

Solving Inequalities

Name: _____ Date: _____ Score: _____ / 24

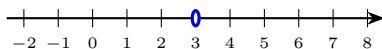
Quick Review

Solving a linear inequality is almost identical to solving an equation, with *one critical difference*: if you **multiply or divide both sides by a negative number, the inequality flips**. So $-2x > 6$ becomes $x < -3$ (the $>$ flipped to $<$). Adding or subtracting any number, or multiplying and dividing by a positive, leaves the inequality direction alone. The solution to a linear inequality is usually an *interval* (everything to one side of a boundary), so the graph is a ray on the number line. Use an **open dot** (hollow circle) for strict $<$ or $>$ — the boundary point is *not* included — and a **closed dot** (filled circle) for \leq or \geq . In interval notation, parentheses $()$ match open dots, and square brackets $[]$ match closed dots; infinity always gets a parenthesis. The classic trap: forgetting to flip when dividing by a negative.

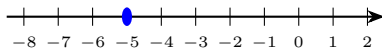
PRACTICE

Solve each inequality. Write the solution set or graph as directed.

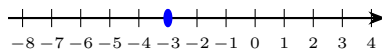
1. Solve $3x + 5 > 14$, then graph the solution. The boundary point is already marked on the number line below — you decide which way the ray points. _____



2. Solve $-2x \geq 10$, then graph it. The boundary value is marked below; determine the dot type and ray direction yourself. _____



3. $4(x - 1) \leq 2x + 6$ _____
4. $\frac{x}{3} + 2 < 5$ _____
5. $-3x + 1 > 7$ _____
6. Solve $5 - 2x \leq 11$, then graph it. The boundary is plotted below — you choose open vs. closed and which direction the ray runs. _____



7. $\frac{x + 4}{2} \geq 3$ _____
8. $7 - (2x - 1) < 3x + 8$ _____
9. $\frac{3x - 1}{2} \geq x + 2$ _____
10. $6x - 5 \leq 2x + 11$ _____
11. $-\frac{1}{2}x + 3 \geq 1$ _____
12. $2(3x + 4) - 5 < 4x + 1$ _____
13. $4 - 3(x + 2) > 2x - 7$ _____
14. $\frac{2x + 1}{3} < x - 1$ _____
15. $5x - 2 \leq 5x + 7$ _____
16. $7 - 4x > 7 - 4x + 1$ _____
17. $3(x - 2) + 1 \geq 2(x - 1)$ _____
18. $\frac{x}{2} - \frac{x}{5} < 3$ _____



19. $-4(2 - x) \leq 3x - 1$ _____

20. $\frac{2 - x}{3} > \frac{x + 4}{6}$ _____

◆ Word Problems

21. A pizza shop charges \$8 per pizza plus a \$5 delivery fee. Maya has at most \$45 to spend. How many pizzas can she order? _____

22. A weight on an elevator must satisfy $300 + 150n \leq 1,500$, where n is the number of additional passengers. What's the largest n allowed? _____

23. To pass a class, Jordan's test average must be at least 80. After four tests his scores are 72, 85, 78, and 86. What does he need on the fifth test? _____

24. A gym charges \$25 per month plus \$3 per visit. Sasha wants to spend less than \$70 in a month. What's the maximum number of visits? _____



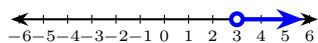
Answer Keys

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. $x > 3$ 2. $x \leq -5$ 3. $x \leq 5$ 4. $x < 9$ 5. $x < -2$ 6. $x \geq -3$ 7. $x \geq 2$ 8. $x > 0$ 9. $x \geq 5$ 10. $x \leq 4$ 11. $x \leq 4$ 12. $x < -1$ | <ol style="list-style-type: none"> 13. $x < 1$ 14. $x > 4$ 15. all real numbers 16. \emptyset 17. $x \geq 3$ 18. $x < 10$ 19. $x \leq 7$ 20. $x < 0$ 21. at most 5 pizzas 22. $n \leq 8$ passengers 23. $s \geq 79$ 24. $v \leq 14$ visits |
|---|--|

Step-by-Step Explanations

1. Subtract 5: $3x > 9$. Divide by 3 (positive, no flip): $x > 3$. The dot at 3 is open (strict $>$), and the ray shades to the right toward larger values.

