1.4 Linear Inequalities in One Variable

1. Definition: A linear inequality in one variable, x, is defined as any relationship of the form:

$$ax + b > 0, ax + b < 0$$

$$ax + b \geq 0, ax + b \leq 0$$

2. The **solution** set to an inequality is the set of real numbers that makes the inequality a true statement.
Example: $-2 < x \leq 3$

a. Graph:

b. Interval Notation: $(-2, 3]$
"(": open interval, not including endpoint; "[": close interval, including endpoint.

c. Set-Builder Notation: $\{x| - 2 < x \leq 3\}$
(The set of all x value such that x is less than and equal to 3 and greater than -2)

3. Properties:

a. **Addition property of inequality:** If $a < b$, then $a + c < b + c$

b. **Subtraction property of inequality:** If $a < b$, then $a - c < b - c$

c. **Multiplication/Division property of inequality:** Multiplied/Divided by a negative number, the sign must be reversed.

Example 1: ***Solving a Linear Inequality:***
Solve the inequality. Graph the solution and write the solution set in interval notation.

a. $3x - 7 > 2(x - 4) - 1$

b. $-2x - 5 < 2$

c. $-6(x-3) \geq 2-2(x-8)$

d. $\dfrac{-5x+2}{-3} > x+2$

Example 2: ***Solving a Linear Inequality Application***

Beth received grades of 97%, 82%, 89%, and 99% on her first four algebra tests. To earn an A in the course, she needs an average of 90% or more. What scores can she receive on the fifth test to earn an A?

Example 3: ***Solving a Literal Equation:***

The number of registered passenger cars, N (in millions), in the United States has risen since 1960 according to the equation $N = 2.5t + 64.4$, where t represents the number of years after 1960 ($t = 0$ corresponds to 1960, t =1 corresponds to 1961, and so on). For what years was the number of registered passenger cars less than 89.4 million?