

Sketching and Describing Function Graphs

Name: _____ Date: _____ Score: _____ / 24

Q 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.

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

◆ 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

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| <ol style="list-style-type: none"> 1. increasing 2. decreasing 3. constant 4. increasing 5. decreasing 6. increasing 7. linear 8. nonlinear 9. linear 10. nonlinear 11. increasing 12. decreasing | <ol style="list-style-type: none"> 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 |
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Step-by-Step Explanations

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| <ol style="list-style-type: none"> 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. | <ol style="list-style-type: none"> 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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