Worksheet: Functions, Domain, Range

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Which of the following relations is not a function?
   a. \[\{(-3, -2), (-1, 3), (0, -2), (3, 4)\}\]
   b. \[\{(0, 1), (3, 2), (5, -3), (0, 2)\}\]
   c. \[\{(4, -7), (-9, 5), (4, -2), (-9, 0)\}\]
   d. \[\{(0, 2), (2, 3), (0, 4), (3, 5)\}\]

2. Which relation is a function?
   a. \[\{(-3, -2), (-1, 3), (0, -2), (3, 4)\}\]
   b. \[\{(0, 1), (3, 2), (5, -3), (0, 2)\}\]
   c. \[\{(-7, -7), (-2, 5), (-1, 6), (-2, -5)\}\]
   d. \[\{(4, -7), (-9, 5), (4, -2), (-9, 0)\}\]

3. Which of the following relations is not a function?
   a. The relation between height and time if a tree grows 4 cm/yr
   b. The relation between money earned and time if interest for a bank account is 5% per month
   c. The relation between distance and time if a car travels 85 km/h
   d. The relation between students' ages and points scored on a test

4. Which relation is a function?
   a. \[2x^2 - 5y^2 = -24\]
   b. \[y = 2x^2 - 3x + 7\]
   c. \[\frac{x^2}{4} - \frac{y^2}{9} = 1\]
   d. \[y^2 = -x + 3y\]

5. Which graph is not a function?
6. Which relation is not a function?
   a. \{(-13, -10), (-15, -12), (-11, -8), (-16, 4)\}
   b. \{(8, 17), (5, 5), (8, -3), (4, -1)\}
   c. \{(-14, -2), (-10, 6), (-1, 3), (10, 6)\}
   d. \{(0, -2), (-4, 6), (4, 15), (12, 6)\}

7. Which graph is not a function?
   a. [Graph 1]
   b. [Graph 2]
   c. [Graph 3]
8. What are the domain and range of the relation?

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
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<tbody>
<tr>
<td>1990</td>
<td>4965</td>
</tr>
<tr>
<td>1995</td>
<td>5199</td>
</tr>
<tr>
<td>2000</td>
<td>5874</td>
</tr>
<tr>
<td>2005</td>
<td>5821</td>
</tr>
</tbody>
</table>

a. Domain = \{1990 ≤ x ≤ 2005\}  
Range = \{4965 ≤ y ≤ 5874\}

Range = \{4965, 5199, 5821, 5874\}

c. Domain = \{x ∈ \mathbb{R}\}  
Range = \{y ∈ \mathbb{R}\}

d. Domain = \{1990, 2005\}  
Range = \{4965, 5874\}

9. A recycling plant recycled 4.9 kg of paper and cardboard the first hour and 7.8 kg/h afterwards. The plant runs for 8 hours. What is the range of the function?

a. \{0 ≤ y ≤ 8\}  
c. \{y ∈ \mathbb{R}\}

b. \{0 ≤ y ≤ 67.2\}  
d. \{4.9 ≤ y ≤ 67.2\}

10. What is the domain of the relation shown?

a. \{-3, -2, 0, 1, 2, 4\}  
c. \{x ∈ \mathbb{I}\}

b. \{-3 ≤ x ≤ 4\}  
d. \{-4, -1, 0, 2, 3, 5\}

11. What are the domain and range of the function \(f(x) = \sqrt{x - 5}\)?
a. Domain = \{x \in \mathbb{R}\}
Range = \{y \in \mathbb{R}\}
b. Domain = \{x \in \mathbb{R} | x \geq 0\}
Range = \{y \in \mathbb{R} | y \geq 0\}
c. Domain = \{x \in \mathbb{R} | x \geq 25\}
Range = \{y \in \mathbb{R} | y \geq 1\}
d. Domain = \{x \in \mathbb{R} | x \geq 5\}
Range = \{y \in \mathbb{R} | y \geq 0\}

12. What are the domain and range of the relation shown?

13. Describe the graph of the relation \(x = -4\). Is the relation a function? Explain your answer.

14. Describe the graph of the relation \(y = 6\). Is the relation a function? Explain your answer.

15. State the domain and range of the relation shown. Is the relation a function?

16. Flower bouquets for a wedding cost $44.50 each. Write a function to describe the amount of money you have to the number of bouquets of flowers you can purchase if you have $360 to spend. Write the domain and range of the function. Explain your answer.
17. State the domain and range of the relation shown. Is the relation a function?

\[ (x + 2)^2 + (y - 5)^2 = 25 \]

18. A relation is defined by \((x + 2)^2 + (y - 5)^2 = 25\). Graph and determine the domain and range of the relation.

**Problem**

19. A ball is dropped from a window that is 20 metres above the ground. The relation \( y = -5t^2 + 20 \) gives the height of the ball in metres after \( t \) seconds. Explain why this relation must be a function. Graph the function and explain why the range has a lower limit.

