**LESSON PLAN OUTLINE- (2-Day Lesson)**

**Day 2-Solving Inequalities**

1. TITLE OF LESSON: Solving inequalities
2. CONTEXT OF LESSON: Earlier in the school year, students learned the inequality symbols and used them to compare fractions, decimals, percents, integers, etc. They have just finished a unit on equations. The next natural step is to link these two ideas together and have them work with one-step inequalities, learning to solve them and graph their solutions. This is the second of two lessons that will address these topics. This one will focus on solving inequalities.
3. LEARNING OBJECTIVES and ASSESSMENT:

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| Learning Objective | Bloom | Assessment (Formative/Summative) |
| Students will be able to model the steps to solve a one-step inequality using Algebra tiles. | Comprehension | Teacher will observe as students work with a partner and their Algebra tiles. A checklist will be used to identify students who may need more help with modeling as the unit progresses. |
| Students will be able to solve a one-step inequality in one variable using paper & pencil. | Comprehension | Teacher will observe as students complete practice problems on their own. A checklist will be used to identify students who may need more help with this skill as the unit progresses. |
| Students will be able to compare and contrast inequalities and equations.  | Analysis | Students will make a foldable to compare and contrast inequalities and equations. As students work, teacher will look for all students to state at least 3 similarities and 3 differences between them. Teacher will also give feedback as needed. |

1. RELATED 2009 VIRGINIA STANDARDS OF LEARNING:

SOL 7.15: The student will

 a) Solve one-step inequalities in one variable; and

 b) graph solutions to inequalities on the number line.

1. MATERIALS NEEDED:

 Power-point slide for warm-up

 Student warm-up folders

 Modeling & Solving Inequalities Notes handout (1 per student)

 Algebra tiles

 Grouping cards for pairing students

 Blank computer paper(1 per student)

 Exit slip(1 per student)

\*Classroom teacher will be responsible for securing all of above materials.

1. PROCEDURE:

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| Time | Mathematical Tasks to be Used,Teacher Thoughts/Actions/Questions | Anticipated Student Comments, Questions, Actions, and Strategies |
|  | INTRODUCTION: Display the warm-up PowerPoint slide and have students begin in their warm-up folder. After students have had enough time to work, discuss the problem with the students, and their answers. Point out that it is different from the kind of inequalities they looked at last time because it has a step involved in solving it. We call these one-step inequalities. Ask students what a solution is that could work. Then ask students for other solutions. This reminds them that inequalities have more than just one solution. Tell them that instead of guessing & checking to find solutions, today they will learn methods to use to find all possible solutions.  | Students work on the warm-up individually. Some students may write an equation rather than an inequality if they do not read the question carefully. When asked for a solution, most students will probably give the value that would solve the equation. When asked for other solutions, they will probably guess and check to find values that could be substituted for x that result in a true statement.  |
|  | BODY: Hand out the Modeling & Solving Inequalities handout to students. Tell them they will first look at how to model inequalities by using Algebra tiles. This helps them gain a better understanding of why we do the steps we do when solving an inequality. Also distribute Algebra tiles to each student. Work through the first 3 examples with the students, asking them questions about the processes along the way. Demonstrate under the document camera how to solve the three given inequalities by using Algebra tiles. Ask students if they have any questions about those three examples before they try some with a partner. Answer any questions they may have. Explain that they will work with a partner to model the 3 inequalities at the bottom of their handout. They will model them with their Algebra tiles and draw pictures at each step just as they did for the example problems. The person that they will work with will be determined by the group-work cards you are about to hand out. Distribute a group-work card to each student and give students time to find their partner. After finding their partner, remind them once again to begin working, and to use the Algebra tiles. After students have had enough time, call on a few students to share their representations under the document camera. Have students explain their work to the class. Have students return to their original seat and work through the 2nd side of the handout with them. Complete the example problems together and then have them try the set of 3 problems on their own. They will graph their answers as well to make connections to the lesson last class. Spend some time discussing the rule about flipping the inequality symbol when multiplying or dividing by a negative number. An example is provided on the paper which shows why you must flip the sign, but have students also come up with their own true inequalities and demonstrate how this is always necessary in order to keep the inequalities true when multiplying or dividing by a negative. As a final activity, students will compare and contrast equations with inequalities. Hand out a blank piece of computer paper to each student. Tell them to fold it in half, hot-dog style. Have them write "equations" and "inequalities" as the titles for each column. Tell them that now they have studied both equations and inequalities. As they have seen, they have similarities as well as differences. Tell them you would like for them to complete this comparison chart using as many similarities and differences they can think of. They should try to come up with at least 3. When finished, students will share their ideas with their table group and then with the whole class to compile a class chart.  |  Students should be following along as the teacher works through the modeling inequalities examples under the document camera. They should be using the Algebra tiles provided to mirror what they see the teacher doing. They will also draw pictures of each step in the boxes provided on their handout. Ask any questions necessary to understand the examples. Students will find their partner, and begin working. Two of the problems include negative numbers, so students may have questions about how to model this. The third problem may be solved differently by various groups. Some students may simply take away 3 negative chips from each side. Others may show the steps by adding 3 positives to each side, and cancelling out the zero pairs. Students return to their original seat and work through the solving equations side of the notes together with the teacher, completing examples on their own as directed. Students may try to solve without showing work. Stress the importance of showing work, by telling them that these are basic inequalities, but when they get into Algebra they will solve inequalities with many steps that they will not be able to solve in their head. It is important that they practice these steps now so they will know how to solve multi-step inequalities later.Students fold their paper, label their columns, and then write similarities and differences. Then they will share ideas with their table group and then with the whole class to compile a class chart. Anticipated similarities: can be solved using inverse operations, solutions can be graphed on a number line. Anticipated differences: equal sign vs. inequality symbols, one solution vs. many solutions, graph is a closed circle vs. graph containing open or closed circle and shading to represent other values making the inequality true. |
|  | CLOSURE: Have a class discussion about the topics learned today. Have students tell a neighbor one thing they learned today. Answer any remaining questions students may have. Tell students they will complete an exit slip. Have them complete this and collect it from them as they leave class.  | Students will listen to a summary of the main points of today's lesson, and will tell their neighbor one thing they learned in class today. Then they will complete their exit slip and hand it in on their way out of class.  |

