Unit 4: Equations & Inequalities

Learning Goal 4.2 – Solving Inequalities

After completion of this unit, you will be able to…

Learning Target #2: Creating and Solving Linear Inequalities

- Solve and graph a linear inequality
- Create and solve an inequality from a context
- Name and graph a compound inequality
- Give solutions for a compound inequality

Timeline for Unit 4

Monday	Tuesday	Wednesday	Thursday	Friday
		2nd Day 1 Solving 1 & 2 Step EquationS	**3rd** Day 2 Multi-Step Equations	**4th** Day 3 Multi-Step Equations, Properties of Equality
7th Day 4 Solving Literal Equations	**8th** Day 5 Solving Literal Equations	**9th** Day 6 Creating & Solving Equations from a Context	**10th** EARLY RELEASE (1st and 2nd) Practice Day	**11th** Day 7 Creating Equations from a Context
14th Day 8 **4.1 Assessment,** Day 8 - Graphing Inequalities	**15th** Day 9 Solving 1 and 2 Step Inequalities	**16th** PSAT DAY (3rd and 4th) Practice Day	**17th** Day 10 Solving MultiStep Inequalities	**18th** Day 11 Creating Inequalities from a Context
21st Day 12 Compound Inequalities	**22nd** **4.2 Assessment**	**23rd**	**24th**	**25th**

	Monday	Tuesday	Wednesday	Thursday	Friday
AM	**NONE**	**Mrs. Jackson 7:45 – 8:15 Room 1210**	**Mr. Webb 7:45 – 8:15 Room 1205**	**Mr. Watson 7:45 – 8:15 Room 1208**	**Mr. Watson 7:45 – 8:15 Room 1208**
PM	**Mrs. Petersen 3:30 – 4:30 Room 1210**	**Mr. Webb 3:30 – 4:30 Room 1205**	**NONE**	**Mrs. Jackson 3:30 – 4:30 Room 1210**	**NONE**

Day 8 – Understanding Inequalities

Think About it: What numbers are bigger than -3? List them below.

An **inequality** is a statement that that compares two quantities that may or may not be equal. The quantities being compared use one of the following signs:

$<$	$>$	$\leq$	$\geq$	$\neq$
$A < B$	$A > B$	$A \leq B$	$A \geq B$	$A \neq B$
A is less than B.	A is greater than B.	A is less than or equal to B.	A is greater than or equal to B.	A is not equal to B.

When reading an inequality, you always to want to read from the variable. Translate the following inequalities into words. Then name some possible solutions.

Possible Solutions

A. $x > 2$ _____ _____

B. $-3 > p$ _____ _____

C. $y \leq 0$ _____ _____

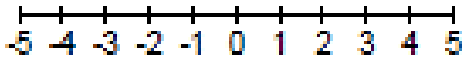
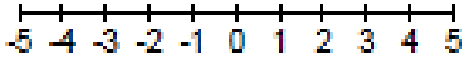
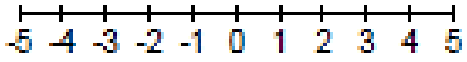
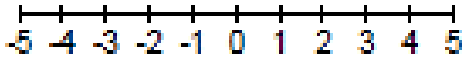
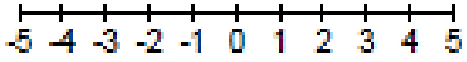
D. $-2 \leq z$ _____ _____

E. $x \neq 1$ _____ _____

When graphing an inequality on a number line, you must pay attention to the sign of the inequality. We use open and closed circles to determine whether the value named in the inequality is part of the solution or not.

Open Circles: They communicate to us that a particular value is NOT included in the solution set.

Closed Circles: They communicate to us that a particular value IS included in the solution set.

Words	Example	Circle	Number Line
Greater Than	$x > 2$	Open	
Less Than	$p < -3$	Open	
Greater Than or Equal To	$z \geq -2$	Closed	
Less Than or Equal To	$y \leq 0$	Closed	
Not Equal To	$x \neq 1$	Open	

Naming Inequalities from a Graph

Write an inequality to represent each graph and then determine if the following numbers are solutions:

1.

Is 2 a solution?

Is -5 a solution?

2.

Is -7 a solution?

Is -1 a solution?

3.

Is -4 a solution?

Is 5 a solution?

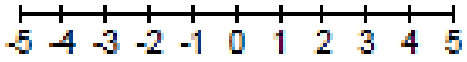
Day 9: Solving Inequalities

A **solution** to an inequality is any number that makes the inequality true.

