

Algebra 1 Lesson 3.4 Notes
Solving Equations with Variables on both sides

Name Key

Objectives:

- Solve multi-step equations with variables on both sides.
- Justify steps and check solutions.

3.4 Solving Equations with Variables on Both Sides

- ① COMBINE LIKE TERMS ON BOTH SIDES - SIMPLIFY EACH SIDE AS MUCH AS POSSIBLE
- ② MOVE ALL VARIABLES TO THE LEFT SIDE
- ③ MOVE ALL #'S (CONSTANTS) TO THE RIGHT SIDE
- ④ SOLVE LIKE NORMAL (SHOULD LOOK LIKE 1-STEP EQUATION)

Practice 1: Solve each equation.

a. $7 - 8x = 4x - 17$

$$\begin{array}{r} \downarrow -4x \quad \downarrow -17 \\ 7 - 12x = -17 \\ \downarrow -7 \\ -12x = -24 \\ \downarrow -12 \\ x = 2 \end{array}$$

CHECK

$$\begin{aligned} 7 - 8(2) &= 4(2) - 17 \\ 7 - 16 &= 8 - 17 \\ -9 &= -9 \end{aligned}$$

b. $20 + c = 4c - 7$

$$\begin{array}{r} \downarrow -4c \quad \downarrow -7 \\ 20 - 3c = -7 \\ \downarrow -20 \\ -3c = -27 \\ \downarrow -3 \\ c = 9 \end{array}$$

CHECK

$$\begin{aligned} 20 + 9 &= 4(9) - 7 \\ 29 &= 36 - 7 \\ 29 &= 29 \end{aligned}$$

c. $24 - 3m = 5m$

$$\begin{array}{r} \downarrow -5m \quad \downarrow -5m \\ 24 - 8m = 0 \\ \downarrow -24 \\ -8m = -24 \\ \downarrow -8 \\ m = 3 \end{array}$$

CHECK

$$\begin{aligned} 24 - 3(3) &= 5(3) \\ 24 - 9 &= 15 \\ 15 &= 15 \end{aligned}$$

d. $9 - 3k = 17 - 2k$

$$\begin{array}{r} \downarrow +2k \quad \downarrow -2k \\ 9 - k = 17 \\ \downarrow -9 \\ -k = 8 \\ \downarrow -1 \\ k = -8 \end{array}$$

{2} {9} {-8}

e. $9 - x = 3(x - 7)$

$$\begin{array}{r} 9 - x = 3x - 21 \\ \downarrow -3x \quad \downarrow -8x \\ 9 - 4x = -21 \\ \downarrow -9 \\ -4x = -30 \\ \downarrow -4 \\ x = \frac{-30}{-4} = \frac{30}{4} = \frac{15}{2} \end{array}$$

{15/2}

f. $3 - 4a = 5(a - 3)$

$$\begin{array}{r} 3 - 4a = 5a - 15 \\ \downarrow -5a \quad \downarrow -6a \\ 3 - 9a = -15 \\ \downarrow -3 \\ -9a = -18 \\ \downarrow -9 \\ a = 2 \end{array}$$

CHECK

$$\begin{aligned} 3 - 4(2) &= 5(2 - 3) \\ 3 - 8 &= 10 - 15 \\ -5 &= -5 \end{aligned}$$

9/22 HOMEWORK

Practice 2: Solve each equation, justify your steps, and check your solution.

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

$$\begin{array}{r} 5x - 10 + 2 = 3x + 18 - 4 \\ 5x - 8 = 3x + 14 \\ \downarrow -3x \quad \downarrow -8 \\ 2x = 22 \\ \downarrow 2 \\ x = 11 \end{array}$$

{11}

Check

$$\begin{aligned} 5(11 - 2) + 2 &= 3(11 + 6) - 4 \\ 55 - 10 + 2 &= 33 + 18 - 4 \\ 47 &= 47 \end{aligned}$$

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

$$\begin{array}{r} 3x - 6 = -5x + 30 + 4x \\ 3x - 6 = -x + 30 \\ \downarrow +x \quad \downarrow +x \\ 4x - 6 = 30 \\ \downarrow +6 \\ 4x = 36 \\ \downarrow 4 \\ x = 9 \end{array}$$

