5.3 teacher notes

Objectives

- Solve two-step linear inequalities using addition and subtraction.
- Solve two-step linear inequalities using multiplication and division.

Vocabulary

Inverse operations (Lesson 3-3)
Linear inequality (Lesson 5-2)
Opposite (Lesson 1-2)

Prerequisites

Solving one-step linear inequalities

Solving two-step linear equations

Graphing inequalities

Get Started

- Write the equation $3x - 5 = 7$ on the board. Solve it as you ask students the following questions:

  What is the first step in solving this equation? Add 5 to both sides.

  What is the second step in solving this equation? Divide both sides by 3.

  Why do we add five to both sides **before** dividing both sides by three? To isolate the x, you "undo" the operations in the reverse order of order of operations.

- Erase the equal signs in all the steps and write a "$\leq$" symbol in the original statement making it $3x - 5 \leq 7$. Have students tell you if the steps written would still solve the inequality. Write the "$\leq$" symbol for the rest of the solution statements.

Section 1

Expand Their Horizons

In Section 1, students will use inverse operations to solve two-step linear inequalities. Students already have all the skills necessary to solve the two-step linear inequalities in this lesson.

Before beginning, discuss the title of the lesson, "Solving Two-Step Linear Inequalities" with the class. Write the inequalities $4x > 20$ and $x - 4 \leq 2$ on the board and have students solve each one. Point out that in each case, only one inverse operation was needed to isolate the variable on one side of the inequality. After viewing the solution of the inequality $4x + 2 < 14$ in the lesson, point out how two steps were needed—one to isolate the x term and one to eliminate the coefficient of x.

Students may be confused by the use of the phrase "work backwards" in the lesson. Remind them of the Order of Operations. When simplifying an expression, operations are completed in the following order: Parentheses and Grouping Symbols, Exponents, Multiplication/Division, and Addition/Subtraction. When solving an inequality, the goal is to isolate a variable on one side, so the operations performed on the variable must be "undone". This is done by reversing the order of operations.

Common Error Alert

When solving the inequality $3x - 3 \leq 15$, some students may complete the inverse operations in the wrong order. Point out that the Properties of Inequality allow the same operation to be done to *both sides* of an inequality.

For inequalities in which the coefficient of the variable is a fraction, review **reciprocals.** Remind students that when using multiplication or division to eliminate the coefficient, they are making the coefficient equal to one. When the coefficient is a fraction, multiplying it by its reciprocal produces a product of one. To review reciprocals, write several fractions on the board and ask the class to name the reciprocal of each one. Examples: $\frac{2}{3}$, $\frac{3}{2}$, 4, $\frac{1}{4}$, $\frac{5}{6}$, $\frac{6}{5}$

1 After students solve the inequality, review what is meant by the solution set, $x > 2$. The solution set is the set of all numbers that make the inequality true. In this case, any value of x greater than two makes the inequality true. Remind students that the solution set includes not only integers, but all real numbers greater than two including fractions, decimals, and irrational numbers.

2 After subtracting seven from both sides of the inequality, some students may divide both sides by $\frac{1}{3}$ as their next step. Offer these students the alternate method of multiplying both sides by the reciprocal of $\frac{1}{3}$, three. Either method results in multiplying both sides of the inequality by three.

3 When Mr. Frogan reads the inequality for this question ($-x + 4 \leq 3$) he says "the *opposite* of x plus four is less than or equal to three." Review with students the definition of *opposite*. The *opposite* of a number is the product of the number and –1. Visual learners may prefer to think of the opposite of a number as being the number the same distance from zero in the opposite direction.

Common Error Alert

When the coefficient of x is –1, as in $-x$, students may solve the inequality by dropping the negative sign from the x and changing the sign of the number on the other side. In doing so, they may forget to reverse the inequality sign. Encourage students to show the step of dividing both sides by –1.

4 To solve this inequality, add 12 to both sides. Next, divide both sides by –6, reversing the inequality sign.

Connections

The total charges asked by many professionals can be modeled by expressions of the form $ax + b$, where a and b are constants. For example, a painter may charge a flat fee of \$50 for supplies, plus \$100 per room painted. The expression $100x + 50$ represents the total fee charged for x rooms painted. If a consumer is restricted by a budget of \$350, he must solve the two-step inequality $100x + 50 \leq 350$ to find the number of rooms he can afford to have painted.

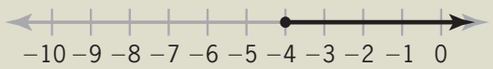
Look Beyond

Students will soon use the concept of inequalities to linear inequalities of two variables. They will graph an inequality such as $y \leq 3x - 5$ on a coordinate plane. They will see that the solution set consists of ordered pairs that define the line $y = 3x - 5$ and a region of ordered pairs defined by the line and the inequality.

Additional Examples

1. Solve and graph.

$$\frac{1}{4}x - 2 \geq -3$$
$$+2 \quad +2$$
$$\frac{1}{4}x \geq -1$$
$$(4)\frac{1}{4}x \geq -1(4)$$
$$x \geq -4$$



2. Solve and graph.

$$-5x - 2 \leq 8$$
$$+2 + 2$$
$$-5x \leq 10$$
$$\frac{-5x}{-5} \leq \frac{10}{-5}$$
$$x \leq -2$$