STEMTeach KU
THE UNIVERSITY OF KANSAS

Classroom Interactions 5E Lesson Plan Template

Author: KP Preut	**Title of Lesson**: Compound Inequalities **Lesson Source/Resources: Unit 2 Inequalities Spiral**
Lesson #: 1 Date lesson will be taught: **10/6**	Subject/Grade level: Algebra 1/9th Grade

Concepts/Main Idea – *explain the concept(s) that will be the focus of this lesson in detail.*

- ★ Problems will be expressions with variables that are being compared with inequality symbols
  - > greater than symbol
  - ≥ greater than or equal to symbol
  - < less than symbol
  - ≤ less than or equal to symbol
- ★ "And" inequalities have a variable lies between two values to make the statement true
  - Example: $1 < x < 5$
    - The value for x will lie between 1 and 5
    - Interval notation represents the possibilities for what could be substituted as x. In this case: (1,5)
- ★ "Or" inequalities have a variable that lies between two sets of two values
  - Example: $x < 1$ or $x > 5$
    - The value lies between $-\infty$ and 1 or it lies between 5 and ∞
    - $(-\infty,1) \cup (5,\infty)$
      - U represents "union" and shows that both parts are true and go together
- ★ To solve for variables in and inequalities, computations need to be done to every portion of the inequality
  - Example $-3 < 2x - 1 < 7$
    - To begin isolating variable, add 1 to each portion of the inequality to get $-2 < 2x < 8$
    - Then, divide each part by 2 to get $-1 < x < 4$

Instructional model and strategies – *The strategies from the learning center that will be used during the lesson*

- ★ Instructional Model: 5E lesson template
- ★ Non-linguistic representation:
  - This means using non-verbal explanations or models to showcase ideas. In this lesson, modeling solutions on a number line will be the non-verbal representation. This will take place during the sections of the lesson.

Objective/s- Write objectives in SWBAT form…
The Students Will Be Able To:

- ★ Students will be able to graph solutions for "and" inequalities.
- ★ Students will be able to write solutions in interval notation for "and" inequalities.
- ★ Students will be able to graph solutions for "or" inequalities.
- ★ Students will be able to write solutions in interval notation for "or" inequalities.

- ★ Students will be able to solve for the variable in "and" inequalities.
- ★ Students will be able to solve for the variable in "or" inequalities.

Evaluation *Based on your objectives, draft the content of the questions you will ask on your pre- and post-tests; at least 1 question for each objective. Questions do not have to be multiple choice. Your actual pre- and post-tests will be included in the interview paper.*

Pre-test assessment – This should line up with the learning targets and provide the teachers with the information needed to make instructional decisions *before* the lesson begins. Be sure the assessment will make the students' thinking visible.

- ★ Provided below

Formative assessment(s) – This should line up with the learning targets and provide teachers with the information needed to make instructional decisions *during* the lesson. Be sure to describe the format of the assessment and what it is designed to assess.

- ★ Explained below

	Post-test assessment - This should line up with the learning targets and provide teachers with the information needed to be confident that students understand the content. Be sure to describe the format of the assessment and what it is designed to assess. ★ Provided below

Kansas Science and Math Standards- Include standard, benchmark and indicator where applicable

For math lessons:

Common Core Math Content:

- ★ A.REI.B Solve equations and inequalities in one variable.

Common Core Math Practice:

- ★ M6: Attend to precision.

NGSS Science and Engineering Practice:

- ★ S5: Use mathematics and computational thinking.

Common Core ELA Practice:

- ★ E4: Construct viable arguments and critique reasoning of others.

Materials list (BE SPECIFIC about quantities)

per Student:

- ★ 25 Unit 2 Spiral Notebooks (students should have these)
- ★ 25 Pre-tests
- ★ 25 calculators (in the classroom)
- ★ 25 iPads (students should have these)

per Group (approx 12 groups):

- ★ 1 large whiteboard

Advance preparation:

- ★ Before class, it would be helpful to write the problems on the white board to save time.

Include handouts at the end of this lesson plan document (blank page provided to paste a copy of your document). List handouts in your materials list.

Accommodations: Include a general statement and any specific student needs. Be sure to include struggling readers.

