**A.REI.B.3: Solve Linear Equations and Inequalities in One Variable.**

EQUATIONS AND INEQUALITIES

A.REI.B.3: Solving Linear Equations and Inequalities in One Variable

**B. Solve equations and inequalities in one variable.**

3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters (linear equations and inequalities only).

**Overview of Lesson**

**- activate prior knowledge and review learning objectives (see above)**

**- explain vocabulary and/or big ideas associated with the lesson**

**- connect assessment practices with curriculum**

**- model an assessment problem and solution strategy**

**- facilitate guided discussion of student activity**

**- facilitate guided practice of student activity**

[**Selected problem set(s)**](http://jmap.org/htmlstandard/JMAP_ALGEBRA_I.htm)

**- facilitate a summary and share out of student work**

**Homework – Write the Math Assignment**

**Vocabulary**

A **term** is a number {1,2,3,…}, a variable {x,y,z,a,b,c…}, or the product of a number and a variable {2x, 3y, ½ a, etc.). Terms are separated by + or – signs in an expression, and the + or – signs are part of each term. (Everything inside parenthesis is treated as one term until the parentheses are removed.)

A **variable** is a letter that represents an unknown value(s). When we are asked to solve an equation, it usually means that we must isolate the variable and find its value.

A **coefficient** is a number that comes in front of a variable. A coefficient can be an integer, a decimal, or a fraction. A coefficient multiplies the variable. Every variable has a coefficient. If a variable appears to have no coefficient, it’s coefficient is an “invisible 1”

An **expression** is a mathematical statement consisting of one or more terms.

An **equation** is two expressions that have an equal (=) sign between them.

**Big Ideas**

Four Column Strategy

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Hand Expression | Sign | Right Hand Expression |
| Given  Add (6) |  | = |  |
|  |  | = | 8 |
| Divide (2) |  | = |  |
| Answer | *x* | = | 4 |
| Check | 2(4) – 6  8-6  2 | =  =  = | 2  2  2 |

**Inequality Symbols:**



The **solution of an inequality** includes any values that make the inequality true.

Solutions to inequalities can be graphed on a number line using open and closed dots.

**Open Dots v Closed Dots**

**Square vs Curved Parentheses**

|  |  |
| --- | --- |
| When the inequality sign does not contain an equality bar beneath it, the dot is open. | When the inequality sign contains includes an equality bar beneath it, the dot is closed, or shaded in. |
| or (1...  means 1 *is not* included in the solution set. | or [1...  means 1 *is* included in the solution set |
| or ...1)  means 1 *is* *not* included in the solution set | or ...1]  means 1 *is* included in the solution set |
|  | |

**The Big Rule for Solving Inequalities**:

All the rules for solving equations apply to inequalties – plus one:

**When an inequality is multiplied or divided by any negative number, the direction of the inequality sign changes.**

**REGENTS PROBLEMS TYPICAL OF THIS STANDARD**

1. Which value of *x* satisfies the equation ?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 8.25 | c. | 19.25 |
| b. | 8.89 | d. | 44.92 |

2. What is the value of *x* in the equation ?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 4 | c. | 8 |
| b. | 6 | d. | 11 |

3. The inequality  is equivalent to

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

4. Given , determine the largest integer value of *a* when .

5. Given that , solve for *x* in terms of *a* and *b*:



6. Solve for *x* algebraically: 

If *x* is a number in the interval , state all integers that satisfy the given inequality. Explain how you determined these values.

**A.REI.B.3: Solve Linear Equations and Inequalities in One Variable.**

**Answer Section**

1. ANS: A

Strategy: Use the four column method.

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Expression | Sign | Right Expression |
| Given |  | = |  |
| Divide both expressions by  (Division property of equality) |  | = |  |
| Cancel and Simplify |  | = |  |
| Subtract  from both expressions  (Subtraction property of equality) | x | = |  |
| Simplify | x | = |  |
| Simplify | x | = | 8.25 |

or

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Expression | Sign | Right Expression |
| Given |  | = |  |
| Distributive Property |  | = | 20 |
| Cancellation |  | = | 20 |
| Simplification |  | = | 20 |
| Subtract  from both expressions  (Subtraction Property of Equality) |  | = |  |
| Simplification |  | = |  |
| Multiply both expressions by 12  (Multiplication property of equality) |  | = |  |
| Cancel |  | = |  |
| Siomplify |  | = | 231 |
| Divide both expressions by 28  (Division property of equality) |  | = |  |
| Simplify | *x* | = | 8.25 |

PTS: 2 REF: 061405ai NAT: A.REI.B.3 TOP: Solving Linear Equations

KEY: fractional expressions

2. ANS: A

Strategy: Use the four column method.

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Expression | Sign | Right Expression |
| Given: |  | = |  |
| Multiply both expressions by 6  (Multiplication property of equality) |  | = |  |
| Cancel and Simplify |  | = |  |
| Simplify |  | = |  |
| Add +4 to both expressions  (Addition property of equality) |  | = | 8 |
| Divide both expressions by 2  (Division property of equality) | x | = | 4 |

PTS: 2 REF: 081420ai NAT: A.REI.B.3 TOP: Solving Linear Equations

KEY: fractional expressions

3. ANS: A

Strategy: Use the four column method for solving and documenting an equation or inequality.