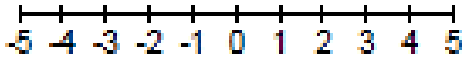
Value of x	x – 4 > -12	Is the inequality true?
-2		
-8		
-10		

Practice: Solve each inequality and graph. Then name three solutions.

1. $x - 4 < -2$



2. $7 \leq \frac{1}{2}x$



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

4. $6x - 5 \leq 7 + 2x$

Day 10 – Solving Multi Step Inequalities

Solving linear inequalities is very similar to solving equations, but there is one minor difference. See if you can figure it out below:

Experiment

Take the inequality 6 > 2. Is this true?

1. Add 3 to both sides. What is your new inequality?

2. Subtract 3 from both sides. What is your new inequality?

3. Multiply both sides by 3. What is your new inequality?

4. Divide both sides by 3. What is your new inequality?

3. Multiply both sides by -3. What is your new inequality?

4. Divide both sides by -3. What is your new inequality?

Conclusion:

Practice Solving Inequalities

Directions: Solve and graph.

a. $-3x - 4 < 2$

b. $\frac{1}{2}x - 7 > -8$

c. $-2(5x - 3) \geq 14$

d. $-x \leq 5$

e. $-7 > -x$

f. $12x - 6 \neq 14x - 2$

g. $11 > 4x + 3$

h. $11x - 5 \leq 15x + 3$

j. $15 - \frac{5}{8}x > 10$

Day 11 – Creating Inequalities from a Context

Part A *Match each equation/inequality with the verbal descriptions listed below. You need to write the equation/inequality next to each verbal description. Try to use logical thinking as to which words indicate an inequality and which type and which ones indicate an equation. Highlight the key words you used to determine the matching equation/inequality.*

Answer Choices

$n \geq 18$ $n = 18$ $n < 18$ $n > 18$ $n \leq 18$

$n < 12$ $n \geq 12$ $n \leq 12$ $n = 12$ $n > 12$

1. The attendant won't start the ride until there is at least 12 people. _____
2. In order to attend the reward party, students must sell greater than of 12 magazines. _____
3. The gas tank can hold at most 18 gallons of gas. _____
4. Maria has party supplies for a maximum of 12 people. _____
5. Children under 12 pay a discounted price at the movie theater. _____
6. You must be a minimum of 18 years old in order to vote. _____
7. Carlos earned $12 mowing a neighbor's yard. _____
8. The number of songs Derrick can purchase with the gift card is fewer than 18. _____
9. Ariel scored 18 points for her team in Saturday's game. _____
10. Coach told us we needed to complete more than 18 repetitions. _____

Part B: Which keywords do you think indicate:

Greater Than	Less Than	Greater Than or Equal To	Less Than or Equal To	Equal to

Part C: Using what you explored above, create an inequality to represent each scenario. Highlight keywords.

a. The maximum number of people allowed on the ride at one time is 100. _____

b. Children under 3 years old get into the park for free. _____

c. In order to qualify for free shipping, you must spend at least $25. _____

d. You essay must be over 300 words. _____

e. Hikers can only hike in areas with an elevation no more than 5000 feet above sea level. _____

f. In order to earn 25% off your total, you have to spend no less than $150. _____

Part D: Are there any other keywords you would add to your chart in Part B after completing Part C? Add them.

Creating Inequalities from a Context

When creating problems that involve inequalities, you will use the same methods as creating equations, except you have new keywords that will replace the equal sign with an inequality sign.

<	≤	>	≥
Less than	Less than or equal to	Greater than	Greater than or equal to
Fewer than	At most	More than	At least
	Maximum		Minimum
	No more than		No less than

Examples: Define a variable for the unknown quantity, create an inequality, and then solve.

1. One half of a number decreased by 3 is no more than 33.
Variables: _____

Inequality: _____

2. Alexis is saving to buy a laptop that costs $1,100. So far she has saved $400. She makes $12 an hour babysitting. What's the least number of hours she needs to work in order to reach her goal?
Variables: _____

Inequality: _____

3. Keith has $500 in a savings account at the bank at the beginning of the summer. He wants to have at least $200 in the account by the end of the summer. He withdraws $25 each week for food, clothes, and movie tickets. How many weeks can Keith withdraw money from his account?
Variables: _____

Inequality: _____

4. Yellow Cab Taxi charges a $1.75 flat rate in addition to $0.65 per mile. Katie has no more than $10 to spend on a ride. How many miles can Katie travel without exceeding her limit?
Variables: _____

Inequality: _____

Day 12 - Compound Inequalities

Scenario: GoodSportsBuys.com is an online store that offers discounts on sports equipment to high school athletes. When customers buy items from the side, they must pay the cost of the items as well as a shipping fee. At GoodSportsBuys.com, a shipping fee is added to each order based on the total cost of all the items purchased. The table below provides the shipping fee categories for GoodSportsBuys.com.

