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Solving Inequalities Using Addition and Subtraction

Unit 3 Lesson 2

SOLVING INEQUALITIES USING ADDITION AND SUBTRACTION

Students will be able to:

solve linear inequalities by using addition and subtraction.

Key Vocabulary:

- Addition Property of Inequalities
- Subtraction Property of Inequalities

SOLVING INEQUALITIES USING ADDITION AND SUBTRACTION

ADDITION PROPERTY OF INEQUALITIES

"If any number is added to each side of a true inequality, the resulting inequality is also true."

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

1. If $a > b$, then $a + c > b + c$.

$11 > 8 \qquad 11 + 2 > 8 + 2 \qquad 13 > 10$

2. If $a < b$, then $a + c < b + c$.

$15 < 21 \qquad 15 + 5 < 21 + 5 \qquad 20 < 26$

3. If $a \geq b$, then $a + c \geq b + c$.

$9 \geq 8 \qquad 9 + 4 \geq 8 + 4 \qquad 13 \geq 12$

4. If $a \leq b$, then $a + c \leq b + c$.

$13 \leq 14 \qquad 13 + 3 \leq 14 + 3 \qquad 16 \leq 17$

SOLVING INEQUALITIES USING ADDITION AND SUBTRACTION

Sample Problem 1: Solve each inequality.

A. $x - 6 \geq 4$

B. $z - 45 < 13$

C. $-4 > z - 8$

D. $-5 + n \leq 9$

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Sample Problem 1: Solve each inequality.

A. $x - 6 \geq 4$ $\quad x - 6 + 6 \geq 4 + 6$ $\quad x \geq 10$

B. $z - 45 < 13$ $\quad z - 45 + 45 < 13 + 45$ $\quad z < 58$

C. $-4 > z - 8$ $\quad -4 + 8 > z - 8 + 8$ $\quad 4 > z$

D. $-5 + n \leq 9$ $\quad -5 + 5 + n \leq 9 + 5$ $\quad n \leq 14$

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SUBTRACTION PROPERTY OF INEQUALITIES

"If any number is subtracted to each side of a true inequality, the resulting inequality is also true."

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

1. If $a > b$, then $a - c > b - c$.

$12 > 7 \qquad 12 + 5 > 7 + 5 \qquad 20 > 12$

2. If $a < b$, then $a - c < b - c$.

$16 < 20 \qquad 16 + 3 < 20 + 3 \qquad 19 < 23$

3. If $a \geq b$, then $a - c \geq b - c$.

$8 \geq 7 \qquad 8 + 2 \geq 7 + 2 \qquad 10 \geq 9$

4. If $a \leq b$, then $a - c \leq b - c$.

$12 \leq 15 \qquad 12 + 4 \leq 15 + 4 \qquad 16 \leq 19$

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Sample Problem 2: Solve each inequality.

A. $\mathbf{20 + x \geq 15}$

B. $\mathbf{y + 5 < 22}$

C. $\mathbf{19 > z + 8}$

D. $\mathbf{x + 16 \leq 27}$

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Sample Problem 2: Solve each inequality.

A. $20 + x \geq 15$ $\quad 20 - 20 + x \geq 15 - 20$ $\quad x \geq -5$

B. $y + 5 < 22$ $\quad y + 5 - 5 < 22 - 5$ $\quad y < 17$

C. $19 > z + 8$ $\quad 19 - 8 > z + 8 - 8$ $\quad 11 > z$

D. $x + 16 \leq 27$ $\quad x + 16 - 16 \leq 27 - 16$ $\quad x \leq 11$

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Sample Problem 3: Solve each inequality.

A. $\boldsymbol{6 + x \geq 2x}$

B. $\boldsymbol{2y < 13 + y}$

C. $\boldsymbol{21 + 4z > 5z}$

D. $\boldsymbol{3x \leq 27 + 2x}$

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Sample Problem 3: Solve each inequality.

A. $6 + x \geq 2x$ $\quad 6 + x - x \geq 2x - x$ $\quad 13 \geq x$

B. $2y < 13 + y$ $\quad 2y - y < 13 + y - y$ $\quad y < 28$

C. $21 + 4z > 5z$ $\quad 21 + 4z - 4z > 5z - 4z$ $\quad 12 > z$

D. $3x \leq 27 + 2x$ $\quad 3x - 2x \leq 27 + 2x - 2x$ $\quad x \leq 11$

SOLVING INEQUALITIES USING ADDITION AND SUBTRACTION

Sample Problem 4: Solve each inequality.

A. Five times a number x plus seven is more than six times a number x.

B. Fifteen plus a number x is less than sixty.

C. Eleven is more than or equal to a number x minus three.

D. A number x plus twenty one is less than or equal to thirty.

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Sample Problem 4: Solve each inequality.

A. Five times a number x plus seven is more than six times a number x.

$$5x + 7 > 6x \qquad 5x - 5x + 7 > 6x - 5x \qquad 7 > x$$

B. Fifteen plus a number x is less than sixty.

$$15 + x < 60 \qquad 15 - 15 + x < 60 - 15 \qquad x < 45$$

C. Eleven is more than or equal to a number x minus three.

$$11 \geq x - 3 \qquad 11 + 3 \geq x - 3 + 3 \qquad 14 \geq x$$

D. A number x plus twenty one is less than or equal to thirty.

$$x + 21 \leq 30 \qquad x + 21 - 21 \leq 30 - 21 \qquad x \leq 9$$

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Sample Problem 5: Ann ran a 5 kilometer race in 45 minutes. Write an inequality to describe the speeds of the runners who were faster than Ann.

Sample Problem 5: Ann ran a 5 kilometer race in 45 minutes. Write an inequality to describe the speeds of the runners who were faster than Ann.

$$speed_{Ann} = \frac{distance_{Ann}}{time_{Ann}} = \frac{5\ km}{45\ min} = speed_{Ann} = \frac{1}{9} \cdot \frac{km}{min}$$

$$speed_{faster\ than\ Ann} > speed_{Ann}$$

$$s_f > \frac{1}{9} \cdot \frac{km}{min}$$