Lesson Plan

A.REI.A.1: Understand Solving Equations as a Process of Reasoning and Explain the Reasoning.

NUMBERS, OPERATIONS, AND PROPERTIES

A.REI.A.1: Understand Solving Equations as a Process of Reasoning and Explaining

A. Understand solving equations as a process of reasoning and explain the reasoning.

1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. (linear).

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)

- facilitate a summary and share out of student work

Homework – Write the Math Assignment

PROPERTIES

Commutative Properties of Addition and Multiplication

For all real numbers a and b:

$a+b=b+a \qquad a\cdot b=b\cdot a$

Associative Properties of Addition and Multiplication

For all real numbers a, b, and c:

$(a+b)+c=a+(b+c) \qquad (a\cdot b)\cdot c=a\cdot(b\cdot c)$

Distributive Properties of Addition and Multiplication

$a(b+c)=ab+ac \qquad a(b-c)=ab-ac$

$(b+c)a=ba+ca \qquad (b-c)a=ba-ca$

Addition Property of Equality

The addition of the same number or expression to both sides of an equation results is permitted.

Multiplication Property of Equality

The multiplication of both sides of an equation by the same number or expression is permitted.

IDENTITY ELEMENTS

Identity Element: The **identity element** is always associated with an *operation*. The **identity element** for a given *operation* is the element that preserves the identity of other elements under the given operation.

Addition

The **identity element** for addition is the number 0

$a+0=a \text{ and } 0+a=a$

The number 0 does not change the value of other numbers under addition.

Multiplication

The **identity element** for multiplication is the number 1
$a \cdot 1 = a$ *and* $1 \cdot a = a$
The number 1 does not change the value of other numbers under multiplication.

Inverse Properties of Addition and Multiplication

Inverse: The **inverse** of a number or expression under a given *operation* will result in the **identity element** for that operation. Therefore, it is necessary to know what the **identity element** of an operation is before finding the **inverse** of a given number or expression.

Addition

The additive inverse of a number or expression results in 0 under addition.

$$a + (-a = 0) \text{ and } (-a) + a = 0$$

$$(x+y) + (-x-y) = 0 \text{ } and \text{ } (-x-y) + (x+y) = 0$$

Multiplication

The multiplicative inverse of a number or expression results in 1 under multiplication.

$$a \times \frac{1}{a} = 1 \text{ and } \frac{1}{a} \times a = 1 \qquad \frac{1}{a} \times a = 1$$

$$(x+y)\left(\frac{1}{(x+y)}\right) = 1 \text{ and } \left(\frac{1}{(x+y)}\right)(x+y) = 1$$

REGENTS PROBLEM TYPICAL OF THIS STANDARD

1. When solving the equation $4(3x^2 + 2) - 9 = 8x^2 + 7$, Emily wrote $4(3x^2 + 2) = 8x^2 + 16$ as her first step. Which property justifies Emily's first step?
   a. addition property of equality
   b. commutative property of addition
   c. multiplication property of equality
   d. distributive property of multiplication over addition

2. Fred's teacher gave the class the quadratic function $f(x) = 4x^2 + 16x + 9$.

   a) State two different methods Fred could use to solve the equation $f(x) = 0$.

   b) Using one of the methods stated in part *a*, solve $f(x) = 0$ for *x*, to the *nearest tenth.*

A.REI.A.1: Understand Solving Equations as a Process of Reasoning and Explain the Reasoning. Answer Section

1. ANS: A
   Strategy: Identify what changed during Emily's first step, then identify the property associated with what changed..

$$4(3x^2 + 2) - 9 = 8x^2 + 7$$

$$4(3x^2 + 2) = 8x^2 + 16$$

Emily moved the -9 term from the left expression of the equation to the right expression of the equation by adding +9 to both the left and right expressions.

Adding an equal amount to both sides of an equation is associated with the addition property of equality.

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2.ANS:
a) Quadratic formula and completing the square are two methods that could be used to solve this problem.

b) -0.7 and -3.3

Complete the Square Method	Quadratic Formula Method
	$f(x) = 4x^2 + 16x + 9$ a=4, b=16, c=9 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-16 \pm \sqrt{(16)^2 - 4(4)(9)}}{2(4)}$ $x = \frac{-16 \pm \sqrt{112}}{8}$ $x = \frac{-16 + \sqrt{112}}{8} = \frac{-5.416}{8} = -.677 = -0.7$ $x = \frac{-16 - \sqrt{112}}{8} = \frac{-26.583}{8} = -3.322 = -3.3$

$f(x) = 4x^2 + 16x + 9$ $4x^2 + 16x + 9 = 0$ $4x^2 + 16x = -9$ $\frac{4x^2}{4} + \frac{16x}{4} = \frac{-9}{4}$ $x^2 + 4x = -\frac{9}{4}$ $x^2 + 4x + (2)^2 = -\frac{9}{4} + (2)^2$ $(x+2)^2 = -\frac{9}{4} + 4$ $(x+2)^2 = -\frac{9}{4} + \frac{16}{4}$ $(x+2)^2 = \frac{7}{4}$ $x + 2 = \pm\sqrt{\frac{7}{4}}$ $x + 2 = \pm\frac{\sqrt{7}}{2}$ $x = -2 \pm \frac{\sqrt{7}}{2}$ $x = -2 + \frac{\sqrt{7}}{2} = -0.677 = -0.7$ $x = -2 - \frac{\sqrt{7}}{2} = -3.322 = -3.3$	

PTS: 1 REF: 011634ai NAT: A.REI.A.1