2. a) slope $= 1$ **b)** The y-intercept is 6. **c)** $y = x + 6$

3. a) -1 **b)** 6 **c)** $y = -x + 6$

Examples

- Stress the importance of working through an order of steps to answer a question (e.g., plot the y-intercept, apply slope (rise, run) to locate at least two other points).
- Ensure that students are drawing their lines carefully and accurately.
- Ensure that students read the example carefully and understand the context.
- Work through the two methods for answering the questions (e.g., creating a table of values and graph, or graphing the y-intercept and then applying the slope).

Key Concepts

- Read the Key Concepts as a class and ensure students understand their meaning.
- Instruct students to make a sketch in their notes of both graphing methods. Have them label one sketch as "a series of points" and the other sketch as "y-intercept and slope."

Discuss the Concepts

- Encourage students to provide support for their answers either by citing other examples from the chapter or by using a graph.

Discuss the Concepts Suggested Answers (page 142)

D1. The y-intercept is the initial fixed cost (e.g., the cost of a plain pizza), and the slope is the rate of change (variable costs, e.g., the cost per item).

D2. c) $y = x + 5$; The cost per game is a variable cost that depends on the number of games bowled. The shoe cost is a fixed cost.

Practise the Concepts (A)

- Encourage students to refer back to the Examples before asking for assistance.
- Complete questions 1 and 3a) as a class to provide a model for students.
- If necessary, review answers to questions before proceeding with the next part of the section. Some students will be able to move ahead independently.

Apply the Concepts (B)

- Ensure students read and understand the context of each problem and what is being asked of them before answering the questions.
- You may wish to have students use **BLM G1 Grid Paper** and/or **BLM G4 Four-Quadrant Grid** for these questions.
- Allow students to work through these problems at their own pace.
- Question 8 is a Chapter Problem. Suggest that students keep the solution to this question handy as it may help them with the Chapter Problem Wrap-Up.
- Question 9 is a Literacy Connect. 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. You may wish to use **BLM 3.5.2 Achievement Check Rubric** to assist you in assessing your students. It can be used as a form of diagnostic or formative assessment, or assigned as a small summative assessment piece.

Achievement Check Answers (page 144)

10. Let R represent the cost of Robin's service in dollars, and t represent time in hours.

$R = 50t + 2000$

for $t = 18$, $R = 50(18) + 2000$

$= 2900$

Similarly, let J represent the cost of Just Desk's service in dollars.

$J = 2(80)t + 1800$

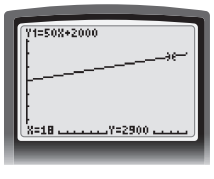
$= 160t + 1800$

for $t = 9$, $R = 160(9) + 1800$

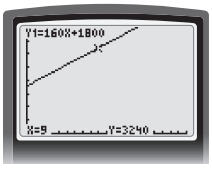
$= 3240$

So, Heidi should choose Robin because it is cheaper, unless Heidi needs the deck finished under 18 hours and is willing to pay $3240.

Robin



Just Desk



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.
- Questions can be completed using paper and pencil and/or graphing technology.