Solving Multi-Step Inequalities

Name: _____	Date: _____	Score: _____ / 42

Quick Review

Multi-step inequalities follow the same playbook as multi-step equations: **distribute** to clear parentheses, **combine like terms** on each side, then use inverse operations to isolate the variable. The one rule that's different: when you **multiply or divide by a negative**, flip the inequality sign. Two ways to write solutions: **set-builder** notation $\{x \mid x > 3\}$ ("the set of all x such that $x > 3$"), and **interval** notation $(3, \infty)$. For interval notation, use square brackets for $\leq$ and $\geq$ (the boundary's included) and parentheses for $<$, $>$, and $\pm\infty$ (not included).

PRACTICE

Solve each inequality.

1. $2x + 5 > 13$ _____
2. $4n - 3 \leq 9$ _____
3. $-3a + 8 < 2$ _____
4. $6 - 2y \geq 10$ _____
5. $3(x - 1) > 12$ _____
6. $-2(m + 4) \leq 6$ _____
7. $5k + 2 - 3k < 10$ _____
8. $4(2p - 1) \geq 12$ _____
9. $7 - 3(n + 2) > -8$ _____
10. $\frac{2x + 6}{4} \leq 3$ _____
11. $-5(x - 2) + 3x < 14$ _____
12. $9 + 4a > 3a + 15$ _____
13. $3x - 5 \leq 2x + 7$ _____
14. $-2(3y - 1) > 4y + 12$ _____
15. $\frac{x}{2} + \frac{x}{3} < 5$ _____
16. $5 - (x + 3) \geq 2x - 7$ _____
17. $-4(2k + 1) < -3(k + 2)$ _____
18. $\frac{3x - 1}{2} \geq 4$ _____
19. $2(x + 5) - 3x \leq 0$ _____
20. $0.5(4x - 2) > 3$ _____

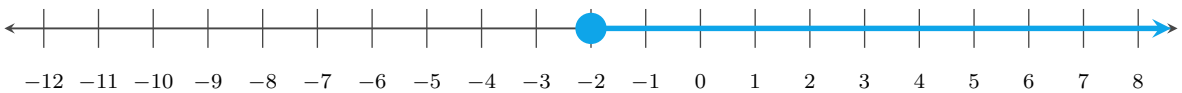
VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. Write the inequality shown on the number line.

Answer: _____

22. Write the inequality shown on the number line.



Answer: _____

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Word Problems

23. A student needs at least 80 points total on 4 quizzes to earn a B. After three quizzes the student has scores of 18, 22, and 19. What score s is needed on the fourth quiz? _____

24. A parking garage charges $\$5$ plus $\$2.50$ per hour. You have at most $\$20$. Write and solve an inequality for the number of hours h you can park. _____

25. A taxi service charges a $\$4$ base fare plus $\$1.75$ per mile. Maria has at most $\$25$ to spend. What's the maximum distance she can travel? _____

26. A phone plan costs $\$25$ per month plus $\$0.10$ per text. If Jamal's budget is less than $\$40$ per month, how many texts t can he send? _____

27. A gym charges a $\$30$ sign-up fee plus $\$8$ per class. Leah has at most $\$110$. How many classes c can she take? _____

28. A club earns $\$12$ per ticket but pays a $\$25$ room fee. How many tickets t must it sell to make more than $\$200$? _____

29. A streaming plan costs $\$15$ plus $\$3$ per rented movie. Nora wants to spend less than $\$45$. What values of m work? _____

30. A rental car costs $\$45$ plus $\$0.20$ per mile. The budget is $\$125$. What is the greatest mileage m? _____

31. A science team buys 4 display boards at $\$7$ each and supplies costing s. Their total must be under $\$60$. _____

32. Mateo has $\$80$ saved and adds $\$15$ each week. How many weeks w until he has at least $\$200$? _____

33. A ride-share charges $\$6$ plus $\$2.25$ per mile. Ari has no more than $\$30$. What mileage m fits the budget? _____

34. A store ships an order for $\$3$ plus $\$5$ per item. The customer wants the total no more than $\$28$. _____

35. A catering company charges $\$75$ plus $\$12$ per guest. The event budget is at most $\$300$. How many guests g fit? _____

36. A school bus rental costs $\$120$ plus $\$3$ per student. The club wants the cost below $\$300$. What values of s work? _____

37. A sale takes 20% off an item and then adds $\$5$ shipping. If the total must be at most $\$45$, how large can price p be? _____

38. A payment plan starts with $\$50$ down and $\$20$ each month. How many months m are needed to pay at least $\$250$? _____

39. An art teacher buys two $\$18$ canvases and p brushes at $\$4$ each. The total must be no more than $\$80$. _____

40. A bank account has $\$500$. Lee withdraws $\$35$ each week. How many weeks w until the balance is still above $\$255$? _____

41. A theater charges $\$9$ per ticket plus a $\$6$ service fee. Rina wants to spend at most $\$60$. How many tickets t? _____

