9PR2.4 Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context.

Solving Problems Involving Linear Inequalities

Inequalities are equations that use **>, <, ≥,** or **≤** in place of the equal sign.

Solving inequalities is done in nearly the same way as solving equation. The only difference is when multiplying or dividing both sides of an inequality by a negative number, the direction of the inequality sign is reversed.

Another difference between linear equation and linear inequalities is that there is only one solution in a linear equation. In a linear inequality, there are many solutions. The solutions that satisfy the linear inequality are referred to as the solution set.

Linear inequalities are graphed on a number line. If the solution set of a linear inequality is **>** or **<** a certain value, the graph will have an unshaded dot at that value followed by an arrow that indicates the direction of the rest of the solutions that make up the solution set.

If the solution set of a linear inequality is **≥** or **≤** a certain value, then the graph has shaded dot at that particular value followed by an arrow that indicates the direction of the rest of the solutions that make up the solution set.

Example

Solve the inequality $-3x \leq 2x + 10$, and then graph it on a number line.

Solution

Step 1

Move all the variables to the left side of the equation by subtracting ***2x*** from both sides.

$$-3x - 2x \leq 2x - 2x + 10$$
$$-5x \leq 10$$

Step 2

Isolate the variable by dividing both sides of the equation by -5.

$$\frac{-5x}{-5} \leq \frac{10}{-5}$$
$$x \geq -2$$

Because both sides are divided by a negative value, the inequality sign is reversed.

Step 3

Place the solution number (-2) in the middle of the line. Write the next three numbers in the sequence on either side of the middle number. Draw a shaded circle at -2 on the number line. The circle is shaded because -2 is part of the solution.

Draw the arrow in the direction that satisfies the solution.

Example

Lindsay has to go to a workshop for a project she is working on in school. While at the workshop, she has to park her car underground. The cost of parking underground is $3.00 for the first hour and $4.25 for each additional hour or portion of an hour. She has $20.00 to spend on parking.

What is the maximum number of additional hours Lindsay can park?

Solution

Step 1
Create an inequality to model the problem.

Let *h* represent the additional hours Lindsay can park. It costs $4.25 for each addition hour of parking, so this can be represented as 4.25*h* in the inequality.

The total cost of parking includes $3.00 for the first hour, which can be represented as +3 in the inequality.

The total amount of moey that Lindsay can spend on parking is $20; therefore, the maximum number of additional hours that she can park can be represented by $4.25h + 3 \leq 20$.

Step 2
Apply inverse operations to isolate the variable.

$$\begin{gathered} 4.25h + 3 \leq 20 \\ 4.25h + 3 - 3 \leq 20 - 3 \\ 4.25h \leq 17 \\ \frac{4.25h}{4.25} \leq \frac{17}{4.25} \\ h \leq 4 \end{gathered}$$

Step 3
Verify the solution set using a test point.

Since $3 \leq 4$, one test point that can be used is 3.

$$\begin{gathered} 4.25h + 3 \leq 20 \\ 4.25(3) + 3 \leq 20 \\ 12.75 + 3 \leq 20 \\ 15.75 \leq 20 \end{gathered}$$

Since the resulting statement is true, the solution set is correct.

Lindsay can park for a maximum of 4 additional hours.