- ★ Read aloud for word problems.
- ★ Students may request to work in the learning pocket in the hall.

Safety: Include a general statement that indicates how you will establish a learning environment where safety for all is assured. Include physical safety concerns specific to this lesson. Identify when you will address these specific concerns with the students

- ★ There are no specific physical safety concerns with this lesson.
- ★ Students will be working in small groups and reporting their work back to the whole class. At the beginning of the lesson, the teacher will establish that students need to respect everyone's ideas and not make disparaging comments if classmates make mistakes.

Extension Activities:	**Backup Plans:**
★ **More practice on IXL math**	★ If the majority of students are not understanding the material, elaborate examples can be done as a class with more teacher direction.

Describe what the student and the teacher will do during each stage of the lesson. Be sure to describe the learning experiences and the assessments. You also need to discuss any management considerations (e.g., picking up materials, movement of students, etc.)

Engagement: Estimated Time: _____10 min___ (This should be a block day or two-day lesson)		
What the teacher does AND how will the teacher direct students: (Directions)	**Probing Questions:** Critical questions that will connect prior knowledge and create a "*Need to know*"	**Expected Student Responses AND Misconceptions -** *think like a student to consider student responses INCLUDING misconceptions:*
★ Teacher will ask students how old any given student at LHS could be (14-18) ★ Can we express this as an inequality? ○ Let's say s represents the age of any student ○ On a number line, where would s be? ■ Between 14 and 18 ○ Our inequality should be 14___s___18, what symbols should be between the numbers and s? ○ Should there be an open or filled in circle at 14? ○ Should there be an open or filled in circle at 18? ○ How do we put it in interval notation? ★ So we've talked about "and '' inequalities, let's discuss "or" inequalities. ★ Think about this room, everyone in this room is either a student or an adult. ○ Students will be what age or younger? ○ I'm 25, so the adults are 25 or older. ○ To talk about the ages of everyone in the room, how can we put this into words? ○ How can we express the idea as an inequality? Let a be your variable. ○ How can we graph it? ○ How do we put it in interval notation?	On a number line, where would s be? What symbols should be between the numbers and s? Should there be an open or filled in circle at 14? Should there be an open or filled in circle at 18? Students will be what age or younger? To talk about the ages of everyone in the room, how can we put this into words? How can we express the idea as an inequality? How can we graph it? How do we put it in interval notation?	★ Between 14 and 18 ★ Before 14 ★ After 14 ★ < ★ > ★ <= ★ >= ★ = ★ Open ★ Filled ★ 14 ★ 18 ★ Everyone is either 18 and younger or 25 and older ★ Everyone is between 18 and 25 ★ Everyone is 14 or older ★ 18<=a or a>=25 ★ 18<=a and a>=25 ★ Various answers with open/filled in circles ★ (-infinity , 18) or (25, +infinity)

		★ (18,25)

Exploration: **Estimated Time: ___20 min (5 min for each part)____**		
What the teacher does AND what the teacher will direct students to do: (Directions)	**Probing Questions: Critical questions that will guide students to a *"Common set of Experiences"***	**Expected Student Responses *AND* Misconceptions -** think like a student to consider student responses *INCLUDING* misconceptions:
★ Explore and explain portions will alternate. The teacher will split students into groups of 2-3 to work on examples. Students should do their work on the large whiteboards. ★ Explore Part 1: ○ Teacher will ask students to work on the "and" inequalities part of the notes. ★ Explore Part 2 ○ Teacher will ask students to work on the "or" inequalities part of the notes. ★ Explore Part 3: ○ Teacher will ask students to work on Example 1 ★ Explore Part 4: ○ Teacher will ask students to work on Example 2	How can we express the idea as an inequality? How can we graph it? How do we put it in interval notation?	★ Various answers with signs, and/or symbols ★ Various answers with open/filled in circles ★ Various answers with different brackets, parenthesis

