3.2 Linear Functions
For use with Exploration 3.2

Essential Question: How can you determine whether a function is linear or nonlinear?

1 EXPLORATION: Finding Patterns for Similar Figures

Go to BigIdeasMath.com for an interactive tool to investigate this exploration.

Work with a partner. Complete each table for the sequence of similar figures. (In parts (a) and (b), use the rectangle shown.) Graph the data in each table. Decide whether each pattern is linear or nonlinear. Justify your conclusion.

a. perimeters of similar rectangles

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. areas of similar rectangles

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2 Linear Functions (continued)

1 EXPLORATION: Finding Patterns for Similar Figures (continued)

c. circumferences of circles of radius \( r \)

d. areas of circles of radius \( r \)

- \( r \) | 1 | 2 | 3 | 4 | 5
- \( C \) |

- \( r \) | 1 | 2 | 3 | 4 | 5
- \( A \) |

Communicate Your Answer

2. How do you know that the patterns you found in Exploration 1 represent functions?

3. How can you determine whether a function is linear or nonlinear?

4. Describe two real-life patterns: one that is linear and one that is nonlinear. Use patterns that are different from those described in Exploration 1.
3.2 Notetaking with Vocabulary
For use after Lesson 3.2

In your own words, write the meaning of each vocabulary term.

linear equation in two variables

linear function

nonlinear function

solution of a linear equation in two variables

discrete domain

continuous domain

Notes:
3.2 Notetaking with Vocabulary (continued)

Core Concepts

Representations of Functions

Words  An output is 3 more than the input.

Equation  \( y = x + 3 \)

<table>
<thead>
<tr>
<th>Input, ( x )</th>
<th>Output, ( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Notes:

Discrete and Continuous Domains

A discrete domain is a set of input values that consists of only certain numbers in an interval.

Example: Integers from 1 to 5

A continuous domain is a set of input values that consists of all numbers in an interval.

Example: All numbers from 1 to 5

Notes:
3.2 Notetaking with Vocabulary (continued)

Extra Practice

In Exercises 1 and 2, determine whether the graph represents a linear or nonlinear function. Explain.

1.  
   ![Graph 1]

2.  
   ![Graph 2]

In Exercises 3 and 4, determine whether the table represents a linear or nonlinear function. Explain.

3.  
<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>-1</td>
<td>2</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

4.  
<table>
<thead>
<tr>
<th>x</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

In Exercises 5 and 6, determine whether the equation represents a linear or nonlinear function. Explain.

5.  
   \[ y = 3 - 2x \]

6.  
   \[ y = \frac{3}{4}x^3 \]

In Exercises 7 and 8, find the domain of the function represented by the graph.
Determine whether the domain is discrete or continuous. Explain.

7.  
   ![Graph 3]

8.  
   ![Graph 4]