Prerequisite Skills

Student Text Pages
2 to 3

Suggested Timing
45–60 min

Tools
- grid paper
- graphing calculator

Related Resources
- G–3 Four Quadrant Grids
- BLM 1–1 Prerequisite Skills

Assessment
You may wish to use **BLM 1–1 Prerequisite Skills** as a diagnostic assessment. Refer students to the Skills Appendix for examples and further practice of the topics.

Teaching Suggestions

- You may wish to have students complete some questions in class and others as homework. Students may show different abilities to recall the concepts. Pairing weaker students with stronger ones would be helpful if all questions are assigned.
- In **question 5**, remind students of the two important algebraic techniques: substitution and elimination. Have students work in pairs on this question. Or, have small student groups present their solutions or post the solutions on the classroom wall.
- In **question 7**, remind students to first look for common factors. They should see that the factored trinomials are still factorable.

Chapter Problem

The Chapter Problem is introduced on page 3. Have students discuss their understanding of this branch of mathematics. The Chapter Problem is revisited in Section 1.2 (question 19), Section 1.5 (question 19), Section 1.6 (question 14), and Section 1.7 (question 14). These questions are designed to help students move toward the Chapter Problem Wrap-Up on page 71. The Chapter Problem questions may be assigned in each section where they appear. Alternatively, you may wish to assign them all with the Chapter Problem Wrap-Up when students have completed the chapter, as part of a summative assessment.

1.1 Functions, Domain, and Range

Student Text Pages
4 to 15

Suggested Timing
75 min

Tools
- grid paper
- graphing calculator

Related Resources
- G–1 Grid Paper
- BLM 1–2 Section 1.1 Practice

Teaching Suggestions

- Allow 20 to 25 min to complete **Investigate A** and **Investigate B**. Ensure students develop a graphical understanding of the essential difference between a relation and a function.
- In **Investigate B**, when students draw graphs in step 2, ask them, “How do the graphs differ? How are they the same?” Step 3 is designed so students construct the idea of the vertical line test in **Example 1**.
- In **Example 1**, use an acetate overlay with a vertical line drawn on it and move the line left and right on each graph to illustrate when a graph fails the vertical line test.
- **Example 2** may require a discussion of discrete versus continuous values in data. In part b), ask, “Can any value be used for the age or the number of children?” This should spark the idea that there is no such thing as 1.4, or π, or the square root of 5 children at the sports camp. Discuss the margin note and have students give examples of different sets of numbers.

- In **Example 3**, discuss the range of each relation and how each range is obtained. Students should develop an understanding of the concept of range without graphing the relation.
- In **Example 4**, students can use the TI-83 Plus or TI-84 Plus graphing calculator to graph the area function $y = -2x^2 + 100x$ to determine the maximum value of the area. Refer to the Technology Appendix on student text page 496.
- An extension of **Example 4** will help with **question 9**. Ask students, "How would your answer change if the fencing was pre-assembled in 6-m sections?"
- Be sure to read through the **Key Concepts** with students to be sure that they have mastered the skills developed in this section.

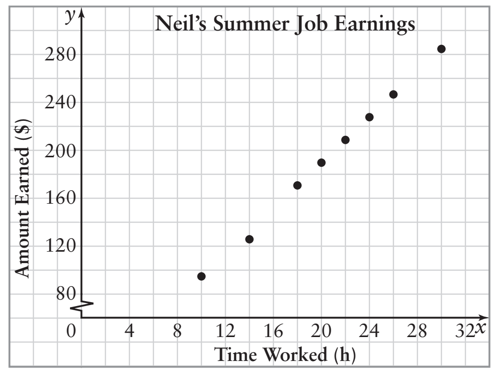
Differentiated Instruction

- Use **cooperative task groups** to complete Investigates A and B.
- Use one **Frayer model** for relations and another for functions to summarize important characteristics. Encourage students to include both graphs and tables in their lists of examples and non-examples for each Frayer model.
- Construct a **word wall** of the key terms *relation*, *function*, *vertical line test*, *domain*, *range*, *real number*, and *asymptote* to keep these definitions accessible to the class throughout the chapter.

