

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.

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|-----------------------------|-------|---|-------|
| 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

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|---|---|
| <ol style="list-style-type: none"> 1. <input type="text" value="no"/> 2. <input type="text" value="yes"/> 3. <input type="text" value="yes"/> 4. <input type="text" value="no"/> 5. <input type="text" value="yes"/> 6. <input type="text" value="no"/> 7. <input type="text" value="yes"/> 8. <input type="text" value="no"/> 9. <input type="text" value="yes"/> 10. <input type="text" value="no"/> 11. <input type="text" value="dashed"/> 12. <input type="text" value="solid"/> | <ol style="list-style-type: none"> 13. <input type="text" value="solid"/> 14. <input type="text" value="dashed"/> 15. <input type="text" value="above"/> 16. <input type="text" value="below"/> 17. <input type="text" value="yes"/> 18. <input type="text" value="yes"/> 19. <input type="text" value="no"/> 20. <input type="text" value="yes"/> 21. <input type="text" value="no"/> 22. <input type="text" value="yes"/> 23. <input type="text" value="solid line, shade above"/> 24. <input type="text" value="yes"/> |
|---|---|

Step-by-Step Explanations

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| <ol style="list-style-type: none"> 1. Substitute: $0 > 0 + 1$ means $0 > 1$, which is false. 2. Substitute: $5 > 0 + 1$ means $5 > 1$, which is true. 3. Substitute: $2 < 3$, which is true. 4. Substitute: $4 < 1$ is false. 5. Substitute: $7 \geq 2(2) + 1 = 5$, which is true. 6. Substitute: $1 \geq 2(1) + 1 = 3$ is false. 7. Substitute: $0 \leq 4 - 2 = 2$, which is true. 8. Substitute: $3 \leq 1 - 2 = -1$ is false. 9. Substitute: $0 \leq 3(0) + 4 = 4$, which is true. 10. Substitute: $2 > 5 - 1 = 4$ is false. 11. The symbol $>$ does not include the line, so the boundary is dashed. 12. The symbol \leq includes the line, so the boundary is solid. 13. The symbol \geq includes the line, so the boundary is solid. 14. The symbol $<$ excludes the line, so the boundary is dashed. | <ol style="list-style-type: none"> 15. For $y >$, the solutions sit above the boundary line. 16. For $y <$, the solutions sit below the boundary line. 17. Substitute: $2 \geq 2$ is true (equal counts for \geq). 18. Substitute: $1 < \frac{1}{2}(6) = 3$, which is true. 19. Substitute: $4 \leq 2(0) + 1 = 1$ is false. 20. Substitute: $10 > 3(3) = 9$, which is true. 21. Substitute $x = 3, y = 2$: $10(3) + 15(2) = 60$. Since $60 > 60$ is false, it does not satisfy the inequality. 22. Substitute $x = 5, y = 8$: $2(5) + 8 = 18$. Since $18 \leq 20$ is true, the load fits. 23. The \geq sign includes the line, so it is solid, and $y \geq$ means the solutions are on or above the line. 24. Substitute $x = 12, y = 10$: $12 + 10 = 22$. Since $22 < 25$ is true, the spending is within budget. |
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