42. A delivery box weighs 2 pounds empty and 1.5 pounds per book. The box must weigh less than 20 pounds. _____

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Answer Keys

1. $x > 4$	**15.** $x < 6$	**29.** $m < 10$
2. $n \leq 3$	**16.** $x \leq 3$	**30.** $m \leq 400$
3. $a > 2$	**17.** $k > \frac{2}{5}$	**31.** $s < 32$
4. $y \leq -2$	**18.** $x \geq 3$	**32.** $w \geq 8$
5. $x > 5$	**19.** $x \geq 10$	**33.** $m \leq \frac{32}{3}$
6. $m \geq -7$	**20.** $x > 2$	**34.** $i \leq 5$
7. $k < 4$	**21.** $x > 8$	**35.** $g \leq 18$
8. $p \geq 2$	**22.** $x \geq -2$	**36.** $s < 60$
9. $n < 3$	**23.** $s \geq 21$	**37.** $p \leq 50$
10. $x \leq 3$	**24.** $h \leq 6$	**38.** $m \geq 10$
11. $x > -2$	**25.** $m \leq 12$ miles	**39.** $p \leq 11$
12. $a > 6$	**26.** $t < 150$	**40.** $w < 7$
13. $x \leq 12$	**27.** $c \leq 10$	**41.** $t \leq 6$
14. $y < -1$	**28.** $t > \frac{225}{12}$; at least 19	**42.** $b < 12$

Step-by-Step Tutor Notes

1. Keep the order of operations in view, then simplify without skipping the sign check. Subtract 5: $2x > 8$. Divide by 2: $x > 4$. After simplifying, the answer is $x > 4$.

2. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Add 3: $4n \leq 12$. Divide by 4: $n \leq 3$. After simplifying, the answer is $n \leq 3$.

3. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract 8: $-3a < -6$. Divide by -3 — flip: $a > 2$. After simplifying, the answer is $a > 2$.

4. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract 6: $-2y \geq 4$. Divide by -2 — flip: $y \leq -2$. After simplifying, the answer is $y \leq -2$.

5. Work one inverse operation at a time and keep both sides balanced. Distribute: $3x - 3 > 12$. Add 3: $3x > 15$. Divide: $x > 5$. After simplifying, the answer is $x > 5$.

6. Keep the order of operations in view, then simplify without skipping the sign check. Distribute: $-2m - 8 \leq 6$. Add 8: $-2m \leq 14$. Divide by -2 — flip: $m \geq -7$. After simplifying, the answer is $m \geq -7$.

7. Keep the order of operations in view, then simplify without skipping the sign check. Combine like terms: $2k + 2 < 10$. Subtract 2: $2k < 8$. Divide: $k < 4$. After simplifying, the answer is $k < 4$.

8. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Distribute: $8p - 4 \geq 12$. Add 4: $8p \geq 16$. Divide: $p \geq 2$. After simplifying, the answer is $p \geq 2$.

9. Distribute: $7 - 3n - 6 > -8$. Combine: $-3n + 1 > -8$. Subtract 1: $-3n > -9$. Divide by -3 — flip: $n < 3$.

10. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Multiply both sides by 4: $2x + 6 \leq 12$. Subtract 6: $2x \leq 6$. Divide: $x \leq 3$. After simplifying, the answer is $x \leq 3$.

11. Distribute: $-5x + 10 + 3x < 14$. Combine: $-2x + 10 < 14$. Subtract 10: $-2x < 4$. Divide by -2 — flip: $x > -2$.

12. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract $3a$: $9 + a > 15$. Subtract 9: $a > 6$. After simplifying, the answer is $a > 6$.

13. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract $2x$: $x - 5 \leq 7$. Add 5: $x \leq 12$. After simplifying, the answer is $x \leq 12$.

14. Distribute: $-6y + 2 > 4y + 12$. Subtract $4y$: $-10y + 2 > 12$. Subtract 2: $-10y > 10$. Divide by -10 — flip: $y < -1$.

15. Multiply both sides by 6 to clear fractions: $3x + 2x < 30$. Combine: $5x < 30$. Divide: $x < 6$.

16. Distribute: $5 - x - 3 \geq 2x - 7$. Combine left: $2 - x \geq 2x - 7$. Add x: $2 \geq 3x - 7$. Add 7: $9 \geq 3x$. Divide: $3 \geq x$, or $x \leq 3$.

17. Distribute: $-8k - 4 < -3k - 6$. Add $8k$: $-4 < 5k - 6$. Add 6: $2 < 5k$. Divide: $\frac{2}{5} < k$, or $k > \frac{2}{5}$.

18. Work one inverse operation at a time and keep both sides balanced. Multiply by 2: $3x - 1 \geq 8$. Add 1: $3x \geq 9$. Divide: $x \geq 3$. After simplifying, the answer is $x \geq 3$.

19. Distribute: $2x + 10 - 3x \leq 0$. Combine: $-x + 10 \leq 0$. Subtract 10: $-x \leq -10$. Divide by -1 — flip: $x \geq 10$.

20. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Distribute: $2x - 1 > 3$. Add 1: $2x > 4$. Divide: $x > 2$. After simplifying, the answer is $x > 2$.

21. Read the table by matching the correct row and column first, then use the count or total that fits the question. The open circle means 8 is not included, and the arrow points right: $x > 8$. This gives $x > 8$.

22. Start with the definition the problem is testing, then apply it directly. The closed circle at -2 and shading right mean $x \geq -2$. So the answer is $x \geq -2$.

23. Set up the inequality: $18 + 22 + 19 + s \geq 80$. Combine: $59 + s \geq 80$. Subtract 59: $s \geq 21$. The student needs at least 21 points on the fourth quiz.

24. "At most \$20" is $\leq$: $5 + 2.5h \leq 20$. Subtract 5: $2.5h \leq 15$. Divide by 2.5: $h \leq 6$ hours.

25. $4 + 1.75m \leq 25$. Subtract 4: $1.75m \leq 21$. Divide by 1.75: $m \leq 12$. Maria can go up to 12 miles.

26. "Less than \$40" is strictly $<$: $25 + 0.10t < 40$. Subtract 25: $0.10t < 15$. Divide: $t < 150$. Jamal can send fewer than 150 texts.

27. The cost is $30 + 8c$, and it must be at most 110: $30 + 8c \leq 110$. Subtract 30: $8c \leq 80$. Divide by 8: $c \leq 10$.

28. Profit is $12t - 25$. More than \$200 means $12t - 25 > 200$. Add 25: $12t > 225$. Divide by 12: $t > 18.75$, so at least 19 whole tickets.

29. The monthly cost is $15 + 3m$. Less than \$45 gives $15 + 3m < 45$. Subtract 15: $3m < 30$. Divide by 3: $m < 10$.

30. Use $45 + 0.20m \leq 125$. Subtract 45: $0.20m \leq 80$. Divide by 0.20: $m \leq 400$.

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31. Move carefully through the arithmetic; one clean operation usually unlocks the next one. The display boards cost $4(7) = 28$, so $28 + s < 60$. Subtract 28: $s < 32$. After simplifying, the answer is $s < 32$.

32. His savings are $80 + 15w$. At least $\$200$ means $80 + 15w \geq 200$. Subtract 80: $15w \geq 120$. Divide by 15: $w \geq 8$.

33. The cost is $6 + 2.25m$. No more than $\$30$ means $6 + 2.25m \leq 30$. Subtract 6: $2.25m \leq 24$. Divide by 2.25: $m \leq \frac{32}{3}$, about 10.67 miles.

34. Let i be the number of items. The total is $3 + 5i \leq 28$. Subtract 3: $5i \leq 25$. Divide by 5: $i \leq 5$.

35. Set up $75 + 12g \leq 300$. Subtract 75: $12g \leq 225$. Divide by 12: $g \leq 18.75$, so at most 18 whole guests fit the budget.

36. The cost model is $120 + 3s < 300$. Subtract 120: $3s < 180$. Divide by 3: $s < 60$.

37. After a 20% discount, the item costs $0.8p$. Use $0.8p + 5 \leq 45$. Subtract 5: $0.8p \leq 40$. Divide by 0.8: $p \leq 50$.

38. The paid amount is $50 + 20m$. At least $\$250$ means $50 + 20m \geq 250$. Subtract 50 and divide by 20: $m \geq 10$.

39. The canvases cost $2(18) = 36$. So $36 + 4p \leq 80$. Subtract 36: $4p \leq 44$. Divide by 4: $p \leq 11$.

40. The balance is $500 - 35w$. Still above $\$255$ means $500 - 35w > 255$. Subtract 500: $-35w > -245$. Divide by -35 and flip: $w < 7$.

41. Keep the order of operations in view, then simplify without skipping the sign check. The total is $9t + 6 \leq 60$. Subtract 6: $9t \leq 54$. Divide by 9: $t \leq 6$. After simplifying, the answer is $t \leq 6$.

42. The weight is $2 + 1.5b$. Less than 20 means $2 + 1.5b < 20$. Subtract 2: $1.5b < 18$. Divide by 1.5: $b < 12$.

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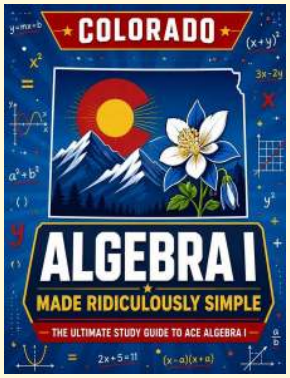

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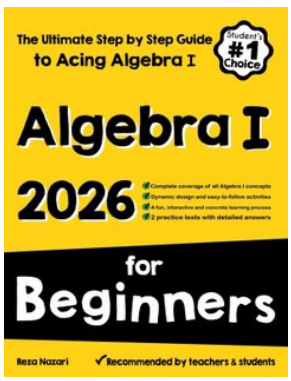

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