Inequality Unit:
High School Placement Test Review

Name: KEY ______________________ **Hour:** _____

Major Objectives (Students will…):

- **Graph and write inequalities.**
- **Solve equations using inequalities (1 step and multi-step equations).**
- **Solve and graph compound inequalities.**

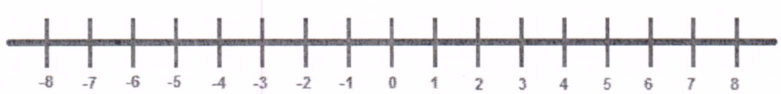
Tools of the Trade:

Prior Knowledge: Solving equations with many steps.

The Symbols:

Symbol	Meaning
=	Equal to
≠	Not equal to
<	Less than
≤	Less than or equal to
>	Greater than
≥	Greater than or equal to

The Arrows: 

The Graph (Number Line): 

The Open Dot: o Used with < or >

The Closed Dot: ● Used with ≤ or ≥

Lesson: Graphing & Writing Inequalities

(From Section 3-1)

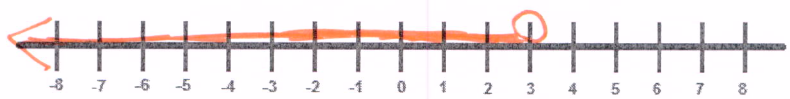
Objective (Student's will…):

Understand how to write and graph in equalities.

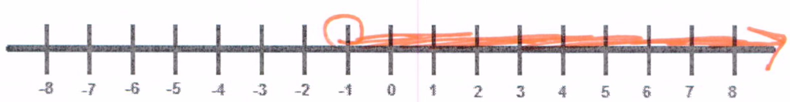
Graphing Inequalities:

Graph the solutions of each inequality on a number line:

1. $y < 3$

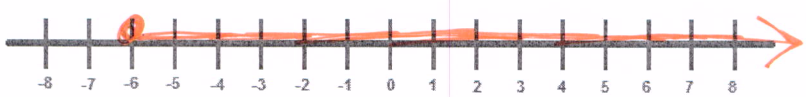


2. $x > -1$



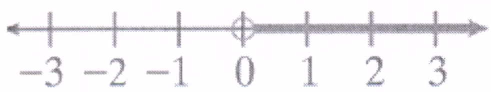
3. $a \leq -2$

4. $-6 \leq g$

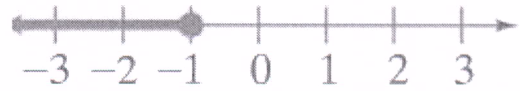


Writing Inequalities to Describe Graphs

Write the inequality shown in each graph.

1. 

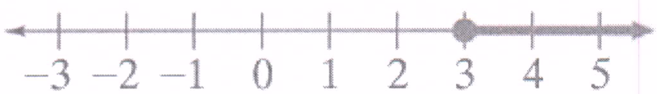
$x > 0$

2. 

$x \leq -1$

Quick Check

Write an inequality for the graph below.



$x \geq 3$

Write an Inequality Using Sentences

1. The restaurant can seat at most 172 people.

$x \leq 172$

2. A person must be at least 35 years old to be elected President of the United States.

$x \geq 35$

3. A law clerk has earned more than $20,000 since being hired.

$x > \$20{,}000$

Lesson: Solving Equations with Inequalities

(Textbook Sections 3-2, 3-3, and 3-4)

Objective (Student's will…):

Solve equations with inequalities.

Solving 1-Step Inequalities

Examples:

1. $p - 4 < 1$
   $+4 \quad +4$
   $p < 5$

2. $8 \geq d - 2$
   $+2 \quad +2$
   $10 \geq d$

3. $y + 5 < -7$
   $-5 \quad -5$
   $y < -12$

4. $4 + c > 7$
   $-4 \quad -4$
   $c > 3$

WHEN MULTIPLYING OR DIVIDING INEQUALITIES BY A NEGATIVE NUMBER (WHEN YOU MOVE A NEGATIVE NUMBER) YOU REVERSE THE SIGN (FLIP).

5. $5 \cdot \frac{x}{5} \geq -2 \cdot 5$
   $x \geq -10$

6. $-2 \cdot -\frac{v}{2} \geq 1.5 \cdot -2$
   $x \leq -3$

7. $\frac{-30}{-5} > \frac{-5c}{-5}$
   $6 < c$

8. $\frac{11z}{11} > \frac{-33}{11}$
   $z > -3$

Solving Multi-Step Inequalities

Remember:

- You solve these problems the same way you solve multi-step equations. The only difference is that there is an inequality sign.
- Flip the sign when multiplying or dividing by a negative.