Explanation: **Estimated Time: ___20 min (5 min for each part)_____**		
What the teacher does AND what the teacher will direct students to do: (Directions)	**Clarifying Questions:** Critical questions that will help students "c*larify their understanding*" and introduce information related to the lesson concepts & vocabulary	**Expected Student Responses *AND* Misconceptions -** think like a student to consider student responses *INCLUDING* misconceptions:
★ Explore and explain portions will alternate. The teacher will split students into groups of 2-3 to work on examples. ★ Explain Part 1: ○ Students will explain their work from Explore Part 1 ★ Explain Part 2 ○ Students will explain their work from Explore Part 2 ★ Explain Part 3: ○ Students will explain their work from Explore Part 3 ★ Explain Part 4: ○ Students will explain their work from Explore Part 4	How can we express the idea as an inequality? How can we graph it? How do we put it in interval notation?	★ Various answers with signs, and/or symbols ★ Various answers with open/filled in circles ★ Various answers with different brackets, parenthesis

Elaboration: **Estimated Time: ___20 min_____**		
What the teacher does AND what the teacher will direct students to do: (Directions)	**Probing Questions:** Critical questions that will help students *"extend or apply"* their newly acquired concepts/skills in *new situations*	**Expected Student Responses *AND* Misconceptions -** think like a student to consider student responses *INCLUDING* misconceptions:
★ The teacher will work with the class to solve compound inequalities. The class will work through Example 3 together. ★ The teacher will direct students to work on remaining problems on pg. 30-31 in groups. ★ Students will be directed to check their answers with the teacher before moving on. ★ Students can then work on their homework (pg 32-33) or practice problems on IXL.	What are the steps for solving the inequality? How can we graph it? How do we put it in interval notation?	★ Get variable by itself ★ Add/subtract the constant ★ Divide by the number in front of the variable ★ Various answers with open/filled in circles ★ Various answers with different brackets, parenthesis

Evaluation: **Estimated Time: ____15 min_____**

Critical questions that ask students to demonstrate their understanding of the lesson's performance objectives.

Formative Assessment(s): *In addition to the pre- and post-test, how will you determine students' learning within this lesson: (observations, student responses/elaborations, white boards, student questions, etc.)?*

- ★ Pre-test (From previous lesson)
- ★ Student explanations (Engage, Explain)
- ★ Observations of student work (Explore, Elaborate)

Summative Assessment: *Provide a copy of the key to the post-test in the interview paper.*

- ★ Post-test that will be given after Special Solutions and Compound Inequalities are taught.

2.6 Compound Inequalities

Concept Checklist:

- ☐ Identify if a compound inequality is an "AND" inequality or an "OR" inequality.
- ☐ Solve compound inequalities.

Warm-up: Solve the inequality for the variable. DO NOT GRAPH. Write the solutions in interval notation, if possible.

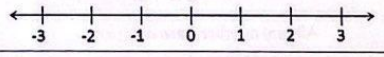
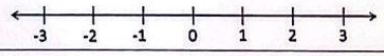
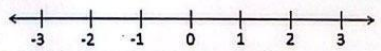
$-12 + 6x < 6(x - 2)$

Notes:

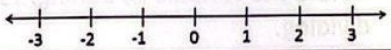
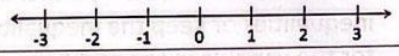
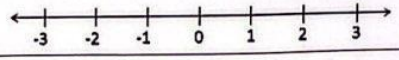
A **compound inequality** is an inequality formed by _____

_____ inequalities with the word "**and**" or the word "**or**."

"**AND**" Inequalities

$x \geq -2 \quad and \quad x < 1$ $-2 \leq x < 1$	
$x \geq -2$	
$x < 1$	
$x \geq -2 \quad and \quad x < 1$	
Interval Notation:	

"OR" Inequalities

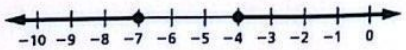
$x \geq 3$ *or* $x < 0$	
$x \geq 3$	
$x < 0$	
$x \geq 3$ *or* $x < 0$	
Interval Notation:	

Example 1: Write each sentence as a compound inequality. Write the solutions in interval notation.

A number (*n*) is less than 6 and greater than or equal to 2.

A number (*n*) is less than or equal to -7 or greater than 12.

Example 2: Write a compound inequality that is represented by the graph.



Notes:

Steps to solve **Compound Inequalities:**

- Isolate the variable by adding, subtracting, multiplying, and/or dividing.
  * In an "AND" inequality, either split the inequality into 2 separate inequalities or keep the inequality together and solve both inequalities for the variable in the middle.