{9}

Check

$$\begin{aligned} 3(9 - 2) &= -5(9 - 6) + 4(9) \\ 27 &= -45 + 30 + 36 \\ 27 &= 21 \end{aligned}$$

f. $3(x-4) = 2x - 5x$

e. $40 + 14j = 2(-4j - 13)$

$$\begin{array}{r} 40 + 14j = -8j - 26 \\ 18j = -34 \\ j = -3 \end{array}$$

$\{-3\}$

Check

Check

$$\begin{aligned} 40 + 14(-3) &= 2(-4(-3) - 13) \\ 40 - 42 &= 2(12 - 13) \\ -2 &= 2(-1) \end{aligned}$$

d. $7w + 1 = 8w + 1$

c. $5z - 2 = 2(3z - 4)$

$$\begin{array}{r} 5z - 2 = 6z - 8 \\ -z = -6 \\ z = 6 \end{array}$$

Check

Check

$$\begin{aligned} 5(6) - 2 &= 2(3(6) - 4) \\ 30 - 2 &= 2(18 - 4) \\ 28 &= 2(14) \\ 28 &= 28 \end{aligned}$$

STATEMENT

TRUE	FALSE
IMS OR \mathbb{R}	NO SOLUTION, \emptyset , $\{ \}$
$45 = 45$	$4 = 5$
$-2 = -2$	$10 = 20$
$3000 = 3000$	$-4 = -3$
$\pi = \pi$	

Special Cases

Every equation has 3 possible results.

A. ONE solution

- Answer written as a SOLUTION SET using the symbol $\{ \}$ (number inside).

B. INFINITELY MANY SOLUTIONS (TRUE STATEMENT)

- Answer written as IMS or \mathbb{R} → ALL REAL NUMBERS

C. NO solution (FALSE STATEMENT) THE EMPTY SET

- Answers can be written as \emptyset or $\{ \}$ (empty set), or write NO SOLUTIONS WITH NOTHING INSIDE

SPECIAL CASES

****You know you have a "special case" (No Solution or IMS) when the variables**

CANCELING !!!!!

↳ (OR DISAPPEARING)

IMS Example

$$3(x+4) - 2 = 12 + 2(x-1) + x$$

No Solution Example

$$5(1+4y) = 2(3+10y)$$

Practice 1: Solve each equation. If there is one solution, write your answer as a solution set. If it is a special case, identify if it has no solution or infinitely many solutions.

a. $-15c + 7c + 1 = 3 - 8c$

b. $62h + 50 - 14h = 48h + 50$

c. $-3(z-1) = 8 - 3z$

d. $16 - 2m = 5m + 9$

$$k. 6 - (-5r) = 5r - 3$$

$$l. 6y - (3y - 6) = 5y - 4$$

$$i. 3(3n + 4) = 54 + 6n$$

$$j. 6x - 4x + 13 = 27 - 2x$$

$$g. 15(n + 20) = 5(3n + 60)$$

$$h. 4(w + 9) + 2w = -6(w - 8)$$

$$e. 6(2a + 10) = 5(a + 5)$$

$$f. 4(x - 3) = -2(6 - 2x)$$

Objectives:

- Determine the LCD in an equation with fractions.
- Use the LCD to clear fractions and solve an algebraic equation.

3.4 Clearing Fractions

Vocabulary:

- **LCD:**

Examples: $\frac{1}{2}, \frac{1}{3}$

$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$

$\frac{3}{5}, \frac{7}{10}$

LCD = _____

LCD = _____

LCD = _____

To Clear Fractions in an equation:

When you have an equation with fractions, you will _____ every term by the _____ to eliminate the denominators!

Practice 1: Solve and check each equation

a. $\frac{x}{5} - \frac{1}{3} = 3$

LCD = _____

b. $\frac{3}{2} + \frac{3}{4}a = \frac{1}{4}a - 2$

LCD = _____

Clear Fractions with Parentheses:

Only multiply the number in _____ of the parentheses!!

c. $\frac{1}{8}(5y+64) = \frac{1}{4}(20+2y)$

LCD = _____

d. $\frac{1}{4}(2x+6) = \frac{3}{8}(x-7)$

LCD = _____

To use this trick, all fractions must be written in _____ form (improper fractions). No _____.

e) $1\frac{1}{2}x + \frac{1}{4}x - \frac{1}{2} = \frac{3}{4}x - 6$

f) $1\frac{1}{2}(x+5) - \frac{1}{4}(x+24) + 3 = 2(x-1)$