Total Cost of Items	Shipping Fee
\$0.01 up to and including \$20	\$6.50
More than \$20 up to and including \$50	\$9.00
Between \$50 and \$75	\$11.00
From \$75 up to, but not including, \$100	\$12.25
\$100 or more	\$13.10

Think About It…

1. What is the least amount a customer can spend on items and pay \$6.50 for shipping? _____

2. What is the greatest amount a customer can spend on items and pay \$6.50 for shipping? _____

3. What is the shipping fee if Michael spends \$75? Why?

Using the inequality symbols you learned yesterday, fill in the boxes to represent each shipping fee category if x represents the total cost of items purchased.

	Compound Inequalities	Compact Form
a. \$6.50 shipping fees:	x ☐ \$0.01 and x ☐ \$20	
b. \$9.00 shipping fee	x ☐ \$20 and x ☐ \$50	
c. \$11.00 shipping fee	x ☐ \$50 and x ☐ \$75	
d. \$12.25 shipping fee	x ☐ \$75 and x ☐ \$100	
e. \$13.10 shipping fee	x ☐ \$100	

When two simple inequalities are combined into one statement using the words OR or AND, the result is a **compound inequality**. Compound inequalities that use the word AND can be written in compact form. Compound inequalities that use the word OR cannot be put into compact form; the word OR must be used.

Difference between AND & OR:

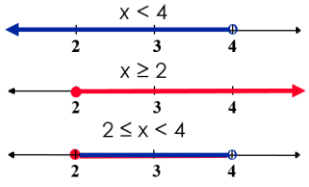
AND means "intersection"

- A number is a solution of the compound inequality if it is a solution to **both** of the inequalities.

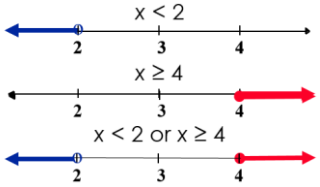
OR means "union"

- A number is a solution of the compound inequality if it is a solution to **one** of the inequalities.

Graph x < 4 and x ≥ 2



Graph x < 2 or x ≥ 4

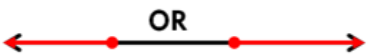


Compound Inequalities in Graph Form:

AND

Smallest number ≤ x ≤ largest number

OR

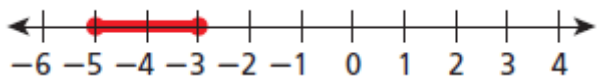


x ≤ smallest number or x ≥ largest number

Writing Compound Inequalities from a Graph

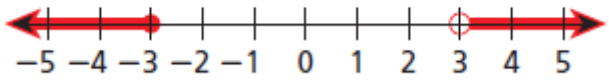
Practice: Identify each of the numbers as an AND or OR compound inequality. Then write the compound inequality.

a.



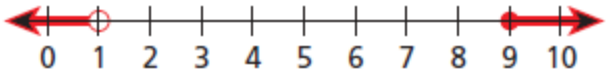
Possible Solutions:

b.



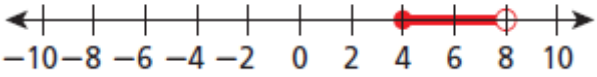
Possible Solutions:

c.



Possible Solutions:

d.



Possible Solutions:

Writing Compound Inequalities from a Context

Practice: Define a variable for each unknown quantity and write a compound inequality for each scenario.

1. Water becomes non-liquid when it is 32° F or below, or when it is at least 212° F. Write an inequality to describe water in its non-liquid form.

2. Every day, a female needs to eat at least 1500 calories, but less than 1800 calories. Write an inequality to describe the amount of calories a female should have per day.

3. Each type of fish thrives in a specific range of temperatures. The optimum temperatures for sharks range from 18 degrees Celsius to 22 degrees Celsius. Write an inequality that represents the temperatures where sharks will NOT thrive.