§1.7 Linear Inequalities

Review Section P.1

Notes: on Interval Notation

- Parentheses () indicate that the endpoint **is not** included in the interval.
- Brackets [] indicate that the endpoint **is** included in the interval.
- Intervals are always open at $\pm\infty$.
- Intervals always have the smallest value on the left and the larger value on the right.

Examples 1 Write in interval notation and graph.

a.) $x \geq -3$ b.) $3 < x < 8$ c.) $x < 6$

Properties of Inequalities - Let a, b and c be real numbers.

1.) $a < b$ and $a + c < b + c$ are equivalent. (addition property)
2.) If $c > 0$, then $a < b$ and $ac < bc$ are equivalent. (multiplication property)
3.) If $c < 0$, then $a < b$ and $ac > bc$ are equivalent. (multiplication property) *

Note: Replacing $<$ with $>$, $\leq$ or $\geq$ results in equivalent properties.

* **Note**: When multiplying or dividing both sides of the inequality by a negative number, we must reverse the direction of the inequality symbol.

<u>Linear Inequalities:</u> an inequality that can be written in the form **ax + b > 0** where $a \neq 0$.
(Note: Any inequality symbol may be used $<, >, \leq, \geq$.)

Use the properties of inequalities to solve linear inequalities by isolating the variable.

Example 2 Solve.

a.) $5x - 7 > 3x + 9$

b.) $1 - \frac{3x}{2} \geq x - 4$

<u>Double Inequalities:</u> Isolate the variable in the middle. Perform operations on each part of the inequality.

Example 3 Solve.

a.) $1 \leq 7x - 6 < 4$

b.) $-3 \leq 6x - 1 < 3$

Absolute Value Inequalities:

1. Solutions of $|x| < a$ are all values of x that lie between -a and a.
   $|x| < a$ if and only if $-a < x < a$

2. The solutions of $|x| > a$ are all values of x that are less than -a or greater than a.
   $|x| > a$ if and only if $x < -a$ or $x > a$

These rules are also valid if <, > are replaced by ≤, ≥.

Example 4 Solve.

a.) $|x-5| < 2$

b) $|x+3| \geq 7$