Answer graph



2. Divide by -2 and flip: $x \leq -5$. (The flip is the move most often missed — check it.) The dot at -5 is closed (\geq became \leq), and the ray shades left.

3. One steady path is: Distribute: $4x - 4 \leq 2x + 6$. Subtract $2x$: $2x - 4 \leq 6$. Add 4: $2x \leq 10$. Divide: $x \leq 5$. That gives a quick check on the answer.

4. Subtract 2: $\frac{x}{3} < 3$. Multiply both sides by 3 (positive, so the $<$ stays put): $x < 9$.

5. Subtract 1: $-3x > 6$. Now divide by -3 — and because -3 is negative, flip the symbol: $x < -2$. (Skipping the flip is the number-one inequality mistake.)

6. Subtract 5: $-2x \leq 6$. Divide by -2 and flip: $x \geq -3$. The dot at -3 is closed (\geq), and the ray shades right.

7. Clear the fraction by multiplying both sides by 2 (positive — no flip): $x + 4 \geq 6$. Subtract 4: $x \geq 2$. The bar groups all of $x + 4$, so the whole numerator gets multiplied.

8. Distribute: $7 - 2x + 1 < 3x + 8$, so $8 - 2x < 3x + 8$. Subtract 8 and $3x$: $-5x < 0$. Divide by -5 and flip: $x > 0$.

9. A careful way to see it: Multiply by 2: $3x - 1 \geq 2(x + 2) = 2x + 4$. Subtract $2x$ and add 1: $x \geq 5$. That gives a quick check on the answer.

10. Gather x -terms: subtract $2x$ from both sides to get $4x - 5 \leq 11$. Add 5: $4x \leq 16$. Divide by 4 (positive, so the symbol stays): $x \leq 4$.

11. One steady path is: Subtract 3: $-\frac{1}{2}x \geq -2$. Multiply by -2 and flip: $x \leq 4$. That gives a quick check on the answer.

12. Distribute: $6x + 8 - 5 < 4x + 1$, so $6x + 3 < 4x + 1$. Subtract $4x$ and 3: $2x < -2$. Divide: $x < -1$.

13. Distribute: $4 - 3x - 6 > 2x - 7$, so $-2 - 3x > 2x - 7$. Add $3x$ and 7: $5 > 5x$. Divide by 5: $1 > x$, i.e. $x < 1$.

14. Keep the rule visible: Multiply by 3: $2x + 1 < 3(x - 1) = 3x - 3$. Subtract $2x$ and add 3: $4 < x$, i.e. $x > 4$. That gives a quick check on the answer.

15. Subtract $5x$: $-2 \leq 7$. Always true. So every real x is a solution: the solution set is all reals.

16. Simplify: $7 - 4x > 8 - 4x$, so $7 > 8$ after adding $4x$. That's false. No x works — empty solution set.

17. Distribute both sides: $3x - 6 + 1 \geq 2x - 2$, which tidies to $3x - 5 \geq 2x - 2$. Subtract $2x$ and add 5 (no negative division, so no flip): $x \geq 3$.

18. Clear fractions with the LCD 10, multiplying every term: $5x - 2x < 30$. Combine like terms: $3x < 30$. Divide by 3: $x < 10$.

19. Distribute the -4 across both terms: $-8 + 4x \leq 3x - 1$. Subtract $3x$ and add 8 to isolate x : $x \leq 7$. (No negative multiplier here, so the symbol never flips.)

20. Multiply by 6: $2(2 - x) > x + 4$, so $4 - 2x > x + 4$. Subtract 4 and x : $-3x > 0$. Divide by -3 and flip: $x < 0$.

21. Let p be the number of pizzas. Cost: $8p + 5 \leq 45$. Subtract 5: $8p \leq 40$. Divide: $p \leq 5$. Since you can't order a fractional pizza, the max is 5 pizzas.

22. Subtract 300: $150n \leq 1200$. Divide by 150: $n \leq 8$. At most 8 additional passengers.

23. Average: $\frac{72 + 85 + 78 + 86 + s}{5} \geq 80$, so $321 + s \geq 400$. Subtract 321:

$s \geq 79$. Jordan needs at least a 79 on test five.

24. Start with the key idea: $25 + 3v < 70$. Subtract 25: $3v < 45$. Divide: $v < 15$. Since visits are whole numbers, the max is 14 visits. That gives a quick check on the answer.



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