20. Jeff mows lawns at $15 for each lawn. He also spends $5.75 in gas and maintenance for his lawnmower for each day. He has time to mow only 7 lawns in one day.
   a) Write an equation that can be used to show how much money Jeff can earn in one day.
   b) Graph your equation.
   c) What are the domain and range of the relation?
d) Is the relation a function?

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Answer Section

MULTIPLE CHOICE

1. ANS: C       PTS: 1       REF: Knowledge and Understanding
   OBJ: 1.1 - Relations and Functions
2. ANS: A       PTS: 1       REF: Knowledge and Understanding
   OBJ: 1.1 - Relations and Functions
3. ANS: D       PTS: 1       REF: Application   OBJ: 1.1 - Relations and Functions
4. ANS: B       PTS: 1       REF: Thinking     OBJ: 1.1 - Relations and Functions
5. ANS: C       PTS: 1       REF: Knowledge and Understanding
   OBJ: 1.1 - Relations and Functions
6. ANS: B       PTS: 1       REF: Knowledge and Understanding
   OBJ: 1.1 - Relations and Functions
7. ANS: A       PTS: 1       REF: Knowledge and Understanding
   OBJ: 1.1 - Relations and Functions
8. ANS: B       PTS: 1       REF: Application
   OBJ: 1.4 - Determining the Domain and Range of a Function
9. ANS: D       PTS: 1       REF: Application
   OBJ: 1.4 - Determining the Domain and Range of a Function
10. ANS: A      PTS: 1       REF: Knowledge and Understanding
    OBJ: 1.4 - Determining the Domain and Range of a Function
11. ANS: D      PTS: 1       REF: Knowledge and Understanding
    OBJ: 1.4 - Determining the Domain and Range of a Function
12. ANS: A      PTS: 1       REF: Knowledge and Understanding
    OBJ: 1.4 - Determining the Domain and Range of a Function

SHORT ANSWER

13. ANS:
The graph of $x = -4$ is a vertical line that crosses the $x$-axis at $(−4, 0)$. The relation is not a function because it
does not pass the vertical-line test.

   PTS: 1       REF: Communication   OBJ: 1.1 - Relations and Functions

14. ANS:
The graph of $y = 6$ is a horizontal line that crosses the $y$-axis at $(0, 6)$. The relation is a function because it
passes the vertical-line test.

   PTS: 1       REF: Communication   OBJ: 1.1 - Relations and Functions

15. ANS:
Domain = \{x \in \mathbb{R} \mid x \leq -2 \text{ and } x \geq 2\},
Range = \{y \in \mathbb{R}\}; no, the relation is not a function.

   PTS: 1       REF: Application   OBJ: 1.4 - Determining the Domain and Range of a Function

16. ANS:
\( f(x) = -44.5x + 360 \), the domain is \( \{x \in \mathbb{R} \mid 0 \leq x \leq 6\} \) because I have enough money to buy 8 bouquets. The range is \( \{4, 48.5, 93, 137.5, 182, 226.5, 271, 315.5, 360\} \) which represents the amount of money I have after purchasing each bouquet.

17. ANS:
Domain = \( \{x \in \mathbb{R} \mid -2 \leq x \leq 6\} \), Range = \( \{y \in \mathbb{R} \mid -1 \leq y \leq 3\} \); no, the relation is not a function.

18. ANS:
\[
\begin{array}{c}
\text{Domain} = \{x \in \mathbb{R} \mid -7 \leq x \leq 2\} \\
\text{Range} = \{y \in \mathbb{R} \mid 0 \leq y \leq 1\}
\end{array}
\]

19. ANS:
This relation is a function because there is a unique dependent value for each independent value. The range has a lower limit because the height of the ball is at 0 metres once it reaches the ground and it cannot drop any further.
PTS: 1    REF: Communication    OBJ: 1.1 - Relations and Functions

20. ANS:

a) \[ y = 15x - 5.75 \]

b) 

c) Domain = \{ x \in \mathbb{I} \mid 0 \leq x \leq 7 \}

Range = \{-5.75, 9.25, 24.25, 39.25, 54.25, 69.25, 84.25, 99.25\}

d) yes

PTS: 1    REF: Application    OBJ: 1.1 - Relations and Functions