Name of Lesson: *Properties of Equality – A Review*

Mathematical Topic: The Four Properties of Equality

Course: Algebra I

Time Allocation: One (1) 56 minute period

Pre-requisite Knowledge: The students will have been introduced to all of the properties of equality in previous lessons. This lesson is designed as a review activity where all of the properties are brought together in the process of solving simple single variable equations.

Objectives: The students will:

1. Be able to identify and define the four properties of equality presented
2. Be able to solve single variable equations having one or two steps.
3. Be able to apply the four properties of equality to solving a variety of simple single simple variable equations as described above.

Materials:

1. TI-84 Plus Silver Edition with Algebra 1 – Part 1 (ALG1PRT1) application.
2. Activity Worksheet One – Properties of Equality
3. Activity Worksheet Two – Free Fall
4. TI View Screen and overhead projector.

Important Vocabulary:

1. *Isolate the variable* – the variable must be alone on one side of the equals or inequality sign and positive.
2. *Inverse operation* – an operation that will "undo" another operation. For example, division is the inverse operation of multiplication.
3. *Equivalent equations* – equations that have the same value, but are visually different.

Procedure:

1. Homework Review (10 – 15 minutes)
   1.1 Ask students which problems they would like to review and what was it that made the problem a challenge (i.e. what did the student not understand). List the numbers on the board from top to bottom in ascending order and the information concerning what made the problem difficult. A student scribe may be used for this part.
   1.2 Select student volunteers to help answer their peer's questions. This may range from a quick verbal answer to doing out the problem on the board in detail. The teacher must determine how in depth the

answers must be in order to ensure that the questions are answered and the students understand the concepts presented.

2. Properties of Equality – definition review (25 - 30 minutes)
   2.1 Ask four student volunteers to come to the board and write a definition of one of the properties of equality as assigned and provide an example. Hand out the TI 84 handhelds and the first activity sheet while the students are placing their responses on the board.
   2.2 Indicate to the students that you will come back to the definitions on the board after the class completes the first activity.
   2.3 Using the teacher handheld, view screen and overhead projector have the students follow along on their handhelds and using the handout complete the first activity. Remind the students that the instructions for accessing the application are on their activity sheets. Continuously circulate around the room and assist students as needed.
   2.4 Once the majority of students have completed Activity One, review the definitions on the board and accompanying examples. Use a student scribe and based upon input from the class make adjustments as necessary. Once the definitions and examples are complete have students make any necessary adjustments to their worksheets.

3. Activity: FREE FALL (5 – 7 minutes)
   3.1 Using the TI View Screen lead the students to the first activity: FREE FALL!
   3.2 Tell the students the following:
   Watch the equation as it falls and quickly solve for x. Enter the solution and press the "ENTER" key before the equation hits the bottom. If an incorrect answer is given, the correct answer is displayed; have the students press any key to resume play. The incorrect equations stack up at the bottom giving them less time in which to respond. Students are to play until they have four incorrect answers.
   3.3 Select the "Silver" level. Have all of the students practice with the Silver level questions. Ask for questions and circulate around the room, observing student responses and making constructive remarks as appropriate.
   3.4 Have the class make general observations about the types of questions and responses were included in this activity. Ensure students use appropriate vocabulary.

4. Homework Activity: FREE FALL. (5 minutes)
   4.1 Students will play FREE FALL at the Silver Level and then the Gold Level completing the accompany Activity Sheet. Please indicate to the students that the Activity Sheets assigned for homework will be collected at the beginning of the next class.

Follow-up: Students who have mastered the material will be able to solve single variable equations involving one or two steps and will be able to identify which properties of equality were applied in the process. After successful completion of this lesson, students will work with more complex single variable equations and apply the properties of equality in solving them. These more complex equations will have more than one constant, will have fractional answers in some cases and will lead in to the concept of combining like terms as it relates to solving equations.

Assessment: The homework activity sheet will be collected and corrected. The teacher will determine if the concepts presented have become part of the class's skill set before moving on to more challenging problems using the Properties of Equality. If the class has not mastered the material, additional practice using the other handheld activities, such as "SOLVE IT" or "BEAM DALE UP" can be used. Use of more traditional worksheets may also be appropriate if the students are demonstrating an understanding of the general concepts, but making errors involving signs, starting with the wrong operation, etc.

