Graphing Linear Inequalities

Name: _____	Date: _____	Score: _____ / 37

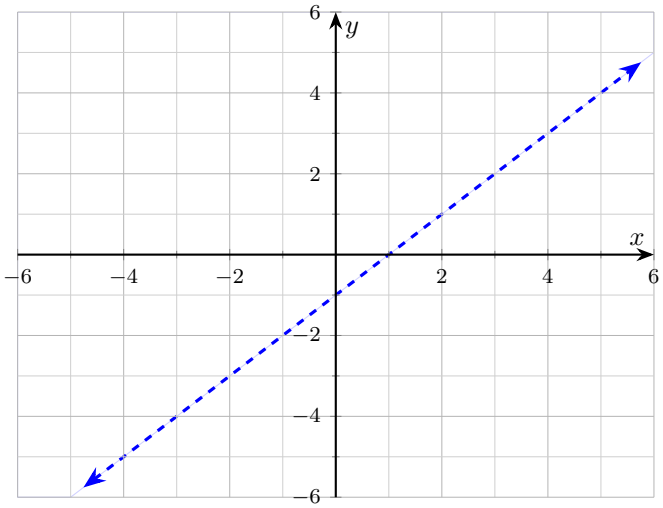
Quick Review

To graph a linear inequality in two variables, do two things: **draw the boundary line**, then **shade the correct half-plane**. The boundary is the equation you'd get by replacing the inequality symbol with $=$. Use a **solid line** for $\leq$ or $\geq$ (boundary included) and a **dashed line** for strict $<$ or $>$ (boundary excluded). For the shading: pick a **test point** not on the line (the origin $(0, 0)$ is easiest if it's not on the boundary). Plug it in. If it makes the inequality true, shade the side that contains it; if false, shade the other side. A handy shortcut: once you have the line in $y = mx + b$ form, $y > mx + b$ means shade *above*, $y < mx + b$ means shade *below*. Watch out: rewriting $-2y > 4x - 6$ as y-isolated form requires dividing by -2, which flips the inequality (and decides whether you shade above or below).

PRACTICE

Solve, sketch, or describe the graph as directed.

1. Boundary line of $y > 2x - 3$ _____
2. Shade above or below for $y > 2x - 3$ _____
3. Boundary line of $y \leq -x + 4$ _____
4. Solid or dashed: $3x - 2y < 6$ _____
5. Test the origin for $2x + y \geq 4$ _____
6. Is $(1, 2)$ a solution of $3x - y < 5$? _____
7. Is $(0, 0)$ a solution of $y > x + 1$? _____
8. $y > \frac{1}{2}x - 1$: above or below? _____
9. $-2y > 4x - 6$: rewrite and decide which side to shade _____
10. Boundary of $y \geq 4$ _____
11. Boundary of $x < -2$ _____
12. Is $(4, -1)$ a solution of $x - 2y \leq 5$? _____
13. Which inequality describes the graph below? _____



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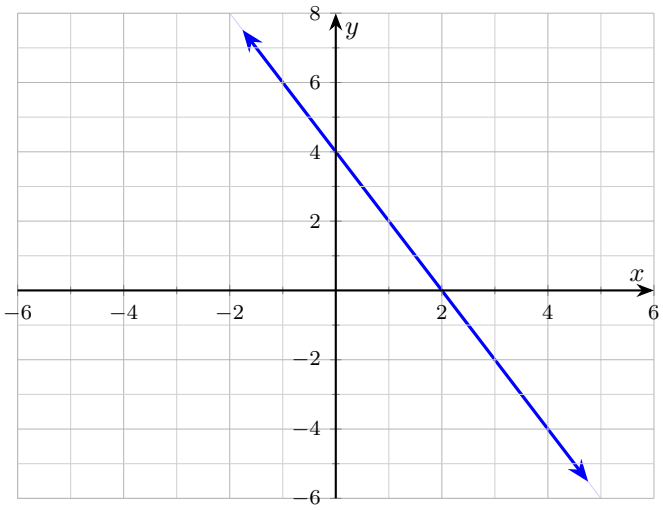
14. Which inequality describes the graph below? _____



