6.5 Find an Equation for a Line Given the Slope and a Point

Strand:
Analytic Geometry

Student Text Pages
330 to 337

Suggested Timing
80 min

Tools
- grid paper

Technology Tools
- *The Geometer's Sketchpad®*
- computers
- graphing calculators

Related Resources
BLM G10 Grid Paper
BLM 6.5.1 Practice: Find an Equation for a Line Given the Slope and a Point
BLM T4 *The Geometer's Sketchpad®* 3
BLM T5 *The Geometer's Sketchpad®* 4
BLM A5 Problem Solving Checklist

Mathematical Process Expectations Emphasis

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

Specific Expectations

Using the Properties of Linear Relations to Solve Problems

AG3.01 graph lines by hand, using a variety of techniques (e.g., graph $y = x - 4$ using the y-intercept and slope; graph $2x + 3y = 6$ using the x- and y-intercepts);

AG3.02 determine the equation of a line from information about the line (e.g., the slope and y-intercept; the slope and a point; two points);

AG3.03 describe the meaning of the slope and y-intercept for a linear relation arising from a realistic situation (e.g., the cost to rent the community gym is $40 per evening, plus $2 per person for equipment rental; the vertical intercept, 40, represents the $40 cost of renting the gym; the value of the rate of change, 2, represents the $2 cost per person), and describe a situation that could be modelled by a given linear equation (e.g., the linear equation $M = 50 + 6d$ could model the mass of a shipping package, including 50 g for the packaging material, plus 6 g per flyer added to the package).

Link to Get Ready

Ensure that students have completed all parts of the Get Ready prior to this section.

Warm-Up

1. Write the equation of a line whose slope and y-intercept are given.
   a) $m = \frac{3}{4}$, $b = -5$
   b) $m = -1$, $b = 6$
2. What is the slope of a line perpendicular to $y = 3x - 7$?
3. What is the slope of a line parallel to $2x - 3y + 8 = 0$?

Warm-Up Answers

1. a) $y = \frac{3}{4}x - 5$ b) $y = -x + 6$
2. $\frac{1}{3}$
3. $\frac{2}{3}$

Teaching Suggestions

- Assign the Warm-Up as individual work. (5 min)
- The focus of this section and Section 6.6 is to build a linear equation based on various pieces of given information. An equation in the form $y = mx + b$ can be produced, or can be used to determine the slope and y-intercept of a line. Various techniques for performing this are illustrated in the examples. The emphasis in the academic course is to be able to apply algebraic reasoning in finding the equation.
- Assign the Examples, and follow up with a class discussion. (20–25 min)
- In Example 1, the slope and a point known to be on a line are given. This information is used to solve for the y-intercept and subsequently to write the equation of the line. The given information is also used to produce the

Common Errors

- Some students may struggle with operations involving fractions and integers when they arise, for example, 1d) and f).

R_x Review basics and provide remediation as needed. Students in the academic program must become proficient at mechanical manipulations of this sort. You may wish to use **BLM 6.5.1 Practice: Find an Equation for a Line Given the Slope and a Point** for remediation or extra practice.

- Some students may substitute the coordinates of a known point into $y = mx + b$ again, after finding m and b, students, when trying to generate the equation of a line.

R_x Remind students that only m and b are required to generate the equation, x and y are left as variables because this will produce an equation that can produce an infinite number of points on the line.

Ongoing Assessment

- Chapter Problem question 7 can be used as an assessment tool. You may wish to use **BLM A5 Problem Solving Checklist** to assist you in assessing your students.
- Communicate Your Understanding questions can be used as quizzes to assess students' Communication skills.

Accommodations

Gifted and Enrichment—Challenge students to research and study the slopes that are used in everyday life, such as stairs, roofs, and highways.

graph of the line. Ensure that students resist the temptation to substitute the known point again, once the y-intercept has been found. Make the distinction in processes between the first step, in which *particular* information (e.g., a single point) is used to solve for the y-intercept, and the second step, in which the slope and y-intercept are used to solve for the *general* case of an equation that can be used to provide infinitely many points are on the line. This distinction requires a relatively high level of abstract reasoning, and may require ongoing reinforcement.

- Example 2 requires application of the same skill as Example 1 to a contextual situation. There is an obvious connection to partial variation, which students have studied previously. The given information is similar to the previous example, if less obvious: the slope (which corresponds to the variable part) is 2 ($2/km), and the point known to be on the line is (10, 25). From this information, students can find the C-intercept, develop the equation, and produce the graph. Graphic and algebraic solutions are presented and compared in the last part of the example. Students should see both methods and appreciate the connections between the graph and the equation.
- Example 3 shows how other knowledge of coordinate geometry can be synthesized and applied, as needed. In this case, students use the properties of parallel and perpendicular lines to determine the slope of the desired line. Review these properties, as needed.
- Assign the exercises as individual work or have students work with a partner. (balance of period)
- You may wish to use **BLM G10 Grid Paper** to support these activities.
- You may wish to use **BLM 6.5.1 Practice: Find an Equation for a Line Given the Slope and a Point** for remediation or extra practice.

Communicate Your Understanding Responses (page 335)

C1. Answers will vary.

Step 2: Substitute $y = 1$, $m = 3$, and $x = 2$ into the slope y-intercept equation
Step 3: Simplify the equation by multiplying 3 and 2
Step 4: Isolate the b term on the right hand side
Step 5: Simplify the equation by subtracting 6 from 1

C2. a) $-\frac{5}{3}$ **b)** 4 **c)** $-\frac{1}{5}$ **d)** $\frac{2}{7}$

Practise

For question 2, some students may not realize immediately that the information provided regarding parallel and perpendicular lines can be used to identify the slope of the desired line. In the case of vertical and horizontal lines, e.g., question 2e), the concept of negative reciprocals is not useful; instead students need to recall the forms of such lines and apply geometric reasoning.

Connect and Apply

Questions 3 and 4 provide the opportunity for students to make connections between the equation of a line, its graph, partial variation, and first differences. It is important for students to see how these various components of the chapter are interrelated.

Question 7, the Chapter Problem question, is a multi-step problem. After finding the equation of the line, students must then find its intercepts in order to obtain the clues.

For question 8, students should be familiar with problems of this type, using $d = mt + b$, from their earlier work with motion sensors. This problem

takes the concepts to a more meaningful context. The numbers are larger, but the concepts are the same. Encourage students who enjoy problems of this type to study senior physics.

For questions 9 and 10, students will need some familiarity using *The Geometer's Sketchpad®*. Some review of basic commands, most of which are introduced in the Use Technology section, may be required. You may wish to use **BLM T4 *The Geometer's Sketchpad®* 3** or **BLM T5 *The Geometer's Sketchpad®* 4** to support this activity. These questions can also be done using a graphing calculator: adjust the WINDOW setting, plot a point from the data in row 1 of L1 and L2, and enter the equation $y = 2x + \#$, where # can be changed until the line passes through the point.

Extend

Question 11 produces a piecewise linear relationship. Suggest breaking the problem up into two parts, before and after Aki changes his speed.

Literacy Connections

It Just Makes Sense III

Look at what you have done in this section: you have used the number value for the slope m and the x and y values from a point and filled the numbers in in the appropriate spot in the slope point form of the equation of the line in order to find out the y-intercept b. Did you have this picked out already as one of the places in this chapter where things "just make sense"?

Exercise Guide

Category	Question Number
Minimum (essential questions for all students to cover the expectations)	1a), c), e), 2, 3, 4
Typical	1–6, 8
Extension	11