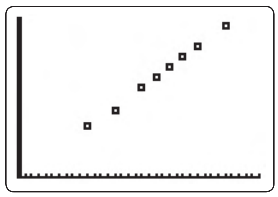
Investigate Answers (pages 4–6)

Investigate A

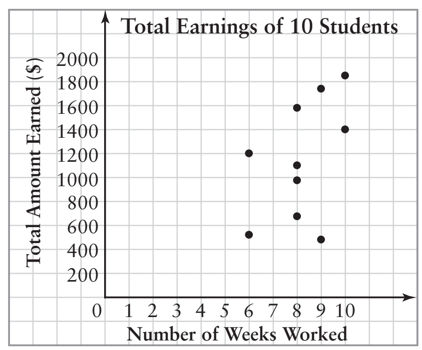
1. Graph of data in table A:



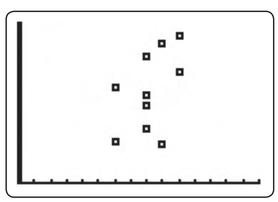
On a graphing calculator:



Graph of data in table B:



On a graphing calculator:



2. Answers may vary. Sample answer: The graph of the data in table A shows that the more hours Neil works per week, the more money he makes. The graph of the data in table B does not appear to show a relationship between the number of weeks worked and the total amount earned by the students. For example, there are four different earnings for working eight weeks.

3. Answers may vary. Sample answer: Yes. If Neil worked 28 h one week, he would earn about $266.

4. Answers may vary. Sample answer: No. The graph of the data in table B does not show a trend, so it is not possible to predict the amount that a student who worked for eight weeks would earn.

5. The set of data in table A is a function. Each value of the independent variable, the number of hours Neil worked, corresponds to exactly one value of the dependent variable, the dollar amount earned. The set of data in table B is not a function, since one value (eight weeks) of the independent variable, the number of weeks worked, corresponds to more than one value ($675, $975, $1100, and $1580) of the dependent variable, the total amount earned.

Investigate B

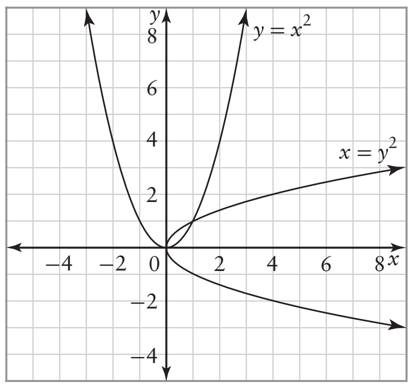
Method 1

1.

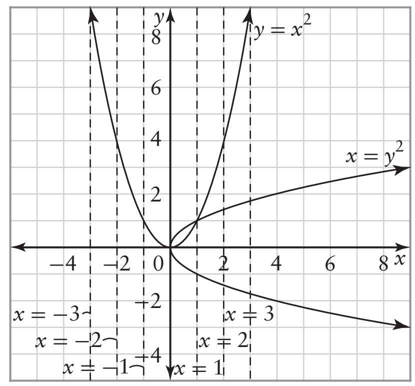
x	$y = x^2$	Coordinates
−3	9	(−3, 9)
−2	4	(−2, 4)
−1	1	(−1, 1)
0	0	(0, 0)
1	1	(1, 1)
2	4	(2, 4)
3	9	(3, 9)

$x = y^2$	y	Coordinates
9	−3	(9, −3)
4	−2	(4, −2)
1	−1	(1, −1,)
0	0	(0, 0)
1	1	(1, 1)
4	2	(4, 2)
9	3	(9, 3)

2.



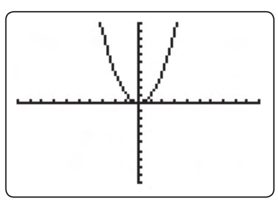
3.



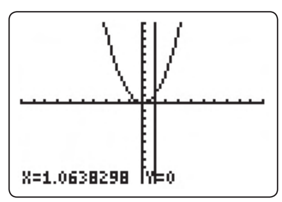
4. Answers may vary. Sample answer: None of the vertical lines drawn intersect the graph of $y = x^2$ at more than one point. That means each value of the independent variable corresponds to no more than one value of the dependent variable. So, the relation $y = x^2$ is a function. Each of the vertical lines drawn at $x = 1$, $x = 2$, and $x = 3$ intersects the graph of $x = y^2$ at more than one point. So, the relation $x = y^2$ is not a function.

Method 2

1.

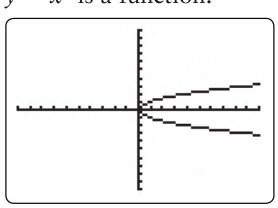


2.

