Sketching and Describing Function Graphs

Name: _____	Date: _____	Score: _____ / 24

Quick Review

You can **describe** a function's graph without drawing it. A function is **increasing** where the output goes up as the input goes up, **decreasing** where the output goes down, and **constant** where the output stays the same. For a linear function $y = mx + b$, a *positive* slope means increasing, a *negative* slope means decreasing, and a *zero* slope means constant. A graph is **linear** if it is a straight line and **nonlinear** if it curves. Reading these clues lets you picture the shape of the graph in your head.

◇ **Example:** Describe the graph of $y = -2x + 5$: is it increasing or decreasing, and linear or nonlinear?
⇒ Look at the equation. The slope is -2, which is negative, so as x gets bigger the output y gets smaller — the graph is **decreasing**. And since x is only to the first power, the graph is a straight line — it is **linear**. So you can picture a straight line tilting downward as you read it left to right.

Answer: decreasing and linear

PRACTICE

Describe each function's behavior as directed.

1. Is $y = 3x + 1$ increasing or decreasing? _____
2. Is $y = -5x + 2$ increasing or decreasing? _____
3. Is $y = 8$ increasing, decreasing, or constant? _____
4. Is $y = x - 6$ increasing or decreasing? _____
5. Is $y = -x$ increasing or decreasing? _____
6. Is $y = \frac{1}{4}x + 3$ increasing or decreasing? _____
7. Is the graph of $y = 2x + 7$ linear or nonlinear? _____
8. Is the graph of $y = x^2 - 1$ linear or nonlinear? _____
9. Is the graph of $y = -4x$ linear or nonlinear? _____
10. Is the graph of $y = \frac{6}{x}$ linear or nonlinear? _____
11. A line passes $(0, 2)$ and $(1, 5)$. Increasing or decreasing? _____
12. A line passes $(0, 9)$ and $(2, 3)$. Increasing or decreasing? _____
13. A line passes $(0, 4)$ and $(5, 4)$. Increasing, decreasing, or constant? _____
14. Does $y = 7x + 1$ cross the y-axis above or below 0? _____
15. Does $y = 2x - 8$ cross the y-axis above or below 0? _____
16. Where does $y = 3x + 6$ cross the y-axis? _____
17. Where does $y = -2x - 5$ cross the y-axis? _____
18. A graph rises, then flattens, then rises again. Linear or nonlinear? _____
19. A graph is a curve that always goes up. Increasing or decreasing? _____
20. Which is steeper: $y = 4x$ or $y = 9x$? _____

♦ Word Problems

21. A runner's distance from home is described by a graph: it rises steadily, then is flat for a while, then rises again. Describe in words what the runner is doing during the flat part. _____
22. A candle's height over time follows $y = -3x + 18$. Is the graph increasing or decreasing, and what does that mean for the candle? _____
23. A savings account follows $y = 10x + 100$, where x is weeks. Describe the graph and say where it crosses the y-axis and what that point means. _____
24. A car's speed over time is shown by a curve that rises quickly, then levels off near a top speed. Is this graph linear or nonlinear, and is the car's speed increasing the whole time? _____

Answer Keys

1. increasing
2. decreasing
3. constant
4. increasing
5. decreasing
6. increasing
7. linear
8. nonlinear
9. linear
10. nonlinear
11. increasing
12. decreasing
13. constant
14. above
15. below
16. $(0, 6)$
17. $(0, -5)$
18. nonlinear
19. increasing
20. $y = 9x$
21. The runner is resting (distance stays constant)
22. decreasing; the candle is getting shorter
23. increasing, linear; crosses at $(0, 100)$ — the starting balance
24. nonlinear; speed is increasing but more and more slowly

Step-by-Step Explanations

1. The slope 3 is positive, so y rises as x rises — increasing.
2. The slope -5 is negative, so y falls as x rises — decreasing.
3. The slope is 0, so the output never changes — the graph is a flat, constant line.
4. The slope is 1, which is positive, so the graph is increasing.
5. The slope is -1, which is negative, so the graph is decreasing.
6. The slope $\frac{1}{4}$ is positive, so the graph rises — increasing.
7. The x is first power, so the graph is a straight line — linear.
8. The x is squared, so the graph curves — nonlinear.
9. The x is first power, so it is a straight line — linear.
10. With x in the denominator the graph is a curve — nonlinear.
11. Slope $= \frac{5-2}{1} = 3$, which is positive — the graph is increasing.
12. Slope $= \frac{3-9}{2} = -3$, which is negative — the graph is decreasing.
13. Slope $= \frac{4-4}{5} = 0$, so the output never changes — constant.
14. The y-intercept is 1, which is positive, so the graph crosses the y-axis above 0.
15. The y-intercept is -8, which is negative, so it crosses below 0.
16. The y-intercept is $b = 6$, so the graph crosses the y-axis at $(0, 6)$.
17. The y-intercept is $b = -5$, so the graph crosses at $(0, -5)$.
18. A straight line keeps the same steepness everywhere. A graph that changes its behavior must be nonlinear.
19. "Always goes up" means the output rises as the input rises — the graph is increasing (just not linear).
20. Steepness is the size of the slope. Since $9 > 4$, the graph of $y = 9x$ is steeper.
21. During the flat part the slope is 0, so the distance from home is not changing. The runner has stopped — resting — before moving again.
22. The slope -3 is negative, so the graph decreases. That means the candle's height is dropping over time — it is burning down.
23. The slope 10 is positive and x is first power, so the graph is increasing and linear. The intercept $(0, 100)$ is the balance at week 0 — the $100 already saved.
24. Because the steepness changes — steep at first, then flatter — the graph is nonlinear. The speed is still increasing the whole time, just by smaller and smaller amounts as it nears the top speed.

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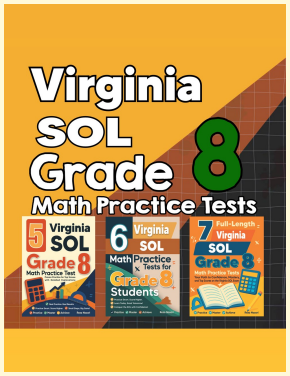

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