Algebra 1 · Unit 4 · Assessment Guide

Linear Inequalities and Systems

For the Parent or Teacher — What to look for

Unit 4 extends Unit 2's work on equations to inequalities and their systems. The mechanics (solving, graphing) are mostly review from earlier grades; the new high school work is REASONING about solution SETS (regions, not points) and modeling situations with constraints. Watch for the sign-flip rule and the interpretation of solution regions in context.

Problem 1 — One-variable solve & graph

- (a) $x \geq 6$. Closed dot at 6, shading right.
- (b) $x > -4$. Open dot at −4, shading right. CRITICAL: the sign flips because we divide by −2.
- (c) ★ The diagnostic — division/multiplication by a NEGATIVE flips the inequality. Strong: explains using a concrete example ("$3 < 5$, but $-3 > -5$"). Weak: just says "the rule says to flip."

Problem 2 — Saving for phone

- (a) $80 + 25w \geq 400$.
- (b) $25w \geq 320 \rightarrow w \geq 12.8 \rightarrow$ at least 13 weeks (rounding UP).
- (c) ★ The diagnostic. 12.8 weeks isn't possible in context; Mia needs at least 13 FULL weeks of pay. Strong: explicitly addresses the difference between algebraic and contextual solutions.
- Weak: writes 12.8 weeks or rounds to 12 (too few).

Problem 3 — Which values satisfy $2x - 5 \leq 7$?

- Equivalent to $x \leq 6$.
- (a) Yes ($-5 \leq 7$). (b) Yes ($7 \leq 7$). (c) No ($9 \leq 7$ is false).
- (d) All real numbers less than or equal to 6. Notation: $x \leq 6$.
- Watch for confusion at boundary: $x = 6$ IS included (≤), $x = 7$ is NOT.

Problem 4 — Diego's error on $-3x > 9$

- (a) $x = 0$: $-3(0) = 0 > 9$? NO. So 0 should NOT be a solution, but Diego's answer $x > -3$ INCLUDES 0. His answer is wrong.
- (b) Dividing by −3 should FLIP the sign: $x < -3$. Correct solution: $x < -3$.
- Strong: catches the missing sign flip and tests with a value to prove it.

Problem 5 — $y > 2x - 1$

- (a) DASHED — strict inequality (>, not ≥), boundary not included.
- (b) (0, 0): is $0 > 2(0) - 1 = -1$? Yes. So (0, 0) IS in solution set.
- (c) Shade ABOVE the dashed line.
- Common error: solid line, or shading below.

Problem 6 — Write an inequality for shaded region

- $y \leq (1/2)x + 3$ (line is included → ≤, not <; "below" the line → y ≤).
- Strong: explicitly justifies BOTH the direction and the inclusion of the line.

Problem 7 — Fundraiser

- (a) $10a + 4s \geq 1200$.

- (b) Sample: (120, 0), (60, 150), (40, 200). Many possible.
- (c) $10(50) + 4(200) = 500 + 800 = 1300 \geq 1200$. ✓ Yes.
- (d) ★ The diagnostic: implicit constraints are $a \geq 0$, $s \geq 0$, and that a, s must be WHOLE numbers. Strong students surface these without being prompted.

Problem 8 — System $y \leq x + 2$ AND $y > -x + 1$

- Solution region: below-or-on $y = x + 2$ line, AND strictly above $y = -x + 1$ line.
- (a) E.g., (2, 0) is in BOTH; (0, 5) is not (fails first); (0, 0) is not (fails second). Lots of valid choices.
- (b) ★ The conceptual core: overlap = points satisfying BOTH constraints simultaneously. "AND" maps to INTERSECTION.

Problem 9 — Bakery system

- (a) $b + m \geq 60$ (or count by goods); $30b + 10m \leq 600$; $b \geq 0$, $m \geq 0$.
- (b) Check: $10 + 50 = 60 \geq 60$ ✓; $30(10) + 10(50) = 300 + 500 = 800 \leq 600$? NO. So this does NOT satisfy the time constraint.
- (c) $40 + 30 = 70 \geq 60$ ✓; $30(40) + 10(30) = 1200 + 300 = 1500 \leq 600$? NO. Also infeasible.
- ★ The diagnostic: students must check ALL constraints, not just the obvious one. Many will check (b) on count and miss time.

Problem 10 — Priya's error on $-4(x - 1) > 12$

- (a) $x = 0$: $-4(0 - 1) = 4 > 12$? NO. So 0 should NOT be in solution set. But Priya's answer $x > -2$ INCLUDES 0. Wrong.
- (b) When dividing by −4, the sign must FLIP: $x < -2$. Correct: $x < -2$.
- Same diagnostic as Problem 4; if they got Problem 4 right but miss this, they're inconsistent — re-teach the rule.

Problem 11 — Geometry of solution sets

- (a) Empty: e.g., two parallel half-planes that don't overlap ($y \geq 3$ AND $y \leq 1$).
- (b) Single point: rare — happens at exact intersection if both are equalities or borderline strict. Strong students may say "impossible with strict inequalities, but possible with two non-strict that share a vertex."
- (c) Unbounded: most overlap regions extend to infinity in some direction.
- (d) Triangle: needs at least THREE inequalities to bound on all three sides.
- ★ A capstone test of geometric intuition about constraint regions.

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