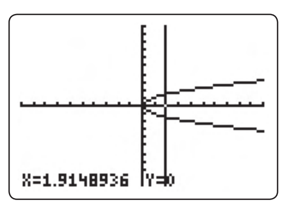


3. Answers may vary. Sample answer: As the vertical line moves from left to right across the graph of $y = x^2$, it passes through at most one point on the curve, so $y = x^2$ is a function.

4.



5.



Answers may vary. Sample answer: No. The relation $x = y^2$ is not a function. There are an infinite number of vertical lines that pass through more than one point on the graph of $x = y^2$.

Communicate Your Understanding Responses (page 12)

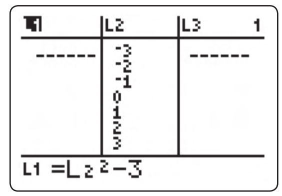
C1 Answers may vary. Sample answer: Suzanne could graph both relations on the same set of axes and use the vertical line test to show that the relation $y = x^2$ is a function, since no vertical line will pass through more than one point on the graph, and that the relation $x = y^2$ is not a function, since an infinite number of vertical lines can be drawn that will pass through more than one point on the graph.

C2 Answers may vary. Sample answer: No. It is not possible to determine if a relation is a function given only the domain and range in set notation. The relation $y = 2x + 1$ is a function that has domain $\{x \in \mathbb{R}\}$ and range $\{y \in \mathbb{R}\}$. The relation $x = y^3 - 4y$ is not a function but it also has domain $\{x \in \mathbb{R}\}$ and range $\{y \in \mathbb{R}\}$.

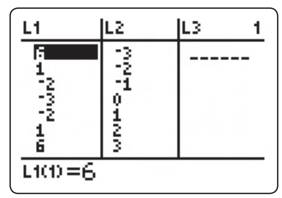
C3 Answers may vary. Sample answer: Sagar could use a graphing calculator to graph the function $y = \dfrac{-4}{2x + 1}$ and determine that the function has domain $\left\{x \in \mathbb{R}, x \neq -\dfrac{1}{2}\right\}$ and range $\{y \in \mathbb{R}, y \neq 0\}$.

Practise, Connect and Apply, Extend

- In **question 1**, have students use the edge of their ruler as a vertical line for the vertical line test. Remind students what *absolute value* means in part b).
- Extend **question 5** by asking students to state which relations are functions.
- **Question 10** gives students the opportunity to solve a problem by using their reflecting and reasoning skills. Students need to apply previous learning to solve the problem and communicate their findings.
- To use the TI-83 Plus or TI-84 Plus graphing calculator to graph the table of values in **question 12**, enter the data by pressing STAT and selecting **1:Edit**. Enter the y-values into **L2**.



  To get the values for **L1**, scroll up to the heading and enter $x = y^2 - 3$ as $L1 = L2^2 - 3$. Then press ENTER. The values will now appear down the **L1** column.



- **Question 13** is an excellent opportunity for students to use concepts and terminology developed in this section.
- **Question 16** allows students to select tools and connect concepts to graph the relations on the same set of axes, and to use their reasoning skills to establish a meaning for one of the coordinates on the graph. They are also required to communicate a justification of their answers.
- Students may answer no for **question 17**. If so, supply a simple example where the answer is yes, (e.g., $y = 3x + 4$ and $y = -x + 7$) and ask them to think of an example where the answer is yes for two non-linear relations.
- The graph in **question 18** part **a**) foreshadows the work on the sine curve in Chapter 5.
- Use **BLM 1–2 Section 1.1 Practice** for remediation or extra practice.

Mathematical Process Expectations

The table shows questions that provide good opportunities for students to use the mathematical processes.

Process Expectation	Selected Questions
Problem Solving	9
Reasoning and Proving	3, 5–10, 12–18
Reflecting	9, 10, 13, 17
Selecting Tools and Computational Strategies	2, 7, 11, 12, 15, 16
Connecting	1, 2, 4–18
Representing	2, 7, 8, 12, 15–17
Communicating	2–4, 9, 10, 12–14, 16–18

Common Errors

- Students are confused with independent and dependent variables in question 9.

R_x Remind students that the input value is the independent variable and the output value that results is the dependent variable.

- Students use the idea that with a given perimeter, the rectangle with the maximum area is a square to answer question 10.

R_x Point out the restriction in the question: the fencing comes in 3-m sections. So, the enclosed area is not square, but rather a rectangle that is close to a square.

- Students find the chart in question 12 confusing.

R_x Point out that the input values in this chart are the y-values in the second column. Students are to substitute the y-values into the expression for x to determine the values in the first column.