Unit 4: Equations & Inequalities

Learning Goal 4.1 – Solving Equations

After completion of this unit, you will be able to…

Learning Target #1: Creating and Solving Linear Equations

- Solve one, two, and multi-step equations (variables on both sides)
- Justify the steps for solving a linear equation
- Create and solve an equation from a context
- Solve a literal equation (multiple variables) for a specified variable
- Use a Formula to Solve Problems

Monday	Tuesday	Wednesday	Thursday	Friday
		2nd Day 1 Solving 1 & 2 Step EquationS	**3rd** Day 2 Multi-Step Equations	**4th** Day 3 Multi-Step Equations, Properties of Equality
7th Day 4 Solving Literal Equations	**8th** Day 5 Solving Literal Equations	**9th** Day 6 Creating & Solving Equations from a Context	**10th** EARLY RELEASE (1st and 2nd) Practice Day	**11th** Day 7 Creating Equations from a Context
14th Day 9 **4.1 Assessment,** Day 8 - Graphing Inequalities	**15th** Day 9 Solving 1 and 2 Step Inequalities	**16th** PSAT DAY (3rd and 4th) Practice Day	**17th** Day 10 Solving MultiStep Inequalities	**18th** Day 11 Creating Inequalities from a Context
21st Day 12 Creating Inequalities from a Context	**22nd** **4.2 Assessment**	**23rd**	**24th**	**25th**

	Monday	Tuesday	Wednesday	Thursday	Friday
AM	**NONE**	**Mrs. Jackson 7:45 – 8:15 Room 1210**	**Mr. Webb 7:45 – 8:15 Room 1205**	**Mr. Watson 7:45 – 8:15 Room 1208**	**Mr. Watson 7:45 – 8:15 Room 1208**
PM	**Mrs. Petersen 3:30 – 4:30 Room 1210**	**Mr. Webb 3:30 – 4:30 Room 1205**	**NONE**	**Mrs. Jackson 3:30 – 4:30 Room 1210**	**NONE**

Foundations of Algebra Unit 4: Equations & Inequalities Notes

Day 1 – Solving One & Two Step Equations

Remember, an **expression** is a mathematical "phrase" composed of terms, coefficients, and variables that stands for a single number, such as $3x + 1$ or $x^2 - 1$. We use Properties of Operations to *simplify* algebraic expressions. Expressions do NOT contain equal signs.

An **equation** is a mathematical "sentence" that says two expressions are equal to each other such as $3x + 1 = 5$. We use Properties of Equality (inverse operations) to *solve* algebraic equations. Equations contain equal signs.

An **Algebra Expression** does NOT have an = sign.

$4n^2 + 7$

An "Equation" does have an Equals sign.

$4n^2 + 7 = 11$

When solving equations, you must perform **inverse operations**, which means you have to perform the operation opposite of what you see. You must also remember the operation you perform on one side of the equation must be performed to the other side.

Informal		Formal		
Operation	**Inverse**	**Property**	**General Example**	**Example 1**
Addition	subtract	Addition Property of Equality	If a = b, then a + c = b + c	If x – 4 = 8, then x = 12 12-4=8 ✓
Subtraction	addition	Subtraction Property of Equality	If a = b, then a – c = b - c	If x + 5 = 7, then x = 2 2+5=7
Multiplication	division	Multiplication Property of Equality	If a = b, then ac = bc	If $\frac{x}{2} = 9$, then x = 18 $\frac{18}{2} = 9$ ✓
Division	multiply	Division Property of Equality	If a = b, then $\frac{a}{c} = \frac{b}{c}$	If 2x = 10, then x = 5 2(5)=10 ✓

No More "Cancelling"

When you first learned to solve equations in middle school, you might have used the words "cancel". We are no longer going to use the word "cancel". Take a look at the following examples:

$x - 120 = 80$

$+120 \quad +120$

$x + 0 = 200$

← Adding the opposite
Additive inverse
Adding to zero ✓

$X = 200$

$200 - 120 = 80$ ✓

$\frac{k}{2} = 16$ ✓

$\frac{k}{2} \times \frac{2}{1} = 16 \times 2$

← Multiplying by the Reciprocal
Multiplicative Inverse
Divides/Multiplies to one

$k = 32$ ✓

$\frac{32}{2} = 16$ ✓

$X = 1x$

$3 \cdot 1 = 3$

Additive Inverse	A number plus its inverse equals 0.	$a + -a = 0$	$7 + -7 = 0$
Multiplicative Inverse (Reciprocal)	A number times its reciprocal equals 1.	$a \cdot \frac{1}{a} = 1$	$3 \cdot \frac{1}{3} = 1$

Foundations of Algebra Unit 4: Equations & Inequalities Notes

Solving One Step Equations Practice

Practice: Solve each equation.