Examples

1. $7 + 6a > 19$

$-7 \qquad -7$

$\frac{6a}{6} > \frac{12}{6}$

$a > 2$

2. $2(t + 2) - 3t \geq -1$

$2t + 4 - 3t \geq -1$

$-t + 4 \geq -1$

$-4 \qquad -4$

$\frac{-t}{-1} \geq \frac{-5}{-1}$

$t \leq 5$

3. $6z - 15 < 4z + 11$

$-4z \qquad -4z$

$2z - 15 < 11$

$+15 \qquad +15$

$\frac{2z}{2} < \frac{26}{2}$

$z < 13$

4. $18x - 5 \leq 3(6x - 2)$

$18x - 5 \leq 18x - 6$

$+6 \qquad +6$

$18x + 1 \leq 18x$

$-18x \qquad -18x$

$1 \leq 0$ NO SOLUTION

Set up an inequality and solve.

5. You wonder if you can save money by using your cell phone for all long distance calls. Long distance calls cost $.05 per minute on your cell phone. The basic plan for your cell phone is $29.99 each month. The cost of regular phone service with unlimited long distance is $39.99. Define a variable and write an inequality that will help you find the number of long-distance call minutes you may make and still save money.

5 +6 FOUND IN PRACTICE

6. The unit cost for a piece of fabric is $4.99 per yard. You have $30 to spend on material. How many feet of material could you buy? Define a variable and write an inequality to solve this problem.

Lesson: Solving Compound Inequalities

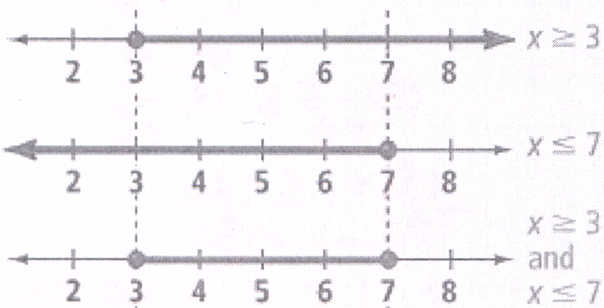
(Textbook Section 3-6)

Objective (Student's will…):

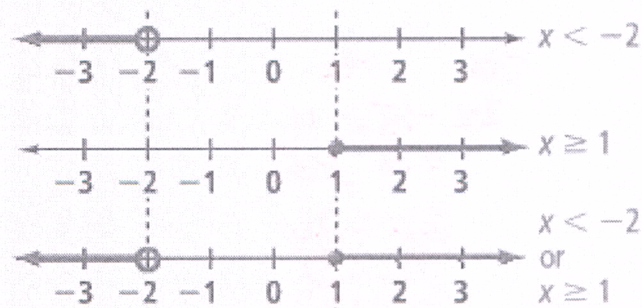
Solve and understand compound inequalities.

Essential Understanding You find the solutions of a compound inequality either by identifying where the solution sets of the distinct inequalities overlap or by combining the solution sets to form a larger solution set.

The graph of a compound inequality with the word *and* contains the *overlap* of the graphs of the two inequalities that form the compound inequality.



The graph of a compound inequality with the word *or* contains *each* graph of the two inequalities that form the compound inequality.



Writing a Compound Inequality

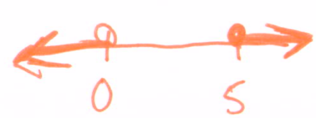
What compound inequality represents the phrase? Graph the solutions.

A all real numbers that are greater than −2 and less than 6

$-2 < x < 6$

B all real numbers that are less than 0 or greater than or equal to 5

$x < 0$ OR $x \geq 5$

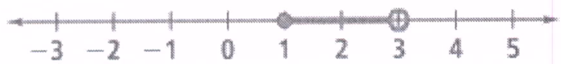


Solving Compound Inequalities Using *And*

What are the solutions of $-3 \leq m - 4 < -1$? Graph the solutions.

$$-3 \leq m - 4 < -1$$

$-3 \leq m - 4$	and	$m - 4 < -1$	Write the compound inequality as two inequalities joined by the word *and*.
$-3 + 4 \leq m - 4 + 4$	and	$m - 4 + 4 < -1 + 4$	Add 4 to each side of each inequality.
$1 \leq m$	and	$m < 3$	Simplify.
$1 \leq m < 3$			Write the solutions as a single inequality.



