Domain and Range

Name: _____ Date: _____ Score: _____ / 26

Quick Review

Domain = all inputs (x-values) a function accepts. **Range** = all outputs (y-values) the function produces. For a list of ordered pairs or a table, just list the x's (domain) and y's (range), no repeats. From a graph, scan left to right for the domain, bottom to top for the range. **Discrete** data (separate points) uses set notation $\{1, 2, 3\}$; **continuous** data (connected curves) uses interval notation $[1, 3]$. Brackets [ ] mean "included"; parentheses ( ) mean "not included." Watch for restrictions: denominators can't be zero, expressions under square roots can't be negative.

PRACTICE

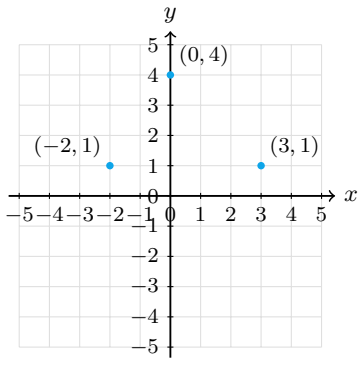
Find the domain and range for each.

1. $\{(1, 4), (2, 8), (3, 12)\}$ _____
2. $\{(0, 0), (1, 1), (2, 4), (3, 9)\}$ _____
3. $\{(-5, 3), (-2, 3), (4, 3)\}$ _____
4. $y = 2x + 1$ for all real x _____
5. $y = x^2$ for all real x _____
6. $y = -3x$ for $0 \leq x \leq 5$ _____
7. Points $(-3, 1), (-1, 3), (2, 0), (3, 2)$ _____
8. $y = |x|$ for $-4 \leq x \leq 4$ _____
9. $f(x) = \dfrac{1}{x}$ _____
10. $\{(2, 6), (2, 9), (3, 6)\}$ _____
11. Line through $(-3, -2)$ and $(3, 2)$, closed ends _____
12. Horizontal line $y = 2$ _____
13. $f(x) = \sqrt{x}$ _____
14. $f(x) = \sqrt{x - 4}$ _____
15. $y = 2^x$ _____
16. $y = 3$ for $x > 0$ _____
17. $f(x) = \dfrac{1}{x - 2}$ _____
18. $y = x^2 + 5$ for all real x _____
19. Cost of n tickets at \$10, $n = 1$ to 5 _____
20. Time of a 100-mile drive at speed r, $r > 0$ _____

VISUAL PRACTICE

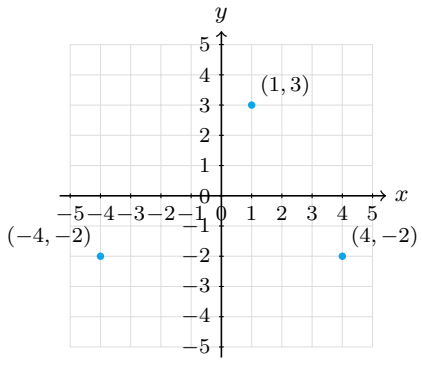
Use the graph, table, chart, or diagram to answer the question.

21. Find the domain and range of the plotted points.



Answer: _____

22. Find the domain and range of the plotted points.



Answer: _____

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Word Problems

23. A movie theater charges $C(t) = 12t$ for t tickets. You can buy 1 to 10 tickets. State the domain and range.

Model: _____ **Answer:** _____

24. A ball is dropped from a 64-foot building. Its height is $h(t) = 64 - 16t^2$ for $t \geq 0$. State the domain and range in context.

Model: _____ **Answer:** _____

25. A car rental costs $30 per day. You rent for d days, where d is a whole number from 1 to 7. State the domain and range.

Model: _____ **Answer:** _____

26. A water tank's volume is $V(t) = 500 - 20t$ liters, where t is time in minutes. The tank drains until empty. State the domain and range in context.

Model: _____ **Answer:** _____

Answer Keys

1. $D = \{1, 2, 3\},\ R = \{4, 8, 12\}$
2. $D = \{0, 1, 2, 3\},\ R = \{0, 1, 4, 9\}$
3. $D = \{-5, -2, 4\},\ R = \{3\}$
4. $D = \mathbb{R},\ R = \mathbb{R}$
5. $D = \mathbb{R},\ R = [0, \infty)$
6. $D = [0, 5],\ R = [-15, 0]$
7. $D = \{-3, -1, 2, 3\},\ R = \{0, 1, 2, 3\}$
8. $D = [-4, 4],\ R = [0, 4]$
9. $D = x \neq 0,\ R = y \neq 0$
10. $D = \{2, 3\},\ R = \{6, 9\}$; not a function
11. $D = [-3, 3],\ R = [-2, 2]$
12. $D = \mathbb{R},\ R = \{2\}$
13. $D = [0, \infty),\ R = [0, \infty)$
14. $D = [4, \infty),\ R = [0, \infty)$
15. $D = \mathbb{R},\ R = (0, \infty)$
16. $D = (0, \infty),\ R = \{3\}$
17. $D = x \neq 2,\ R = y \neq 0$
18. $D = \mathbb{R},\ R = [5, \infty)$
19. $D = \{1, 2, 3, 4, 5\},\ R = \{10, 20, 30, 40, 50\}$
20. $D = (0, \infty),\ R = (0, \infty)$
21. $D = \{-2, 0, 3\},\ R = \{1, 4\}$
22. $D = \{-4, 1, 4\},\ R = \{-2, 3\}$
23. $D = \{1, 2, \ldots, 10\},\ R = \{12, 24, \ldots, 120\}$
24. $D = [0, 2],\ R = [0, 64]$
25. $D = \{1, \ldots, 7\},\ R = \{30, 60, \ldots, 210\}$
26. $D = [0, 25],\ R = [0, 500]$