Example 3: Solve the compound inequality for the variable. Graph the solutions on the number line. Write the solutions in interval notation.

5. $-5 \leq c - 3 < 4$

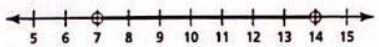
6. $-36 < 3y - 6 < -15$

7. $-2m + 7 \geq 13$ *or* $5m + 12 > 37$

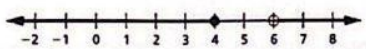
2.6 Compound Inequalities Practice

Directions: For #1-2, write the compound inequality that is represented by the graph. Write the solutions in interval notation.

1.

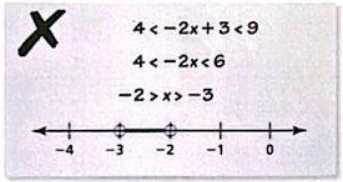


2.

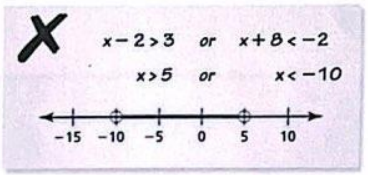


For #3-4, describe and correct the error in solving and/or graphing the compound inequalities.

3.



4.



For #5-10, solve each compound inequality for the variable. Graph the solutions on the number line. Write the solutions in interval notation.

5. $-50 < 7k + 6 < -8$

6. $-1 \leq 9 + n \leq 17$

7. $-3 \leq 2w - 1 < 5$

8. $7 < 4c + 3 \leq 23$

9. $-a \geq 9$ *or* $2 + 4a \geq 10$

10. $2h < 10$ *or* $\frac{h}{2} \geq 3$

POST-TEST

Name: _____

1. ***Solve for the variable and write in interval notation. Then, circle if the inequality does not have a special solution, has no solutions, or has infinitely many solutions***

    a) $3r \leq 9$

Interval notation: _____

Not a special solution No solutions All real numbers

    b) $5s - 3 \geq 5s - 1$

Interval notation: _____

Not a special solution No solutions All real numbers

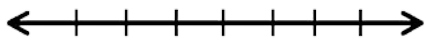
c) $8z + 3 \geq 8z - 5$

Interval notation: _____

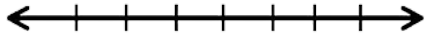
Not a special solution No solutions All real numbers

2. Graph the inequalities

a) $x \geq -1$ *and* $x < 3$

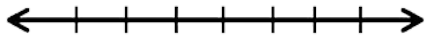


b) $x \leq -1$ or $x > 3$



3. ***Solve inequality for the variable and graph***

a) $-1 \leq 2m - 1 < 7$



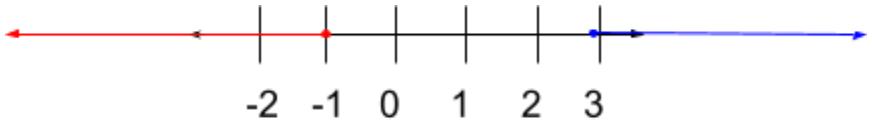
Pre/Post Test Key

1a. 7 points possible
- ★ 2 points for solving for variable
  - $r \leq 3$
- ★ 4 points for interval notation
  - $(-\infty, 3]$
- ★ 1 point for circling correct answer
  - Not a special solution

1b. 7 points possible
- ★ 2 points for solving for variable
  - $-3 \geq -1$
- ★ 4 points for interval notation
  - No Solutions / NS
- ★ 1 point for circling correct answer
  - No solutions

1c. 7 points possible
- ★ 2 points for solving for variable
  - $3 \geq -5$
- ★ 4 points for interval notation
  - $(-\infty, \infty)$
- ★ 1 point for circling correct answer
  - All real numbers

2a. 4 points possible
- ★ 2 points for each part of the graph
  - 

2b. 4 points possible
- ★ 2 points possible for each part of the graph
  - 

3a. 5 points possible

- ★ 3 points possible for solving for the variable
  - $0 \leq m < 4$
- ★ 2 points possible for graph
  -