Got It? **2.** What are the solutions of $-2 < 3y - 4 < 14$? Graph the solutions.

$-2 < 3y - 4$
$+4 \quad\quad +4$
$\frac{2}{3} < \frac{3y}{3}$
$\frac{2}{3} < y$

$\frac{2}{3} < y < 6$

$3y - 4 < 14$
$+4 \quad +4$
$\frac{3y}{3} < \frac{18}{3}$
$y < 6$

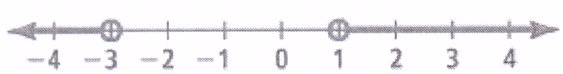
Solving Compound Inequalities Using *Or*

What are the solutions of $3t + 2 < -7$ or $-4t + 5 < 1$? Graph the solutions.

$3t + 2 < -7$	or	$-4t + 5 < 1$
$3t + 2 - 2 < -7 - 2$	or	$-4t + 5 - 5 < 1 - 5$
$3t < -9$	or	$-4t < -4$
$\frac{3t}{3} < \frac{-9}{3}$	or	$\frac{-4t}{-4} > \frac{-4}{-4}$
$t < -3$	or	$t > 1$

Reverse the inequality symbol when you divide by a negative number.

The solutions are given by $t < -3$ or $t > 1$.



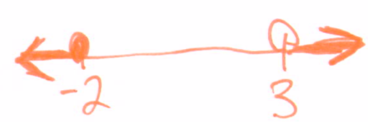
Got It? **4.** What are the solutions of $-2y + 7 < 1$ or $4y + 3 \leq -5$? Graph the solutions.

$-2y + 7 < 1$ OR $4y + 3 \leq -5$

$-7 \quad -7 \qquad\qquad -3 \quad -3$

$\frac{-2y}{-2} < \frac{-6}{-2} \qquad\qquad \frac{4y}{4} \leq \frac{-8}{4}$

$y > 3$ OR $y \leq -2$



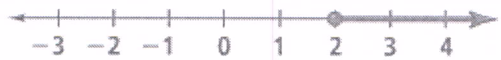
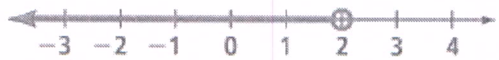
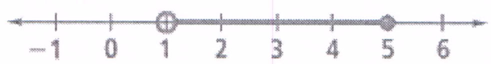
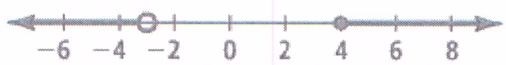
Interval Notation

You can use an inequality such as $x \leq -3$ to describe a portion of the number line called an *interval*. You can also use *interval notation* to describe an interval on the number line. **Interval notation** includes the use of three special symbols. These symbols include

parentheses: Use (or) when a $<$ or $>$ symbol indicates that the interval's endpoints are *not* included.

brackets: Use [or] when a $\leq$ or $\geq$ symbol indicates that the interval's endpoints *are* included.

infinity: Use ∞ when the interval continues forever in a *positive* direction.
Use $-\infty$ when the interval continues forever in a *negative* direction.

Inequality	Graph	Interval Notation
$x \geq 2$		$[2, \infty)$
$x < 2$		$(-\infty, 2)$
$1 < x \leq 5$		$(1, 5]$
$x < -3$ or $x \geq 4$		$(-\infty, -3)$ or $[4, \infty)$

A **What is the graph of $[-4, 6)$? How do you write $[-4, 6)$ as an inequality?**

B **What is the graph of $x \leq -1$ or $x > 2$? How do you write $x \leq -1$ or $x > 2$ in interval notation?**

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

Got It? **5. a.** What is the graph of $(-2, 7]$? How do you write $(-2, 7]$ as an inequality?
b. What is the graph of $y > 7$? How do you write $y > 7$ in interval notation?

a. 

$-2 < x \leq 7$

b. 

$(7, \infty)$

Lesson: Absolute Value Equations & Inequalities

(Textbook Section 3-7)

Objective (Student's will…):

Solve equations and inequalities involving absolute value.

Solving an Absolute Value Equation

CANNOT BE NEGATIVE

What are the solutions of $|x| + 2 = 9$? Graph and check the solutions.