Step-by-Step Tutor Notes

1. Think of slope as the amount the output changes for each 1-unit change in the input. Just list the x's and y's separately. So the requested value is $D = \{1, 2, 3\},\ R = \{4, 8, 12\}$.
2. Use the clue in the question first, then let the arithmetic finish the job. These are squares, but the domain/range just lists what appears. So the answer is $D = \{0, 1, 2, 3\},\ R = \{0, 1, 4, 9\}$.
3. Take it one clear step at a time and keep the original question in mind. All three outputs are 3, so the range is just one element. So the answer is $D = \{-5, -2, 4\},\ R = \{3\}$.
4. A non-horizontal line covers every real x and produces every real y. Both are all real numbers.
5. Domain is all reals, but the parabola never dips below 0, so the range is $y \geq 0$.
6. As x goes from 0 to 5, y goes from 0 down to -15. (Negative slope flips the range orientation.).
7. Focus on the main idea of the problem, then simplify carefully. List the x's, then the y's — sort each in order if you want. So the answer is $D = \{-3, -1, 2, 3\},\ R = \{0, 1, 2, 3\}$.
8. x runs from -4 to 4; $|x|$ runs from 0 (at $x = 0$) up to 4 (at the endpoints).
9. Can't divide by zero, so $x \neq 0$. And $\frac{1}{x}$ is never exactly 0, so $y \neq 0$ either.
10. The domain is $\{2, 3\}$ and the range is $\{6, 9\}$. Since $x = 2$ has two outputs, the relation is not a function.
11. Focus on the main idea of the problem, then simplify carefully. Closed dots include the endpoints. x goes -3 to 3; y goes -2 to 2. So the answer is $D = [-3, 3],\ R = [-2, 2]$.
12. Start with the definition the problem is testing, then apply it directly. x takes all values; y is always 2. So the answer is $D = \mathbb{R},\ R = \{2\}$.
13. Focus on the main idea of the problem, then simplify carefully. Square roots need non-negative inputs, and they return non-negative outputs. So the answer is $D = [0, \infty),\ R = [0, \infty)$.
14. Inside the radical must be ≥ 0: $x - 4 \geq 0$, so $x \geq 4$. Output still starts at 0.
15. Exponentials accept any x, and the output is always positive but approaches 0 without reaching it.
16. This is a good place to slow down, check the notation, and simplify cleanly. Restricted constant function. Only the open right side of $x = 0$ is allowed. So the answer is $D = (0, \infty),\ R = \{3\}$.
17. Denominator can't be zero: $x \neq 2$. Output never reaches 0 for the same reason as before.
18. Use the structure of the expression to find the important point, then check that it fits the context. Domain is all reals. Range starts at 5 (the vertex) and goes up. That leads to $D = \mathbb{R},\ R = [5, \infty)$.
19. Start with the definition the problem is testing, then apply it directly. Tickets are discrete (whole numbers only). Domain and range are listed sets. So the answer is $D = \{1, 2, 3, 4, 5\},\ R = \{10, 20, 30, 40, 50\}$.
20. Speed must be positive (no division by zero, no driving backwards). Time can be any positive number depending on speed.
21. The domain is the set of x-values. The range is the set of y-values.
22. The domain is the set of x-values: $\{-4, 1, 4\}$. The range is the set of y-values: $\{-2, 3\}$.
23. Tickets are whole numbers from 1 to 10, so the domain is the set $\{1, 2, \ldots, 10\}$. The cost goes from $12(1) = 12$ up to $12(10) = 120$ in \$12 steps. Discrete points — don't connect them with a line.
24. Time starts at 0. The ball hits the ground when $h(t) = 0$: $64 - 16t^2 = 0$, so $t^2 = 4$, $t = 2$ (positive root). Domain is $[0, 2]$. Height goes from 0 ft (ground) up to 64 ft (start). Range $[0, 64]$.
25. Days are whole numbers 1 through 7. Cost is $30d$ in steps of 30: $30, 60, 90, \ldots, 210$. Discrete data.
26. Time starts at 0; tank empties when $V = 0$: $500 - 20t = 0$, so $t = 25$ minutes. Domain $[0, 25]$. Volume runs 500 (start) down to 0 (empty). Range $[0, 500]$.

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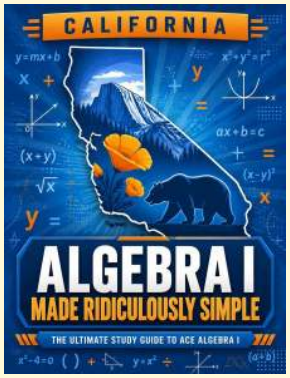

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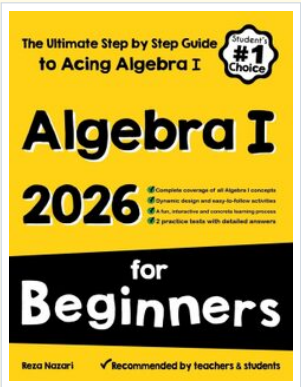

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