15. Rewrite $4x + 2y > 8$ in slope-intercept form. _____

16. Shade above or below for $y < -3x + 1$ _____

17. Is $(2, 5)$ a solution of $y \geq 2x + 1$? _____

18. Rewrite $-y \leq 3 - 2x$ to graph. _____

19. Boundary slope and intercept of $2y - 4x = 8$ for graphing. _____

20. Is the origin in the solution set of $y < -x + 2$? _____

♦ Word Problems

21. A bakery sells muffins for $\$2$ and bagels for $\$3$. To meet sales goals, total revenue must be at least $\$60$. Write an inequality in m (muffins) and b (bagels), and determine whether selling 20 muffins and 5 bagels meets the goal. ____

22. A delivery van's load L (in pounds) plus packages P (each weighing 50 lb) must satisfy $L + 50P \leq 2000$. If $L = 500$ pounds, what is the maximum number of packages? ____

23. Draw the boundary line and describe the region for $y > -x + 2$. Is the origin in the region? ____

24. A movie theater's ticket sales satisfy $8a + 5c \geq 200$, where a is adult tickets and c is child tickets. If 15 adult tickets are sold, what is the minimum number of child tickets needed to meet the goal? ____

Additional Practice

25. Solve $3x - 7 \leq 11$. _____

26. Solve $-2x + 5 > 13$. _____

27. Solve $4(x - 3) \geq 2x + 6$. _____

28. Solve $-5 \leq 2x + 1 < 9$. _____

29. Write the boundary line for $y < -3x + 4$. _____

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30. For $y \geq 2x - 5$, is the boundary solid or dashed? _____

31. For $y < -x + 6$, shade above or below the line? _____

32. Test $(0, 0)$ in $y > 4x - 3$. _____

33. Solve $7 - 3x \leq -8$. _____

34. Solve $2x + 5 > 1$ and $x - 4 \leq 3$. _____

35. Graph $x \leq -2$: vertical or horizontal boundary? _____

36. Graph $y > 5$: vertical or horizontal boundary? _____

37. Is $(-1, 4)$ a solution of $y \leq -2x + 1$? _____

Answer Keys

1. $y = 2x - 3$ (dashed)
2. above
3. $y = -x + 4$ (solid)
4. dashed
5. false; shade away
6. yes
7. no
8. above
9. $y < -2x + 3$, shade below
10. $y = 4$ (solid horizontal)
11. $x = -2$ (dashed vertical)
12. no
13. $y > x - 1$
14. $y \leq -2x + 4$
15. $y > -2x + 4$
16. below
17. yes
18. $y \geq 2x - 3$
19. $y = 2x + 4$
20. yes
21. $2m + 3b \geq 60$; no, $\$55 < \$60$
22. $P \leq 30$
23. Dashed line $y = -x + 2$; shade above; origin not included
24. $c \geq 16$

Additional Practice Answers

25. $x \leq 6$
26. $x < -4$
27. $x \geq 9$
28. $-3 \leq x < 4$
29. $y = -3x + 4$
30. solid
31. below
32. true
33. $x \geq 5$
34. $-2 < x \leq 7$
35. vertical
36. horizontal
37. no