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Expression | Sign | Right Expression |
| Given: |  | < |  |
| Add +8 to both expressions  (Addition property of equality) |  | < |  |
| Add  to both expressions  (Addition property of equality) |  | < |  |
| Simplify |  | < |  |
| Divide both expressions by  (Division property of equality) |  | < |  |
| Simplify |  | < |  |
| Rewrite | x | > | 9 |

PTS: 2 REF: 011507ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

4. ANS:

The largest integer value for *a* is 2.

Strategy: Use the four column method.

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Expression | Sign | Right Expression |
| Given |  | > |  |
| Substitute -1 for *x* |  | > |  |
| Simplify |  | > |  |
| Combine like terms |  | > |  |
| Add +9 to both expressions  (Addition property of equality) |  | > |  |
| Divide both expressions by  and reverse the sign | a | < | 3 |

Since a must be less than 3, the largest integer value that is less the three is two.

PTS: 2 REF: 061427ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

5. ANS:



Strategy: Use the four column method. Remember that .

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Expression | Sign | Right Expression |
| Given |  |  |  |
| Distributive Property |  |  |  |
| Transpose |  |  |  |
| Factor |  |  |  |
| Divide by | *x* | See NOTE below |  |

NOTE: Since , the expression  must be a negative number. When dividing an inequality by a negative number, the direction of the inequality sign must be reversed.

PTS: 2 REF: 011631ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

6. ANS:

6, 7, 8 are the numbers greater than or equal to 6 in the interval.

Strategy: Use the four column method to solve the inequality, then interpret the solution.

STEP 1: Solve the inequality.

|  |  |  |  |
| --- | --- | --- | --- |
| Notes | Left Expression | Sign | Right Expression |
| Given |  |  |  |
| Clear parentheses  (Distributive property) |  |  |  |
| Simplify  (Combine like terms) |  |  |  |
| Add 5x to both expressions  (Addition property of equality) | 24 |  |  |
| Subtract 12 from both expressions  (Subtraction property of equality) | 12 |  | 2x |
| Divide both expressions by 2  (Division property of equality) | 6 |  | x |
| Rewrite | x |  | 6 |

STEP 2: Interpret the solution set for the interval .

The interval  contains the integers 4, 5, 6, 7, and 8.

If , then the solution set of integers is .

PTS: 4 REF: 081534ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

**Homework - Write the Math Assignment**

START Write your name, date, topic of lesson, and class on your paper.

NAME: Mohammed Chen

DATE: December 18, 2015

LESSON: Missing Number in the Average

CLASS: Z

PART 1a. Copy **the problem** from the lesson and underline/highlight key words.

PART 1b. State your understanding of **what the problem is asking**.

PART 1c. **Answer** the problem.

PART 1d. Explanation of **strategy** with all work shown.

PART 2a. Create **a new problem** that addresses the same math idea.

PART 2b. State your understanding of **what the new problem is asking**.

PART 2c. **Answer** the new problem.

PART 2d. Explanation of **strategy** used in solving the new problem with all work shown.

**Clearly label each of the eight parts.**

**Grading Rubric**

Each homework writing assignment is graded using a four point rubric, as follows:

|  |  |
| --- | --- |
| Part 1.  The Original Problem | **Up to 2** points will be awarded for: a) correctly restating the original problem; b) explicitly stating what the original problem is asking; c) answering the original problem correctly; and d) explaining the math. |
| Part 2.  My New Problem | **Up to 2** points will be awarded for: a) creating a new problem similar to the original problem; b) explicitly stating what the new problem is asking; c) answering the new problem correctly; and d) explaining the math. |

This assignment/activity is designed to incorporate elements of [Polya’s four step universal algorithm](http://www.jmap.org/SupportFiles/JMAP_EXTRAS/Handouts/Polya.pdf) for problem solving with the idea that writing is thinking. Polya’s four steps for solving any problem are:

1. Read and understand the problem.
2. Develop a strategy for solving the problem.
3. Execute the strategy.
4. Check the answer for reasonableness.

EXEMPLAR OF A WRITING THE MATH ASSIGNMENT

**Part 1a. The Problem**

TOP Electronics is a small business with five employees. The mean (average) weekly salary for the five employees is $360. If the weekly salaries of four of the employees are $340, $340, $345, and $425, what is the salary of the fifth employee?

**Part 1b. What is the problem asking?**

Find the salary of the fifth employee.

**Part 1c. Answer**

The salary of the fifth employee is $350 per week.

**Part 1d. Explanation of Strategy**

The arithmetic mean or average can be represented algebraically as:



I put information from the problem into the formula. The problem says there are 5 employees, so . The problem also gives the mean (average) salary and the salaries of 4 of the employees. These numbers can be substituted into the formula as follows:



Check: 

**Part 2a. A New Problem**

Joseph took five math exams this grading period and his average score on all of the exams is 88. He remembers that he received test scores of 78, 87, 94, and 96 on four of the examinations, but he has lost one examination and cannot remember what he scored on it. What was Joseph’s score on the missing exam?

**Part 2b What is the new problem asking?**

Find Joseph’s score on the missing exam.

**Part 2c. Answer to New Problem**

Joseph received a score of 85 on the missing examination.

**Part 2d. Explanation of Strategy**

I substitute information from the problem into the formula for the arithmetic mean, as follows:





The answer makes sense.