Resources: The activity is from the TI applications for the TI-84 Plus Silver Edition. The first activity sheet includes only the observation problems found on TI activity sheet 2-10 from Topics in Algebra 1, copy write 2001 Texas Instruments. The instructions for completing FREE FALL as found the lesson plan are copied with minor revision from TI activity sheet 2 – 19 from Topics in Algebra 1, copy write 2001, Texas Instruments. The FREE FALL activity sheet is of my own design, but does contain the instructions for the activity as adapted from the TI activity sheet 2 – 19 as referenced above.

ACTIVITY ONE – PROPERTIES OF EQUALITY

Name: _____ Date: _____ Period: _____

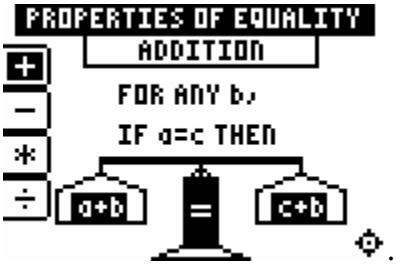
Overview: In this activity you will be reviewing the properties of equality and comparing what is presented on the handheld to the information placed on the board by some of the class members. From this you will develop a working definition for each of the four properties of equality and a unique example for each.

Instructions:

1. Press the "ON" button.
2. Press the "APPS" key.
3. Press "3" and "ENTER". Press "ENTER" again.
4. Press "2" (LINEAR EQUATIONS) and "2" again (USING ALGEBRA). Press "1" (OVERVIEW) This brings you to the first screen for the application.

Most of the navigation from this point forward will be accomplished using the arrow keys.

5. Press the right arrow key.
6. Follow the overview and advance through the screens using the right arrow key until you get to the Properties of Equality Screen as shown.



7. You will start with the Addition Property of Equality. Once this is completed, including the three types of equations to be solved, you will work through the balance of the remaining properties of equality. When you reach a screen which indicates that the next section is "ACTIVITIES" and you have completed all of the overview material, including the questions on the back of this activity sheet, please stop.

Observations:

Observation 1: $x - 5 = 8$

Observation 2: $(3/2)x = 9$

Observation 3: $4 - x = 10$

For each of the four properties of equality listed below write your own definition based upon the handheld activity you just completed and what you learned in the previous class. Make sure to include the appropriate vocabulary, writing it in a way that someone who was unfamiliar with the property itself could understand it after reading you definition and reviewing your example.

The Addition Property of Equality:

The Subtraction Property of Equality:

The Multiplication Property of Equality:

The Division Property of Equality:

Working with a neighbor, share your definitions and examples with each other. Give each other feedback and make changes to your definitions and examples as necessary.

ACTIVITY TWO – FREE FALL

Name: _____ Date: _____ Period: _____

Overview: In this activity you will be solving a variety of single variable equations and tracking your progress applying the four properties of equality.

Instructions:

1. On your TI 84 go to the Free Fall activity and select the silver level.
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2. For general play: watch the equation as it falls and quickly solve for x. Enter the solution and press the "ENTER" key before the equation hits the bottom. If an incorrect answer is given, the correct answer is displayed; press any key to resume play. The incorrect equations stack up at the bottom giving you less time in which to respond.

3. Play at the Silver level until you have either finished all of the questions or have four incorrect responses (causing the activity to stop). You can have three of fewer incorrect responses and still have attempted all questions. Record your score and the equations you answered incorrectly in the spaces provided. Solve each of the equations by hand, writing out each step and next to each step recording the applicable property of equality.

4. Go back to the Free Fall Activity mina menu and select the Gold level. Play at this level until you have less than four incorrect answers (or four times, whichever comes first). For each round you play, record your score and the equations which you answered incorrectly. Solve any incorrectly answered questions from the final round in the space provided making sure to record the property of equality that was applied to each step.

Activity:

SILVER LEVEL SCORE: _____

Equation 1: _____ Equation 2: _____

Equation 3:_____ Equation 4: _____

GOLD LEVEL

Round 1 Score: _____
Equation 1: _____ Equation 2: _____

Equation 3:_____ Equation 4: _____

Round 2 Score: _____
Equation 1: _____ Equation 2: _____

Equation 3:_____ Equation 4: _____

Round 3 Score: _____
Equation 1: _____ Equation 2: _____

Equation 3:_____ Equation 4: _____

Round 4 Score: _____
Equation 1: _____ Equation 2: _____

Equation 3:_____ Equation 4: _____