Name: _____ Date: _____

SOLVING LINEAR EQUATIONS
COMMON CORE ALGEBRA II

We will learn many new equation solving techniques in Algebra II, but the most basic of all equations are those where the variable, say x, is only raised to the first power. These are known as **linear equations**. You need to have good fluency with solving these equations in order to be successful in the beginning portions of Algebra II. Let's start with some practice.

***Exercise* #1:** Solve each of the following linear equations for the value of x.

(a) $3x+5=26$

(b) $8x-7=4x-5$

(c) $\frac{x+8}{2}=-6$

(d) $6(x+4)-2(x-1)=2x+20$

It is important to understand that each step in solving one of these equations can be justified by either using one of the properties of real numbers (from the last lesson) or a property of equality (such as the additive or multiplicative properties).

***Exercise* #2:** Justify each step in solving $2(x+7)+4x=44$ using either a property of real numbers (commutative, associative, or distributive) or a property of equality (additive or multiplicative).

$2(x+7)+4x=44$

$2x+14+4x=44$ _____

$2x+4x+14=44$ _____

$x(2+4)+14=44$ _____

$6x+14=44$

$6x+14-14=44-14$ _____

$6x=30$

$\frac{6x}{6}=\frac{30}{6}$ _____

$x=5$

Strange things can sometimes happen when solving linear (and other) equations. Sometimes we get no solutions at all, in which case the equation is known as **inconsistent**. Other times, any value of x will solve the equation, in which case it is known as an **identity**.

***Exercise* #3:** Try to solve the following equation. State whether the equation is an **identity** or **inconsistent**. Explain.

$$6x-2(x+4)=3(x+2)+x-5$$

***Exercise* #4:** An identity is an equation that is true for all values of the substitution variable. Trying to solve them can lead to confusing situations. Consider the equation:

$$2x-6+x-1=3(x-3)+2$$

(a) Test the values of $x=5$ and $x=3$ in this equation. Show that they are both solutions.

(b) Attempt to solve the equation until you are sure this is an identity.

***Exercise* #5:** Which of the following equations are identities, which are inconsistent, and which are neither?

(a) $8x-2(x+3)=5(x-1)+x$

(b) $\frac{4x+2}{2}+8=2x+9$

(c) $2x+8-(x-7)=2(2x-3)$

(d) $2x+1+2(x-1)=\frac{16x-4}{4}$

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SOLVING LINEAR EQUATIONS
COMMON CORE ALGEBRA II HOMEWORK

FLUENCY

1. Solve each of the following linear equations. If the equation is inconsistent, state so. If the equation is an identity, also state so. Reduce any non-integer answers to fractions in simplest form.

(a) $7x+5=2x-35$

(b) $\frac{x}{3}-7=-5$

(c) $4x+5=4x-1$

(d) $\frac{5(x-3)}{2}-1=14$

(e) $3(x-1)+2=x+9$

(f) $4x-(2x-1)=x+5+x-6$

(g) $5(2x-6)+2(4x+3)=8x-9$

(h) $\frac{2x+5}{6}=\frac{x}{18}$ (Cross multiply to begin)

(i) $\frac{10x-4}{2}+7=5(x+1)$

(j) $18-2(x+7)=\frac{8x-20}{2}-2$

APPLICATIONS

2. Laura is thinking of a number such that the sum of the number and five times two more than the number is 26 more than four times the number. Determine the number Laura is thinking of.

3. As if #2 wasn't confusing enough, Laura is now trying to come up with a number where three less than 8 times the number is equal to half of 16 times the number after it was increased by 1. She can't seem to find a number that works. Explain why.

4. When finding the intersection of two lines from both Algebra I and Geometry, you first "set the linear equations equal" to each other. Find the intersection point of the two lines whose equations are shown below. Be sure to find both the x and y coordinates.

$$y = 5x + 1 \text{ and } y = 2x - 11$$

REASONING

5. Explain why you cannot find the intersection points of the two lines shown below. Give both an algebraic reason and a graphical reason.

$$y = 4x + 1 \text{ and } y = 4x + 10$$