1.4 – Absolute Value Inequalities (Using Interval Notation)

Inequality notation → a method of rewriting expressions using the six inequality symbols which are … $<$, $>$, $\leq$, $\geq$, $\neq$, and $=$.

Interval notation → a method of rewriting inequalities using numbers, infinity symbols and/or both with grouping symbols such as brackets [ ] and parentheses ( ).

- brackets represents closed dots / underlined inequalities such as $\leq$, $\geq$, or $=$
  ● → pts on solid lines or closed dots are included.
- parentheses represents open dots / non-underlined ineq. such as $<$, $>$, or $\neq$
  ○ → pts on dashed lines or open dots are excluded
- If you **have more than 1 interval** (or "area of shading"), then you must use the Union Symbol. *more than 1 part*

Example 1: Complete the chart below using the appropriate notation and graph.

	Inequality Notation	Interval Notation	Graph (on a number line)
a.)	$x > -2$	$(-2, \infty)$	
b.)	$x \leq 1$	$(-\infty, 1]$	
c.)	$-3 \leq x < 0$	$[-3, 0)$	
d.)	all real numbers (IR)	$(-\infty, \infty)$	
e.)	IR , $x \neq 2$	$(-\infty, 2) \cup (2, \infty)$	
f.)	$x < -1$ or $x \geq 2$	$(-\infty, -1) \cup [2, \infty)$	

Review of Solving Linear Inequalities

- Steps are the SAME as solving equations: get rid of [Grouping] (symbols) and fractions (LCD)
- You must follow THREE RULES when solving with inequalities:

Rule 1 – If you multiply / divide by a Negative # then you must Reverse the Ineq. Symbol

Rule 2 – To help write your solution set, ALWAYS have the variable on LEFT side

Rule 3 – You must write your solution set (final answer) in Interval Notation

Example 2: Solve each inequality and write your answer in interval notation.

a.) $3x - 6(8x + 7) > 138$

$3x - 48x - 42 > 138$

$-45x - 42 > 138$

$+42 \quad +42$

$\frac{-45x}{-45} > \frac{180}{-45}$

$x < -4$

$(-\infty, -4)$

b.) $\frac{3x-5}{4} \geq \frac{x}{3}$ LCD: 12

Multiply by LCD: 12

$3(3x-5) \geq 4x$

$9x - 15 \geq 4x$

$+15 \quad +15$

$9x \geq 4x + 15$

$-4x \quad -4x$

$\frac{5x}{5} \geq \frac{15}{5}$

$x \geq 3$ $[3, \infty)$

c.) $7 - 4x \geq -2x - 2(x - 2)$

$7 - 4x \geq -2x - 2x + 4$

$7 - 4x \geq -4x + 4$

$+4x \quad +4x$

$7 \geq 4$ ← True statement

IR

$(-\infty, \infty)$

Compound & Absolute Value Inequalities

– **compound inequality** → two inequalities that are joined by the word AND or the word OR and is solved by solving each part the inequality; 2 parts!

- "OR" compound inequality is the Union of the two inequalities → $x \leq -1$ or $x > 2$

  $(-\infty, -1] \cup (2, \infty)$

- "AND" compound inequality is the Intersection of the two inequalities → $x \geq -1$ and $x < 2$

  $[-1, 2)$

  Inequalities intersect

  ** Can also be written as: $-1 \leq x < 2$ ← SAME!

Example 3: Solve each compound inequality. Write your answer in interval notation.

a.) $3x + 4 < -5$ or $7 - 3x \leq -11$

$-4 \quad -4 \qquad -7 \quad -7$

$\frac{3x}{3} < \frac{-9}{3} \qquad \frac{-3x}{-3} \leq \frac{-18}{-3}$

$x < -3$ or $x \geq 6$

$(-\infty, -3) \cup [6, \infty)$

b.) $6 - \frac{1}{2}x \leq 10$ and $\frac{2}{3}x + 4 \leq 6$

$-6 \quad -6 \qquad -4 \quad -4$

$-2\left(-\frac{1}{2}x\right) \leq 4(-2) \qquad 3\left(\frac{2}{3}x\right) \leq 2(3)$

$x \geq -8$ and $2x \leq 6$

$x \geq -8$ and $x \leq 3$

$-8 \leq x \leq 3$

$[-8, 3]$

c.) $13 < 2x + 7 \leq 17$ "AND"

$-7 \quad -7 \quad -7$

$\frac{6}{2} < \frac{2x}{2} \leq \frac{10}{2}$

$3 < x \leq 5$

$(3, 5]$

"AND" compound inequalities can be written without the word!