

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

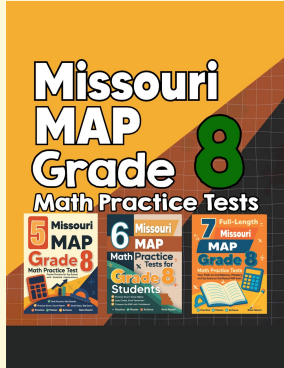
- | | |
|---|--|
| 1. <input type="text" value="no"/> | 13. <input type="text" value="solid"/> |
| 2. <input type="text" value="yes"/> | 14. <input type="text" value="dashed"/> |
| 3. <input type="text" value="yes"/> | 15. <input type="text" value="above"/> |
| 4. <input type="text" value="no"/> | 16. <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

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