1. MEETING THE NEEDS OF ALL STUDENTS: The use of Algebra tiles in this lesson can be helpful to both special needs students as well as students above grade-level. They allow for manipulation of material and a better understanding of the math involved. Above grade-level students could be challenged at various points throughout the lesson with 2-step inequalities to model and solve if they finish their work early. Their exit slip could also include a 2-step inequality rather than a one-step inequality for an extra challenge.
2. WHAT COULD GO WRONG WITH THIS LESSON AND WHAT WILL YOU DO ABOUT IT? This lesson has a lot of material to cover and it is possible that the class will run out of time to complete all parts of the lesson. If this is the case, the comparison activity between equations and inequalities could be completed the following class block as a warm-up. In the case that even more material does not get covered, it can be completed the next day. Plans for the next day of class can be to finish up this lesson and review for a quiz on inequalities.
3. CONNECTION TO CTA: Group-work and summarizing with a neighbor were both themes of John Strebe's presentation and were incorporated into this lesson. Also, students compared and contrasted inequalities with equations which took them to a higher level of Bloom's Taxonomy, a theme discussed by many presenters at the CTA. An open-ended assessment question was also used as closure for this lesson as discussed by Pat Lintner.

**Warmup:** Andrea has saved $220 for her vacation this summer. She would like to have at least $439 by the time she leaves. How much more money does she need to save for her vacation to reach her goal? Write an inequality to model this situation.

**Exit Slip:**

 Solve the inequality x - 7 > 2 ,showing your work. Give 2 solutions which satisfy the inequality. How do you know these numbers are solutions?

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**Modeling & Solving Inequalities**

**Part I: Modeling Inequalities**

Let’s model some inequalities. Remember what we’re solving for!

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| **X + 2 > 3** | **3x < 9** | **X - 5 > 2** |
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 Try the next set with your partner.

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| **X + 1 < 5** | **2x < -6** | **X - 3 > -3** |
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**Part II: Solving Inequalities**

Solving an inequality is very similar to solving an equation. The main difference is that we have an inequality symbol instead of an .

**Examples 1, 2, & 3:** Solve the following inequalities. Graph each solution.

1) p + 7 < 13 2) t – 14 ≥ -6 3) 5y < 20



**Try these:** Solve the following inequalities. Graph each solution. Show all work!

4) 3m ≤ -12 5) z – (-6) > 2 6) c < -7

 2



**Reverse the sign!**

**Why?**

Suppose you start with the true statement: 2 < 3. Now, multiply both sides by negative 2, for example.

What did you get?

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Is this still a true statement?

**A Special Case:**

When multiplying or dividing by a negative number, you must

*reverse the inequality symbol* in order to keep the inequality true.

 **Example:** Solve: -4n > 24

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