Describing Functions

Practice and Problem Solving: A/B

Graph each equation. Tell whether the equation is linear or nonlinear.

1. \( y = 3x \)
2. \( y = x^2 + 1 \)

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

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

Tell whether each equation can be written in the form \( y = mx + b \). Write yes or no. If yes, write the equation in the form \( y = mx + b \).

3. \( y = 8 - x^2 \)
4. \( y = 4 + x \)
5. \( y = 3 - 2x \)

The amount of water in a tank being filled is represented by the equation \( y = 20x \), where \( y \) is the number of gallons in the tank after \( x \) minutes.

6. Complete the table of values for this situation.

<table>
<thead>
<tr>
<th>Time (min), ( x )</th>
<th>(0)</th>
<th>(1)</th>
<th>(2)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (gal), ( y )</td>
<td></td>
<td></td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

7. Sketch a graph of the equation.

8. Use your graph to predict the amount of water in the tank after 6 minutes.

9. Explain how you know whether relationship between \( x \) and \( y \) is linear or nonlinear.
12. If she got a grade of anything but a 95, it would no longer be a function because the input value, 2 hours, would be paired with two different output values.

**Practice and Problem Solving: C**

1. not a function; input value 2 is paired with more than one output value, 8 and 9
2. function; each input value is paired with only one output value
3. No; There are at least four Mondays, each likely to have a different output value (different amounts of mulch applied). Also, there are at least four of each other day, with different outputs likely.
4. Yes. For each weight of beads she buys (input), there can only be one dollar amount representing the amount of money she pays (output).
5. There is only one number of animals for each day, so each input is paired with only one output.
6. No; Each day (input) would then most likely have two number of animals (outputs) paired with it.

**Practice and Problem Solving: D**

1. function
2. not a function
3. not a function
4. function
5. not a function
6. function
7. not a function
8. function
9. C
10. It is a function because there is only one year number (input) paired with each number of elephants (output).

**Reteach**

1. \{ (1, 1), (2, 3), (3, 5) \}
2. \{ (6, 2), (5, 3), (4, 8) \}
3. Yes; Each input value is paired with only one output value.
4. No; The input value 1 is paired with both 2 and 8.

5. Yes; Each input value is paired with only one output value.
6. No; The input value 1 is paired with both 1 and 2.

**Reading Strategies**

1. Sample answer:

<table>
<thead>
<tr>
<th>Input</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

2. Answers will vary. Sample answer:

3. Answers will vary. Sample answer: because the input value 1 is paired with more than one output value

4. no
5. no
6. yes

**Success for English Learners**

1. If any input (x-value) has more than one output (y-value), the relation is not a function.
2. Yes. Since the input values 3 and 5 are each only paired with one output value, it is a function.
2. **Input, x** | -2 | -1 | 0 | 1 | 2
|---|---|---|---|---|
| **Output, y** | 5 | 2 | 1 | 2 | 5

nonlinear

3. No.

4. Yes; \( y = x + 4 \)

5. Yes; \( y = -2x + 3 \)

6. **Time (min), x** | 0 | 1 | 2 | 3 | 4
|---|---|---|---|---|
| **Water (gal), y** | 0 | 20 | 40 | 60 | 80

8. 120 gal

9. It is linear; the solutions lie on a line.

**Practice and Problem Solving: C**

1. nonproportional

**Practice and Problem Solving: D**

1. | **Input, x** | **x − 1** | **Output, y** | (x, y) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>(-1, -1)</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>-1</td>
<td>(0, -1)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>(1, 0)</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>(2, 1)</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2</td>
<td>(3, 2)</td>
</tr>
</tbody>
</table>

2. | **Input, x** | **2x + 6** | **Output, y** | (x, y) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>2(-2) + 6</td>
<td>2</td>
<td>(-2, 2)</td>
</tr>
<tr>
<td>-1</td>
<td>2(-1) + 6</td>
<td>4</td>
<td>(-1, 4)</td>
</tr>
<tr>
<td>0</td>
<td>2(0) + 6</td>
<td>6</td>
<td>(0, 6)</td>
</tr>
<tr>
<td>1</td>
<td>2(1) + 6</td>
<td>8</td>
<td>(1, 8)</td>
</tr>
</tbody>
</table>

2. \( y - 5 = -2(3x - 1) \)

\[ y - 5 = -6x + 2 \]

\[ y = -6x + 7 \]

Since the equation can be written in \( y = mx + b \) form it is linear. The equation is not true for \((0, 0), 0 \neq 7\), therefore the relationship between \( x \) and \( y \) is not proportional.

3. Yes it is linear since the equation is of the form \( y = mx + b \). No it is not proportional because the equation is not true for \((0, 0), 0 \neq 3\). She would spend $63 on groceries since \( y = 2(30) + 3 = 63 \).

4. \( y = 12x + 5; 60 = 12x + 5 \), so \( x = \frac{55}{12} \) h or 275 min.

5. It is not linear. The graph is a V-shape. Therefore, it is nonproportional.