

# 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"> <li>1. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">increasing</span></li> <li>2. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">decreasing</span></li> <li>3. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">constant</span></li> <li>4. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">increasing</span></li> <li>5. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">decreasing</span></li> <li>6. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">increasing</span></li> <li>7. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">linear</span></li> <li>8. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">nonlinear</span></li> <li>9. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">linear</span></li> <li>10. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">nonlinear</span></li> <li>11. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">increasing</span></li> <li>12. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">decreasing</span></li> </ol> | <ol style="list-style-type: none"> <li>13. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">constant</span></li> <li>14. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">above</span></li> <li>15. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">below</span></li> <li>16. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(0, 6)</span></li> <li>17. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(0, -5)</span></li> <li>18. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">nonlinear</span></li> <li>19. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">increasing</span></li> <li>20. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;"><math>y = 9x</math></span></li> <li>21. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">The runner is resting (distance stays constant)</span></li> <li>22. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">decreasing; the candle is getting shorter</span></li> <li>23. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">increasing, linear; crosses at (0, 100) — the starting balance</span></li> <li>24. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">nonlinear; speed is increasing but more and more slowly</span></li> </ol> |
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### Step-by-Step Explanations

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| <ol style="list-style-type: none"> <li>1. The slope 3 is positive, so <math>y</math> rises as <math>x</math> rises — increasing.</li> <li>2. The slope <math>-5</math> is negative, so <math>y</math> falls as <math>x</math> rises — decreasing.</li> <li>3. The slope is 0, so the output never changes — the graph is a flat, constant line.</li> <li>4. The slope is 1, which is positive, so the graph is increasing.</li> <li>5. The slope is <math>-1</math>, which is negative, so the graph is decreasing.</li> <li>6. The slope <math>\frac{1}{4}</math> is positive, so the graph rises — increasing.</li> <li>7. The <math>x</math> is first power, so the graph is a straight line — linear.</li> <li>8. The <math>x</math> is squared, so the graph curves — nonlinear.</li> <li>9. The <math>x</math> is first power, so it is a straight line — linear.</li> <li>10. With <math>x</math> in the denominator the graph is a curve — nonlinear.</li> <li>11. Slope = <math>\frac{5-2}{1} = 3</math>, which is positive — the graph is increasing.</li> <li>12. Slope = <math>\frac{3-9}{2} = -3</math>, which is negative — the graph is decreasing.</li> <li>13. Slope = <math>\frac{4-4}{5} = 0</math>, so the output never changes — constant.</li> <li>14. The <math>y</math>-intercept is 1, which is positive, so the graph crosses the <math>y</math>-axis above 0.</li> <li>15. The <math>y</math>-intercept is <math>-8</math>, which is negative, so it crosses below 0.</li> </ol> | <ol style="list-style-type: none"> <li>16. The <math>y</math>-intercept is <math>b = 6</math>, so the graph crosses the <math>y</math>-axis at (0, 6).</li> <li>17. The <math>y</math>-intercept is <math>b = -5</math>, so the graph crosses at (0, <math>-5</math>).</li> <li>18. A straight line keeps the same steepness everywhere. A graph that changes its behavior must be nonlinear.</li> <li>19. "Always goes up" means the output rises as the input rises — the graph is increasing (just not linear).</li> <li>20. Steepness is the size of the slope. Since <math>9 &gt; 4</math>, the graph of <math>y = 9x</math> is steeper.</li> <li>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.</li> <li>22. The slope <math>-3</math> is negative, so the graph decreases. That means the candle's height is dropping over time — it is burning down.</li> <li>23. The slope 10 is positive and <math>x</math> is first power, so the graph is increasing and linear. The intercept (0, 100) is the balance at week 0 — the \$100 already saved.</li> <li>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.</li> </ol> |
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