

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



◆ 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

- 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 $x > 4$.
- 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 $n \leq 3$.
- 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 $a > 2$.
- 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 $y \leq -2$.
- 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 $x > 5$.
- 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 $m \geq -7$.
- 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 $k < 4$.
- 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 $p \geq 2$.
- Distribute: $7 - 3n - 6 > -8$. Combine: $-3n + 1 > -8$. Subtract 1: $-3n > -9$. Divide by -3 — flip: $n < 3$.
- 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 $x \leq 3$.
- Distribute: $-5x + 10 + 3x < 14$. Combine: $-2x + 10 < 14$. Subtract 10: $-2x < 4$. Divide by -2 — flip: $x > -2$.
- 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 $a > 6$.
- 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 $x \leq 12$.
- Distribute: $-6y + 2 > 4y + 12$. Subtract $4y$: $-10y + 2 > 12$. Subtract 2: $-10y > 10$. Divide by -10 — flip: $y < -1$.
- Multiply both sides by 6 to clear fractions: $3x + 2x < 30$. Combine: $5x < 30$. Divide: $x < 6$.
- 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 $x \leq 3$.
- Distribute: $-8k - 4 < -3k - 6$. Add $8k$: $-4 < 5k - 6$. Add 6: $2 < 5k$. Divide: $\frac{2}{5} < k$, or $k > \frac{2}{5}$.
- 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 $x \geq 3$.
- Distribute: $2x + 10 - 3x \leq 0$. Combine: $-x + 10 \leq 0$. Subtract 10: $-x \leq -10$. Divide by -1 — flip: $x \geq 10$.
- 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 $x > 2$.
- 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 $x > 8$.
- 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 $x \geq -2$.
- 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.
- "At most \$20" is \leq : $5 + 2.5h \leq 20$. Subtract 5: $2.5h \leq 15$. Divide by 2.5: $h \leq 6$ hours.
- $4 + 1.75m \leq 25$. Subtract 4: $1.75m \leq 21$. Divide by 1.75: $m \leq 12$. Maria can go up to 12 miles.
- "Less than \$40" is strictly $<$: $25 + 0.10t < 40$. Subtract 25: $0.10t < 15$. Divide: $t < 150$. Jamal can send fewer than 150 texts.
- The cost is $30 + 8c$, and it must be at most 110: $30 + 8c \leq 110$. Subtract 30: $8c \leq 80$. Divide by 8: $c \leq 10$.
- 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.
- The monthly cost is $15 + 3m$. Less than \$45 gives $15 + 3m < 45$. Subtract 15: $3m < 30$. Divide by 3: $m < 10$.
- Use $45 + 0.20m \leq 125$. Subtract 45: $0.20m \leq 80$. Divide by 0.20: $m \leq 400$.



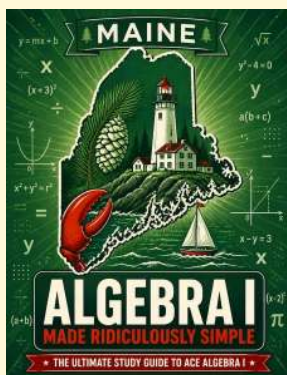
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31. Move carefully through the arithmetic; one clean operation usually unlocks the next one. The display boards cost $4(7) = 28$, so $28 + s < 60$. Subtract 28: $s < 32$. After simplifying, the answer is $s < 32$.
32. His savings are $80 + 15w$. At 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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