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Solving Inequalities by Using Addition and Subtraction

(Pages 384–390)

Addition and Subtraction Properties of Inequalities

For all numbers a , b , and c , the following are true.

- If $a > b$, then $a + c > b + c$ and $a - c > b - c$. (Also true for \geq)
- If $a < b$, then $a + c < b + c$ and $a - c < b - c$. (Also true for \leq)

The solutions of an inequality can be graphed on a number line or written using **set-builder notation**.

EXAMPLE

Solve $3m - 7 > 4m + 1$. Check your solution, and graph it on a number line.

$$\begin{aligned} 3m - 7 &> 4m + 1 \\ 3m - 7 - 3m &> 4m + 1 - 3m \\ -7 &> m + 1 \\ -7 - 1 &> m + 1 - 1 \\ -8 &> m \text{ or } m < -8 \end{aligned}$$

In set builder notation, the solution set is $\{m \mid m < -8\}$, which is read “the set of all numbers m such that m is less than -8 .”

Only numbers less than -8 substituted into the original inequality should yield a true statement.

$$\begin{aligned} 3(0) - 7 &\stackrel{?}{>} 4(0) + 1 && \text{Let } m = 0. \\ -7 &> 1 && \text{false} \end{aligned}$$

$$\begin{aligned} 3(-9) - 7 &\stackrel{?}{>} 4(-9) + 1 && \text{Let } m = -9. \\ -34 &> -35 && \text{true} \end{aligned}$$

Since only the number less than -8 yields a true statement, the solution checks.

Graph the point -8 using an open circle, since -8 is not part of the solution. Then draw a heavy arrow to the left to indicate numbers less than -8 .


Try These Together

1. Solve and graph $z - 16 \leq 5$.

2. Solve and graph $j + \frac{1}{2} > 9$.

PRACTICE

Solve each inequality. Then check your solution, and graph it on a number line.

3. $-6 + m > 6$

4. $3y \leq 2y + 4$

5. $x - 1 < -14$

6. $-0.05 \leq v - (-0.06)$

Solve each inequality. Then check your solution.

7. $x + \frac{1}{3} < \frac{1}{6}$

8. $-0.8x - 0.7 < 0.3 - 1.8x$

9. $5x + 7 \geq 4x + 8$

10. $2h - 5 \leq h + 4$

11. $-u - 45 \geq 38$

12. $2x + \frac{1}{3} \leq 3x + \frac{2}{3}$

Define a variable, write an inequality, and solve each problem. Then check your solution.

13. A number decreased by -3 is at least 10.

14. Twice a number is more than the difference of that number and 4.

15. **Standardized Test Practice** Which number is a solution of $2x \leq x + 8$?

A 12

B 11

C 9

D 6

Answers: 1–6. For graphs, see Answer Key. 1. $\{z \mid z < 21\}$ 2. $\{t \mid t > 8\frac{2}{3}\}$ 3. $\{m \mid m < 12\}$ 4. $\{y \mid y \leq 4\}$ 5. $\{x \mid x < -13\}$
6. $\{v \mid v \geq -0.11\}$ 7. $\{x \mid x < -\frac{6}{11}\}$ 8. $\{x \mid x < 1\}$ 9. $\{x \mid x \geq 1\}$ 10. $\{h \mid h \leq 9\}$ 11. $\{u \mid u \leq -83\}$ 12. $\{x \mid x \geq -\frac{3}{11}\}$
13. $x - (-3) \geq 10$; $\{x \mid x \geq 7\}$ 14. $2x > x - 4$; $\{x \mid x > -4\}$ 15. D