

# Graphing Linear Inequalities in Two Variables

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

A **linear inequality in two variables**, like  $y > 2x + 1$ , has a whole *region* of solutions, not just a line. To graph it, first graph the **boundary line**  $y = 2x + 1$ . Use a **solid line** for  $\leq$  or  $\geq$  (the line is included) and a **dashed line** for  $<$  or  $>$  (not included). Then **shade** the side that works: for  $y >$  shade above, for  $y <$  shade below. To test whether a point is a solution, just substitute it in — if it makes a true statement, it's in the shaded region.

◊ **Example:** Is the point  $(2, 5)$  a solution of  $y > 2x - 1$ ?

⇒ To check a point, we just substitute its coordinates and see if the inequality stays true. Here  $x = 2$  and  $y = 5$ , so we plug in:  $5 > 2(2) - 1$ . Work out the right side:  $2(2) - 1 = 3$ , so the question becomes “is  $5 > 3$ ?” Yes, it is! So  $(2, 5)$  is a solution and would land in the shaded region of the graph. If we had gotten a false statement, the point would be outside it.

**Answer:** yes,  $5 > 3$

## PRACTICE

Test each point in the inequality, or describe the boundary line.

- |                             |       |                                             |       |
|-----------------------------|-------|---------------------------------------------|-------|
| 1. $(0, 0) : y > x + 1$     | _____ | 11. $y > x + 2$ : line solid or dashed?     | _____ |
| 2. $(0, 5) : y > x + 1$     | _____ | 12. $y \leq 3x - 1$ : line solid or dashed? | _____ |
| 3. $(3, 2) : y < x$         | _____ | 13. $y \geq -x$ : line solid or dashed?     | _____ |
| 4. $(1, 4) : y < x$         | _____ | 14. $y < 2x + 5$ : line solid or dashed?    | _____ |
| 5. $(2, 7) : y \geq 2x + 1$ | _____ | 15. $y > x$ : shade above or below?         | _____ |
| 6. $(1, 1) : y \geq 2x + 1$ | _____ | 16. $y < x - 3$ : shade above or below?     | _____ |
| 7. $(4, 0) : y \leq x - 2$  | _____ | 17. $(2, 2) : y \geq x$                     | _____ |
| 8. $(1, 3) : y \leq x - 2$  | _____ | 18. $(6, 1) : y < \frac{1}{2}x$             | _____ |
| 9. $(0, 0) : y \leq 3x + 4$ | _____ | 19. $(0, 4) : y \leq 2x + 1$                | _____ |
| 10. $(5, 2) : y > x - 1$    | _____ | 20. $(3, 10) : y > 3x$                      | _____ |

## ◆ Word Problems

21. A student earns \$10 per lawn ( $x$ ) and \$15 per car wash ( $y$ ), and wants to earn more than \$60. Does mowing 3 lawns and washing 2 cars satisfy  $10x + 15y > 60$ ? \_\_\_\_\_
22. A backpack can hold no more than 20 lb. Books weigh 2 lb each ( $x$ ) and notebooks 1 lb each ( $y$ ). Does 5 books and 8 notebooks satisfy  $2x + y \leq 20$ ? \_\_\_\_\_
23. A line has equation  $y = 4x - 3$ . For the inequality  $y \geq 4x - 3$ , should the boundary line be solid or dashed, and which side is shaded? \_\_\_\_\_
24. A budget says spending  $x$  on snacks and  $y$  on drinks must stay under \$25, so  $x + y < 25$ . Is spending \$12 on snacks and \$10 on drinks allowed? \_\_\_\_\_



## Answer Keys

- |                                         |                                                          |
|-----------------------------------------|----------------------------------------------------------|
| 1. <input type="text" value="no"/>      | 13. <input type="text" value="solid"/>                   |
| 2. <input type="text" value="yes"/>     | 14. <input type="text" value="dashed"/>                  |
| 3. <input type="text" value="yes"/>     | 15. <input type="text" value="above"/>                   |
| 4. <input type="text" value="no"/>      | 16. <input type="text" value="below"/>                   |
| 5. <input type="text" value="yes"/>     | 17. <input type="text" value="yes"/>                     |
| 6. <input type="text" value="no"/>      | 18. <input type="text" value="yes"/>                     |
| 7. <input type="text" value="yes"/>     | 19. <input type="text" value="no"/>                      |
| 8. <input type="text" value="no"/>      | 20. <input type="text" value="yes"/>                     |
| 9. <input type="text" value="yes"/>     | 21. <input type="text" value="no"/>                      |
| 10. <input type="text" value="no"/>     | 22. <input type="text" value="yes"/>                     |
| 11. <input type="text" value="dashed"/> | 23. <input type="text" value="solid line, shade above"/> |
| 12. <input type="text" value="solid"/>  | 24. <input type="text" value="yes"/>                     |

### Step-by-Step Explanations

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| <p>1. Substitute: <math>0 &gt; 0 + 1</math> means <math>0 &gt; 1</math>, which is false.</p> <p>2. Substitute: <math>5 &gt; 0 + 1</math> means <math>5 &gt; 1</math>, which is true.</p> <p>3. Substitute: <math>2 &lt; 3</math>, which is true.</p> <p>4. Substitute: <math>4 &lt; 1</math> is false.</p> <p>5. Substitute: <math>7 \geq 2(2) + 1 = 5</math>, which is true.</p> <p>6. Substitute: <math>1 \geq 2(1) + 1 = 3</math> is false.</p> <p>7. Substitute: <math>0 \leq 4 - 2 = 2</math>, which is true.</p> <p>8. Substitute: <math>3 \leq 1 - 2 = -1</math> is false.</p> <p>9. Substitute: <math>0 \leq 3(0) + 4 = 4</math>, which is true.</p> <p>10. Substitute: <math>2 &gt; 5 - 1 = 4</math> is false.</p> <p>11. The symbol <math>&gt;</math> does not include the line, so the boundary is dashed.</p> <p>12. The symbol <math>\leq</math> includes the line, so the boundary is solid.</p> <p>13. The symbol <math>\geq</math> includes the line, so the boundary is solid.</p> <p>14. The symbol <math>&lt;</math> excludes the line, so the boundary is dashed.</p> | <p>15. For <math>y &gt;</math>, the solutions sit above the boundary line.</p> <p>16. For <math>y &lt;</math>, the solutions sit below the boundary line.</p> <p>17. Substitute: <math>2 \geq 2</math> is true (equal counts for <math>\geq</math>).</p> <p>18. Substitute: <math>1 &lt; \frac{1}{2}(6) = 3</math>, which is true.</p> <p>19. Substitute: <math>4 \leq 2(0) + 1 = 1</math> is false.</p> <p>20. Substitute: <math>10 &gt; 3(3) = 9</math>, which is true.</p> <p>21. Substitute <math>x = 3, y = 2</math>: <math>10(3) + 15(2) = 60</math>. Since <math>60 &gt; 60</math> is false, it does not satisfy the inequality.</p> <p>22. Substitute <math>x = 5, y = 8</math>: <math>2(5) + 8 = 18</math>. Since <math>18 \leq 20</math> is true, the load fits.</p> <p>23. The <math>\geq</math> sign includes the line, so it is solid, and <math>y \geq</math> means the solutions are on or above the line.</p> <p>24. Substitute <math>x = 12, y = 10</math>: <math>12 + 10 = 22</math>. Since <math>22 &lt; 25</math> is true, the spending is within budget.</p> |
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