$|x| + 2 = 9$

$-2 \quad -2$

$|x| = 7$ OR -7

7 OR -7

What are the solutions of $|n| - 5 = -2$? Graph and check the solutions.

$+5 \quad +5$

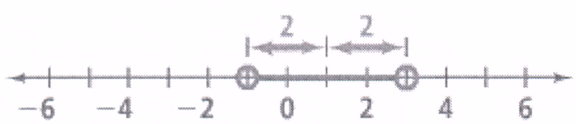
$|n| = 3$ OR -3

3 OR -3

Solving an Absolute Value Inequalities

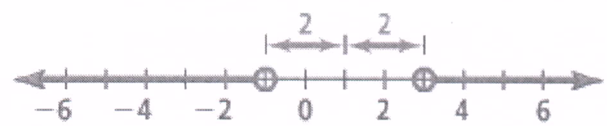
You can write absolute value inequalities as compound inequalities. The graphs below show two absolute value inequalities.

$|n - 1| < 2$



$|n - 1| < 2$ represents all numbers with a distance from 1 that is less than 2 units. So $|n - 1| < 2$ means $-2 < n - 1 < 2$.

$|n - 1| > 2$



$|n - 1| > 2$ represents all numbers with a distance from 1 that is greater than 2 units. So $|n - 1| > 2$ means $n - 1 < -2$ or $n - 1 > 2$.

$|3 + 2x| < 11$ (AND)

$-11 < 3 + 2x < 11$

$-11 < 3 + 2x \qquad 3 + 2x < 11$

$-3 \quad -3 \qquad -3 \quad -3$

$\frac{-14}{2} < \frac{2x}{2} \qquad \frac{2x}{2} < \frac{8}{2}$

$-7 < x \qquad x < 4$

$\boxed{-7 < x < 4}$

$|5 + 2y| \geq 3$ (OR)

$5 + 2y \geq 3$ OR $5 + 2y \leq -3$

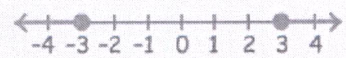
$-5 \quad -5 \qquad -5 \quad -5$

$\frac{2y}{2} \geq \frac{-2}{2} \qquad \frac{2y}{2} < \frac{-8}{2}$

$\boxed{y \geq -1 \text{ OR } y < -4}$

What are the solutions of $|8n| \geq 24$? Graph the solutions.

Think	Write
The inequality says that $8n$ is at least 24 units from 0 on a number line.	$\|8n\| \geq 24$
To be at least 24 units from 0, $8n$ can be less than or equal to -24 or greater than or equal to 24.	$8n \leq -24$ or $8n \geq 24$
You need to isolate n. Undo multiplication by dividing each side by the same number.	$\frac{8n}{8} \leq \frac{-24}{8}$ or $\frac{8n}{8} \geq \frac{24}{8}$ $n \leq -3$ or $n \geq 3$



What are the solutions of $|2x + 4| \geq 5$? Graph the solutions.

$2x + 4 \geq 5$
$-4 \quad -4$
$\frac{2x}{2} \geq \frac{1}{2}$
$x \geq \frac{1}{2}$

$2x + 4 \leq -5$
$-4 \quad -4$
$\frac{2x}{2} \leq \frac{-9}{2}$

$\boxed{x \geq \frac{1}{2} \text{ OR } x \leq -4.5}$

Manufacturing A company makes boxes of crackers that should weigh 213 g. A quality-control inspector randomly selects boxes to weigh. Any box that varies from the weight by more than 5 g is sent back. What is the range of allowable weights for a box of crackers?

Relate difference between actual and ideal weights | is at most | 5 g

Define Let w = the actual weight in grams.

Write $|w - 213|$ | $\leq$ | 5

$|w - 213| \leq 5$

$-5 \leq w - 213 \leq 5$ Write a compound inequality.

$208 \leq w \leq 218$ Add 213 to each expression.

The weight of a box of crackers must be between 208 g and 218 g, inclusive.

Examples

A food manufacturer makes 32-oz boxes of pasta. Not every box weighs exactly 32 oz. The allowable difference from the ideal weight is at most 0.05 oz. Write and solve an absolute value inequality to find the range of allowable weights.

$|w - 32| \leq 0.05$

$w - 32 \leq 0.05$
$+32 \quad +32$

$w - 32 \geq -0.05$
$+32 \quad +32$

$w \leq 32.05$ AND $w \geq 31.95$

$\boxed{31.95 \leq w \leq 32.05}$