1. $x - 4 = 3$ Operation You See: subtract Inverse Operation: addition

$+4 \quad +4$

$x + 0 = 7$

$x = 7$

2. $y + 4 = 3$ Operation You See: addition Inverse Operation: subtract

$-4 \quad -4$

$y = -1$

3. $3 \cdot \frac{s}{3} = 9 \cdot 3$ Operation You See: division Inverse Operation: multiply

$s = 27$

4. $\frac{6p}{6} = \frac{12}{6}$ ✓ Operation You See: multiplication Inverse Operation: divide

$p = \frac{12}{6}$

$p = 2$

$6(2) = 12$ ✓

Practice: Solve each equation on your own.

a. $x - 6 = 10$

$+6 \quad +6$

$x = 16$

b. $-5d = 25$

$\frac{-5d}{-5} = \frac{25}{-5}$

$d = -5$

c. $8 + m = -4$

d. $\frac{x}{7} = 1$

e. $y + 9 = 2$

$-9 \quad -9$

$y = -7$

f. $\frac{3}{1} \cdot \frac{1}{3}x = 6 \cdot \frac{3}{1}$

$x = 6 \cdot \frac{3}{1}$

$x = 18$

Solving Two Step Equations

When solving equations with more than one step, you still want to think about how you can "undo" the operations you see. For the following equations, describe the operations being performed on each variable (go in PEMDAS order). Then describe the inverses using a table.

a. $3x + 5 = 14$

$-5 \quad -5$

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

b. $2n - 6 = 4$

$+6 \quad +6$

$\frac{2n}{2} = \frac{10}{2}$

$n = 5$

c. $\frac{4}{1} \cdot \frac{(x-2)}{4} = 1 \cdot 4$

$x - 2 = 4$

$+2 \quad +2$

$x = 6$

Foundations of Algebra Unit 4: Equations & Inequalities Notes

Practice: Solve each equation, showing all steps, for each variable.

PEMDAS

1. $3x - 4 = 14$

$+4 \quad +4$

$\frac{3x}{3} = \frac{18}{3}$

$x = 6$

2. $2x + 4 = 10$

3. $7 - 3y = 22$

$-7 \quad -7$

$\frac{-3y}{-3} = \frac{15}{-3}$

$y = -5$

4. $0.5m - 1 = 8$

5. $-6 + \frac{x}{4} = -5$

$+6 \quad +6$

$\frac{x}{4} = 1$

$x = 4$

6. $\frac{4(x-8)}{4} = -5 \cdot 4$

$(x-8) = -20$

$+8 \quad +8$

$x = -12$

Error Analysis with Solving Equations

1. William solved the following equation on his homework last night. However, he solved it incorrectly. Describe the mistake William made and what he should have done instead. Then re-solve the equation to find the correct answer.

✗
$4 = \frac{y}{8} + 1$
$32 = y + 1$
$31 = y$

Mistake: multiplied before he subtracted (wrong order)

Corrected Solution:

$4 = \frac{y}{8} + 1$

$-1 \quad -1$

$8 \cdot 3 = \frac{y}{8} \cdot 8$

$24 = y$ ✓

$4 = \frac{24}{8} + 1$

$4 = 3 + 1$ ✓

2. Tyler solved the following equation on his homework last night. However, he solved it incorrectly. Describe the mistake Tyler made and what he should have done instead. Then re-solve the equation to find the correct answer.

✗
$28y + 7 = 21$
$28y = 28$
$y = 1$

Mistake: Tyler added 7 to each side, instead of subtracting (not inverse)

Corrected Solution:

$28y + 7 = 21$

$-7 \quad -7$

$\frac{28y}{28} = \frac{14}{28}$

$y = \frac{1}{2}$ OR 0.5

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