3.2 Investigate Slope and *y*-Intercept Using Technology

Strand
Modelling Linear Relations

Student Text Pages
111–117

Suggested Timing
75–150 min

Tools
- calculators
- graphing calculators

Related Resources
BLM 3.2.1 Practice: Investigate Slope and *y*-Intercept Using Technology
BLM G1 Grid Paper

Specific Expectations

Graphing and Writing Equations of Lines

In this section, students will

ML2.03 identify, through investigation with technology, the geometric significance of m and b in the equation $y = mx + b$

Link to Get Ready

This section deals primarily with graphing. Students need to be able to work with integers and to understand coordinate graphing. These skills are reviewed in questions 4, 5, and 6 of the Get Ready. Ensure that students complete these questions before proceeding with Section 3.2.

Warm-Up

1. Subtract.

a) $6 - 4$ **b)** $4 - 6$ **c)** $-3 - 1$
d) $-3 - 8$ **e)** $5 - (-2)$ **f)** $-6 - (-6)$

2. Evaluate.

a) $\frac{7 + 3}{6 - 4}$ **b)** $\frac{4 - 9}{2 - 4}$ **c)** $\frac{-2 - (-6)}{5 - 1}$ **d)** $\frac{-7 - 4}{12 - (-10)}$

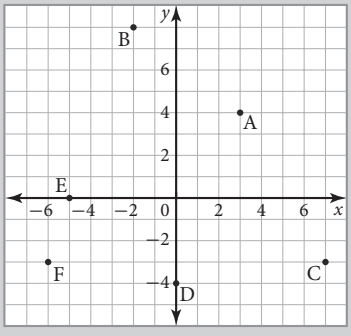
3. Plot the following points.
A (3, 4), B (−2, 8), C (7, −3), D (0, −4), E (−5, 0), F (−6, −3)

Warm-Up Answers

1. a) 2 **b)** −2 **c)** −4 **d)** −11 **e)** 7 **f)** 0

2. a) 5 **b)** $2\frac{1}{2}$ or 2.5 **c)** 1 **d)** $-\frac{1}{2}$ or −0.5

3.



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 question 3. Then, discuss the solutions as a class. (5–10 min)

Common Errors

- Some students may select the wrong number for the variables in the equation of a line.

R_x Work through some examples as a class to ensure students understand how to select the correct variable.

- Some students may reverse the slope and the intercept when presented with the equation of a line (e.g., if given the equation $y = 3x + 8$, they may use 8 as the slope and 3 as the y-intercept).

R_x Use sample graphs on an overhead to review and have students correctly identify the slope and the intercepts in equations of lines.

- Some students may miss a step when using a graphing calculator, particularly in question 1 of Investigate A.

R_x Have students work with a partner when working with graphing calculators.

- Some students may begin to try and solve word problems (e.g., in the Apply the Concepts (B) section) without thoroughly reading and interpreting the question.

R_x Have students work with a partner and explain the steps. Or, if students are working independently, have them rewrite the questions in their own words.

Assessment

- Assess students' knowledge and understanding of the Key Concepts.
- Assessment of students knowledge and communication skills can be facilitated by one on one or small group discussions.
- Assess students' ability to identify the slope and y-intercept and their facility with a graphing calculator in their completion of Practise the Concepts (A).
- Assess students' knowledge of m and b as they relate to Example 2.
- Use Apply the Concepts (B) to perform a formative assessment. The Chapter Problem (question 10) can be used to assess students' ability to identify the slope and the y-intercept in a given equation and the significance of these numbers in the context of the question.
- For students who complete the Extend the Concepts (C) question, assess their ability to understand why no graph is visible and their facility with the graphing calculator in part b).

Section Opener

- Ask students to look at the photo in the Section Opener and explain how it might relate to mathematics and linear relations.
- Ask students to think of how ski resort managers and snow removal equipment operators use mathematics to make decisions.

Investigate

- Depending on the ability of students, Investigate A can be done independently or it can be teacher-directed. Some students may require extra attention for Question 6.
- Use an overhead to demonstrate some or all of the Investigate A, if necessary.
- Use **BLM 3.2.1 Practice: Investigate Slope and y-Intercept Using Technology** for extra practice or remediation.

Investigate Answers (pages 111–112)

Part A

2. b) As the x-values increase by 1, the y-values also increase by 1.
c) The slope of the line $y = x$ is 1.
3. b) This line is steeper than $y = x$.
c) As the x-values increase by 1, the y-values increase by 2.
d) The slope of the line $y = 2x$ is 2.
4. b) steeper, steeper, steeper, less steep
c) The y-values increase by 3, 4, 10, $\frac{1}{2}$.
d) 3, 4, 10, $\frac{1}{2}$
5. b) as steep, steeper, steeper, steeper
c) The y-values decrease by 1, 2, 3, 4.
d) $-1, -2, -3, -4$
6. The slope and the rate of change in the y-values is the same.

Part B

2. b) 0	**c)** 0	
3. b) same	**c)** 2	**d)** 2
4. b) all are as steep	**c)** 3, 5, −2, −7	**d)** 3, 5, −2, −7
5. b) all are as steep	**c)** 1, 4, −5	**d)** 1, 4, −5

6. The y-intercept is the value of the term added to the term containing the variable x.

Examples

- You may wish to work through Example 1 as a class.
- Read and discuss Example 3 with the class to strengthen students' ability to understand the connection between the pricing of a common item and a linear relation.

Key Concepts

- Read the Key Concepts aloud and discuss with the class.
- Conduct an informal quiz to reinforce understanding. Give the equation of a line, and ask students for m and b. Next, give students m and b and ask for the equation of the line.

Accommodations

Perceptual—Have students work with a partner when using a graphing calculator. Some students may benefit from a one-on-one discussion of the concepts. Use currency manipulatives to display the cost of the sundaes with various numbers of toppings in order to strengthen the connection between the *y*-value and money and the constant rate of change in Example 3.

Language/ESL—Read and discuss word problems before students attempt them. Ensure that students understand what is being asked of them in the problems. Read each part of the Example solutions aloud.

Discuss the Concepts

- Engage as many students as possible in the discussion.
- Discussions can be conducted one-on-one, in a small group, or with the entire class.
- Students can use manipulatives or a metre stick and some books and construct a slope. A hands-on approach will facilitate more students entering the discussion. Ask students to come up with a way of changing the *y*-intercept for a constructed slope.

Discuss the Concepts Suggested Answers (page 115)

D1. If the slope increases, the line becomes steeper.

D2. You can tell the value of b in $y = mx + b$ by looking at where the line intersects the *y*-axis.

Practise the Concepts (A)

- Encourage students to refer back to the Examples before asking for assistance.
- Have students work independently or in pairs using a graphing calculator for Practise the Concepts questions.
- An alternative approach to questions 3 and 4 is to have students state the slope and the *y*-intercept by considering the equation.
- Demonstrate part a) of the questions, if necessary, and have students complete the other parts of the questions independently.

Apply the Concepts (B)

- You may wish to work through question 8a) and b) with students and assign the rest of the questions to students to complete independently.
- Have the graphing calculator projector unit ready and use it to demonstrate the solutions to the problems when necessary.
- 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 9b) 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.

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.
- If students become stuck, have them graph the relation on paper and then locate the standard window on the paper graph. The standard window setting uses *x*-values and *y*-values from -10 to $+10$. Once students locate the standard window setting on their paper graph, they should be able to understand why no line appears on the graphing calculator screen and what changes need to be made to the graphing calculator window setting in order to see the graph.