**Chapter 1: Equations and Inequalities**

1.7 🡪 Linear Inequalities

You can solve inequalities by finding all values of $x $for which the inequality is true. Such values are **solutions** and are said to **satisfy** the inequality. The set of all real numbers that are solutions of an inequality is the **solution set** of the inequality.

$$x+1<4$$

The set of all points on the real number line that represent the solution set is the **graph** of the inequality. Graphs of many types of inequalities consist of intervals on the real number line.

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INTERVALS AND INEQUALITIES

Write an inequality to represent each interval, graph the solution, and state whether the interval is bounded or unbounded.

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| --- | --- | --- | --- |
| Interval Notation | Inequality | Graph | Bounded or Unbounded |
| 1. (-3, 5] |  |  |  |
| 2. [4, 9) |  |  |  |
| 3. (-1, ∞)  |  |  |  |
| 4. (–∞, 3] |  |  |  |

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SOLVING A LINEAR INEQUALITY

The simplest type of inequality is a **linear inequality** in a single variable.

5. $5x-7>3x+9$ Graph Interval Notation

 Graph Interval Notation

6. $ 3-2\left(n-4\right)< -1$

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 Graph Interval Notation

7. $-5\left(1-4a\right)\leq -45 $

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 Graph Interval Notation

8. $x-15 \geq -4(-6+3x)$

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 Graph Interval Notation

9. $ 1-\frac{3x}{2}<x-4$

SOLVING A DOUBLE (COMPOUND) INEQUALITY

To solve the double inequality, you can isolate $x$ as the middle term.

 Graph Interval Notation

10. $-4\leq 5x-2<7$

 Graph Interval Notation

11. $-4< \frac{2x-3}{3}<4$

 Graph Interval Notation

12. $-8\leq 1-3\left(x-2\right)<13$

SOLVING AN ABSOLUTE VALUE INEQUALITY

Let $x$ be a variable of an algebraic expression and let $a$ be a real number such that $a\geq 0.$

1. The solutions of $\left|x\right|<a$ are all values of $x$ that lie between $-a$ and $a$.

$\left|x\right|<a$ if and only if $-a<x<a$

$\left|x\right|<4$ if and only if $-4<x<4$

2. The solutions of $\left|x\right|>a$ are all values of $x$ that are less than $-a$ or greater than $a.$

$\left|x\right|>a$ if and only if $x<-a$ or $x>a$

$\left|x\right|>5$ if and only if $x<-5$ or $x>5$

\*\*These rules are also valid if < is replaced by ≤ and > is replaced by ≥.\*\*

 Graph Interval Notation

13. $\left|x-5\right|<2$

 Graph Interval Notation

14. $\left|\frac{x-3}{2}\right|\leq 5$

 Graph Interval Notation

15. $\left|2x+1\right|\geq 7$

Graph Interval Notation

16. $\left|9-2x\right|-2>-1$

17. $8+\left|4x-7\right|<17$ Graph Interval Notation

APPLICATIONS

20. Subcompact car can be rented from Company A for $180 per week with no extra charge

 for mileage. A similar car can be rented from Company B for $100 per week, plus 20 cents

 for each mile driven. How many miles must you drive in a week to make the rental fee for

 Company B more than that for Company A?

21. A man begins an exercise and diet program that is designed to reduce his weight by at

 least 2 pounds per week. At the beginning of the diet the man weighs 225 pounds. Find

 the maximum number of weeks before the man’s weight will reach (or fall below) his goal

 of 192 pounds.

22. You go to a candy store to buy chocolates that cost $9.89 per pound. The scale that is

 used in the store has a state seal of approval that indicates the scale is accurate to within

 half an ounce. According to the scale, your purchase weighs one-half pound and costs

 $4.95. How much might you have been undercharged or overcharged due to an error in

 the scale?