

Algebra Unit 2

Introduction

Situations in the real world often determine the types of values we would expect as answers to equations and inequalities. When an inequality has one or more variables and contains at least one inequality symbol ($<$, $>$, \leq , \geq , or \neq), it is called an **algebraic inequality**.

Sometimes there are limits or restrictions on the values that can be substituted into an equation or inequality; other times, limits or restrictions are placed on answers to problems involving equations or inequalities. These limits or restrictions are called **constraints**.

Key Concepts

- Many real-world situations can be modeled using an equation, an inequality, or a **system of equations or inequalities**. A system is a set of equations or inequalities with the same unknowns.
- When creating a system of equations or inequalities, it is important to understand that the solution set is the value or values that make each sentence in the system a true statement.
- Being able to translate real-world situations into algebraic sentences will help with the understanding of constraints.

Example 1

Determine whether the coordinate $(-2, 9)$ is a solution to the inequality $y \leq 5x + 6$.

Example 2

A taxi company charges \$2.50 plus \$1.10 for each mile driven. Write an equation to represent this situation. Use this equation to determine how far you can travel if you have \$10.00. What is the minimum amount of money you will spend?

Example 3

A school supply company produces wooden rulers and plastic rulers. The rulers must first be made, and then painted.

- It takes 20 minutes to make a wooden ruler. It takes 15 minutes to make a plastic ruler. There is a maximum amount of 480 minutes per day set aside for making rulers.
- It takes 5 minutes to paint a wooden ruler. It takes 2 minutes to paint a plastic ruler. There is a maximum amount of 180 minutes per day set aside for painting rulers.

Example 4

Use the system of inequalities created in Example 3 to give a possible solution to the system.

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Problem-Based Task 1.4.1: Skate Constraints

A sporting goods company produces figure skates and hockey skates. One group of workers makes the blades for both types of skates. Another group makes the boots for both types of skates.

- It takes 2 hours to make the blade of a figure skate. It takes 3 hours to make the blade of a hockey skate. There is a maximum of 40 hours per week in which the blades can be made for both types of skates.
- It takes 3 hours to make the boot of a figure skate. It takes 1 hour to make the boot for a hockey skate. There is a maximum of 20 hours per week in which boots can be made for both types of skates.

What are possible combinations of the number of figure skates and hockey skates that can be produced given the constraints of this situation?

Practice 1.4.1: Representing Constraints

Determine whether each coordinate listed below is a solution to the given algebraic sentence.

1. Is the coordinate $(-2, -4)$ a solution to the equation $y = 3x - 2$?
2. Is the coordinate $(1, -3)$ a solution to the inequality $y \leq -4x + 6$?

Read each scenario and use it to complete the parts that follow.

3. Given the inequalities $y > 5x - 8$ and $y \geq 3x + 4$, find a point that
 - a. satisfies both inequalities.
 - b. satisfies neither inequality.
 - c. satisfies one inequality, but not the other.
4. You pay \$12 to get into the fair, plus \$3 per ticket for x ride tickets.
 - a. Write an equation to find the total cost of attending the fair.
 - b. Now write an inequality and solve it to determine the maximum number of tickets you can buy if you have \$24 to spend.
 - c. What is the minimum amount of money you will spend?

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5. Charlie borrowed \$500 from his aunt. He has already paid back \$75. His aunt doesn't charge any interest and he is planning on making \$15 payments each Friday.
 - a. Write an equation that represents the number of weeks it will take Charlie to repay his aunt if he pays \$15 each Friday.

 - b. Is the solution to the equation the actual number of weeks it will take Charlie to repay his aunt? Explain your answer.