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. A careful way to see it: Strict inequality $>$ $\Rightarrow$ dashed boundary. Slope 2, y-intercept $(0, -3)$. That gives a quick check on the answer.
2. For $y >$ stuff, shade the half-plane above the line. (Test $(0, 0)$: $0 > -3$, true. Origin is above the line $\Rightarrow$ shade that side.)
3. One steady path is: $\leq$ includes the boundary, so the line is solid. Slope -1, y-intercept $(0, 4)$. That gives a quick check on the answer.
4. Look only at the symbol. A strict $<$ (no "or equal to") means points *on* the boundary don't count, so draw the line dashed. Solid lines are reserved for $\leq$ and $\geq$.
5. Plug $(0, 0)$: $0 + 0 \geq 4$ is false. Origin is in the wrong half-plane — shade the side that does not contain $(0, 0)$.
6. Keep the rule visible: $3(1) - 2 = 1$, and $1 < 5$ is true. Yes, it's a solution. This is the part to check before moving on, because it keeps the answer tied to the original question.
7. One steady path is: $0 > 0 + 1 = 1$ is false. The origin lies below the line. This is the part to check before moving on, because it keeps the answer tied to the original question.
8. The inequality is already solved for y. When y is *greater than* the line, the solutions sit above it, so shade above. (You can confirm with a test point above the line.)
9. Divide both sides by -2 and flip: $y < -2x + 3$. The $<$ means shade below the boundary.
10. Keep the rule visible: Horizontal line at $y = 4$, solid (because $\geq$). Shade above for $y \geq$. That gives a quick check on the answer.
11. One steady path is: Vertical line at $x = -2$, dashed (strict). Shade everything to the left. That gives a quick check on the answer.
12. Plug in: $4 - 2(-1) = 4 + 2 = 6$. Is $6 \leq 5$? No. The point is not in the solution set. (The trick on this one: $-2(-1)$ is $+2$, not -2.)
13. The boundary $y = x - 1$ is dashed (strict). The shading is above the line, so the inequality is $y > x - 1$.
14. Boundary $y = -2x + 4$ drawn as a solid line (so $\leq$ or $\geq$). Shaded region is at or below: $y \leq -2x + 4$.
15. One steady path is: Subtract $4x$: $2y > -4x + 8$. Divide by 2 (positive — no flip): $y > -2x + 4$. That gives a quick check on the answer.
16. Solved for y already. Since y is *less than* the line, the solution points lie below it — shade below. (The boundary itself is dashed because $<$ is strict.)
17. A careful way to see it: $2(2) + 1 = 5$, and $5 \geq 5$ is true (boundary is included). This is the part to check before moving on, because it keeps the answer tied to the original question.
18. Keep the rule visible: Multiply by -1 and flip: $y \geq -(3 - 2x) = 2x - 3$. The line is solid; shade above. That gives a quick check on the answer.
19. One steady path is: Solve: $2y = 4x + 8 \Rightarrow y = 2x + 4$. Slope 2, y-intercept $(0, 4)$. This is the part to check before moving on, because it keeps the answer tied to the original question.
20. Start with the key idea: $0 < -0 + 2 = 2$ is true. Origin is below the line. This is the part to check before moving on, because it keeps the answer tied to the original question.
21. A careful way to see it: $2m + 3b \geq 60$. With $m = 20, b = 5$: $2(20) + 3(5) = 40 + 15 = 55$, which is less than 60 — does *not* satisfy the inequality. That gives a quick check on the answer.
22. Keep the rule visible: $500 + 50P \leq 2000$. Subtract 500: $50P \leq 1500$. Divide: $P \leq 30$. Max is 30 packages. That gives a quick check on the answer.
23. Strict $>$ gives a dashed line. Plug $(0, 0)$: $0 > -0 + 2 = 2$, false. So the origin lies below the boundary, not in the solution region. Shade the half-plane above.
24. Start with the key idea: $8(15) + 5c \geq 200$, so $120 + 5c \geq 200$, $5c \geq 80$, $c \geq 16$. Need at least 16 child tickets. That gives a quick check on the answer.

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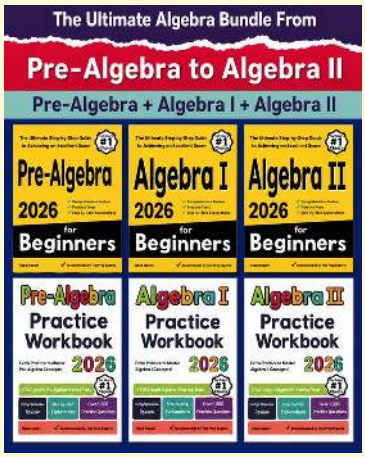

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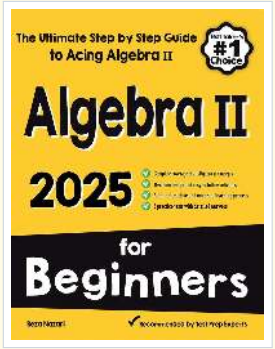

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