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5-3 Study Guide and Intervention

Solving Multi-Step Inequalities

Solve Multi-Step Inequalities To solve linear inequalities involving more than one operation, undo the operations in reverse of the order of operations, just as you would solve an equation with more than one operation.

Example 1: Solve $6x - 4 \leq 2x + 12$.

$6x - 4 \leq 2x + 12$	Original inequality
$6x - 4 - 2x \leq 2x + 12 - 2x$	Subtract $2x$ from each side.
$4x - 4 \leq 12$	Simplify.
$4x - 4 + 4 \leq 12 + 4$	Add 4 to each side.
$4x \leq 16$	Simplify.
$\frac{4x}{4} \leq \frac{16}{4}$	Divide each side by 4.
$x \leq 4$	Simplify.

The solution is $\{x \mid x \leq 4\}$.

Example 2: Solve $3a - 15 > 4 + 5a$.

$3a - 15 > 4 + 5a$	Original inequality
$3a - 15 - 5a > 4 + 5a - 5a$	Subtract $5a$ from each side.
$-2a - 15 > 4$	Simplify.
$-2a - 15 + 15 > 4 + 15$	Add 15 to each side.
$-2a > 19$	Simplify.
$\frac{-2a}{-2} < \frac{19}{-2}$	Divide each side by –2 and change > to <.
$a < -9\frac{1}{2}$	Simplify.

The solution is $\{a \mid a < -9\frac{1}{2}\}$

Exercises

Solve each inequality. Check your solution.

1. $11y + 13 \geq -1$
$\left\{y \mid y \geq -1\frac{3}{11}\right\}$

2. $8n - 10 < 6 - 2n$
$\left\{n \mid n < 1\frac{3}{5}\right\}$

3. $\frac{q}{7} + 1 > -5$
$\{q \mid q > -42\}$

4. $6n + 12 < 8 + 8n$
$\{n \mid n > 2\}$

5. $-12 - d > -12 + 4d$
$\{d \mid d < 0\}$

6. $5r - 6 > 8r - 18$
$\{r \mid r < 4\}$

7. $\frac{-3x + 6}{2} \leq 12$
$\{x \mid x \geq -6\}$

8. $7.3y - 14.4 > 4.9y$
$\{y \mid y > 6\}$

9. $-8m - 3 < 18 - m$
$\{m \mid m > -3\}$

10. $-4y - 10 > 19 - 2y$
$\left\{y \mid y < -14\frac{1}{2}\right\}$

11. $9n - 24n + 45 > 0$
$\{n \mid n < 3\}$

12. $\frac{4x - 2}{5} \geq -4$
$\left\{x \mid x \geq -4\frac{1}{2}\right\}$

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

13–15. Sample answer: Let n = the number.

13. Negative three times a number plus four is no more than the number minus eight. $-3n + 4 \leq n - 8$; $\{n \mid n \geq 3\}$

14. One fourth of a number decreased by three is at least two. $\frac{1}{4}n - 3 \geq 2$; $\{n \mid n \geq 20\}$

15. The sum of twelve and a number is no greater than the sum of twice the number and –8.
$12 + n \leq 2n + (-8)$; $\{n \mid n \geq 20\}$

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5-3 Study Guide and Intervention *(continued)*

Solving Multi-Step Inequalities

Solve Inequalities Involving the Distributive Property When solving inequalities that contain grouping symbols, first use the Distributive Property to remove the grouping symbols. Then undo the operations in reverse of the order of operations, just as you would solve an equation with more than one operation.

Example : Solve $3a - 2(6a - 4) > 4 - (4a + 6)$.

$3a - 2(6a - 4) > 4 - (4a + 6)$	Original inequality
$3a - 12a + 8 > 4 - 4a - 6$	Distributive Property
$-9a + 8 > -2 - 4a$	Combine like terms.
$-9a + 8 + 4a > -2 - 4a + 4a$	Add $4a$ to each side.
$-5a + 8 > -2$	Combine like terms.
$-5a + 8 - 8 > -2 - 8$	Subtract 8 from each side.
$-5a > -10$	Simplify.
$a < 2$	Divide each side by –5 and change > to <.

The solution in set–builder notation is $\{a \mid a < 2\}$.

Exercises

Solve each inequality. Check your solution.

1. $2(t + 3) \geq 16$
{t | t ≥ 5}

2. $3(d - 2) - 2d > 16$
{d | d > 22}

3. $4h - 8 < 2(h - 1)$
{h | h < 3}

4. $6y + 10 > 8 - (y + 14)$
$\left\{y \mid y > -2\frac{2}{7}\right\}$

5. $4.6(x - 3.4) > 5.1x$
{x | x < –31.28}

6. $-5x - (2x + 3) \geq 1$
$\left\{x \mid x \leq -\frac{4}{7}\right\}$

7. $3(2y - 4) - 2(y + 1) > 10$
{y | y > 6}

8. $8 - 2(b + 1) < 12 - 3b$
{b | b < 6}

9. $-2(k - 1) > 8(1 + k)$
$\left\{k \mid k < -\frac{3}{5}\right\}$

10. $0.3(y - 2) > 0.4(1 + y)$
{y | y < –10}

11. $m + 17 \leq -(4m - 13)$
$\left\{m \mid m \leq -\frac{4}{5}\right\}$

12. $3n + 8 \leq 2(n - 4) - 2(1 - n)$
{n | n ≥ 18}

13. $2(y - 2) > -4 + 2y$
∅

14. $k - 17 \leq -(17 - k)$
{k | k is a real number}

15. $n - 4 \leq -3(2 + n)$
$\left\{n \mid n \leq -\frac{1}{2}\right\}$

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

16–18. Sample answer: Let *n* = the number.

16. Twice the sum of a number and 4 is less than 12. **2(n + 4) < 12; {n | n < 2}**

17. Three times the sum of a number and six is greater than four times the number decreased by two.
3(n + 6) > 4n – 2; {n | n < 20}

18. Twice the difference of a number and four is less than the sum of the number and five.
2(n – 4) < n + 5; {n | n < 13}