

INDEPENDENT VARIABLE

IDV WORKSHEETS



SOLVING TWO-STEP EQUATIONS

ADDITIVE INVERSE FIRST | NEGATIVES | FRACTIONS

ANIMATED
POWERPOINT:
DOES THE WORK
FOR YOU!

FULL ANSWER
KEYS
INCLUDED



6 EXAMPLE
PROBLEMS
5 PRACTICE
SHEETS

ALONG • FOLLOW-ALONG SHEET, BOX 1

Solve the Two-Step Equation

Solve for x.

$$3x + 13 = 19$$
$$\begin{array}{r} -13 \quad -13 \\ \hline 3x = 6 \\ \hline \frac{3x}{3} = \frac{6}{3} \\ x = 2 \end{array}$$

INVERSE 1 Get rid of the number by the variable, subtract 13 from both sides.

REWRITE Rewrite the equation: $3x = 6$.

INVERSE 2 x is multiplied by 3, so divide both sides by 3.

REWRITE Rewrite: $x = 2$.

FOLLOW ALONG • FOLLOW-ALONG SHEET, BOX 5

Solve the Two-Step Equation

Solve for x.

$$\frac{2}{5}x - 5 = -3$$
$$\begin{array}{r} +5 \quad +5 \\ \hline \frac{2}{5}x = 2 \\ \hline \frac{5}{2} \cdot \frac{2}{5}x = 2 \cdot \frac{5}{2} \\ x = 5 \end{array}$$

INVERSE 1 Get rid of the number by the variable, -5: add 5 to both sides.

REWRITE Rewrite the equation: $(2/5)x = 2$.

INVERSE 2 x is multiplied by 2/5, so multiply both sides by the reciprocal, 5/2.

REWRITE Rewrite: $x = 5$.

CHECK Substitute 5 for x in the original equation: $\frac{2}{5} \cdot 5 - 5 = 2 - 5 = -3$ ✓

CHECK Both sides match ✓

LEVELED
PRACTICE,
FIND THE
MISTAKE +
MAZE

MORE PRACTICE. LESS PREP. BETTER OUTCOMES.

Inside the Animated Lesson

INDEPENDENT VARIABLE
GRADES 7-8 • PRE-ALGEBRA

SOLVING TWO-STEP EQUATIONS
ADDITIVE INVERSE FIRST | THEN MULTIPLICATIVE INVERSE | NEGATIVES & FRACTIONS

Animated PowerPoint lesson
 6 animated worked problems • follow-along sheet
 Practice A, B, C • Find the Mistake • maze

MORE PRACTICE, LESS PREP, BETTER OUTCOMES.
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$$\begin{array}{r}
 2x + 7 = -7 \\
 -7 \quad -7 \\
 \hline
 2x = -14 \\
 \frac{2}{2} \quad \frac{-14}{2} \\
 \hline
 x = -7
 \end{array}$$

FOR THE TEACHER
How to Use This Lesson

- Print**
The Follow-Along Sheet, Practice A, B or C, Find the Mistake, the maze and the exit tickets (4 per page). The packet is in lesson order.
- Preview**
Go through the slideshow once to see how the animations appear. Each problem is a short run of Morph slides.
- Present**
Students solve each problem on the Follow-Along Sheet before you reveal each part.
- Release**
You decide how many examples to show before students practice on their own.

MATERIALS
 Pencil
TIME
 About 50–60 minutes (or split over two days)
WHAT'S INCLUDED
 Animated lesson (this file)
 Follow-Along Sheet
 Practice A, B, C
 Find the Mistake • Equation Maze
 Exit tickets
 Full answer keys
 Game of All Games (separate deck)
BEFORE THIS LESSON
 Solving One-Step Equations (the additive and multiplicative inverse)

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QUICK REVIEW
How do we UNDO an operation?

ADDITIVE INVERSE
 What you add or subtract to a number to get zero. It undoes + and -.

MULTIPLICATIVE INVERSE
 What you multiply or divide a number by to get one. It undoes × and ÷.

GOLDEN RULE: Whatever is done to one side of an equation, you do to the other.

KEY IDEA
Which Inverse Comes First?

Undo in reverse order; the last thing done to x is the first thing you undo.

BUILD IT: START WITH x

$$\begin{array}{c}
 x \\
 \downarrow \\
 2x \\
 \downarrow \\
 2x + 7
 \end{array}$$
 start with x
 multiply by 2
 then add 7

SOLVE IT: UNDO IN REVERSE
Step 1: undo the + 7 first. Subtract 7 from both sides (additive inverse).
Step 2: undo the × 2. Divide both sides by 2 (multiplicative inverse).
Like socks and shoes: socks go on first, but shoes come off first.

Use the inverse operation to get rid of the number by the variable FIRST.

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WARM-UP • FOLLOW-ALONG SHEET, NOTES BOX
Solve the One-Step Equation

Solve for x.

$$\frac{3}{5} \cdot \frac{5}{3}x = 4 \cdot \frac{3}{5}$$

INVERSE x is multiplied by 5/3, so multiply both sides by the reciprocal, 3/5.

$$x = \frac{12}{5}$$

REWRITE Rewrite: x = 12/5.

$$\frac{5}{3} \cdot \frac{12}{5} = 4 \quad \checkmark$$

CHECK Substitute 12/5 for x in the original equation. Both sides match ✓

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FOLLOW-ALONG • FOLLOW-ALONG SHEET, BOX 1
Solve the Two-Step Equation

Solve for x.

$$3x + 13 = 19$$

INVERSE 1 Get rid of the number by the variable, 13: subtract 13 from both sides.

$$3x = 6$$

REWRITE Rewrite the equation: 3x = 6.

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

INVERSE 2 x is multiplied by 3, so divide both sides by 3.

$$x = 2$$

REWRITE Rewrite: x = 2.

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FOLLOW-ALONG • FOLLOW-ALONG SHEET, BOX 5
Solve the Two-Step Equation

Solve for x.

$$\frac{2}{5}x - 5 = -3$$

INVERSE 1 Get rid of the number by the variable, -5: add 5 to both sides.

$$\frac{2}{5}x = 2$$

REWRITE Rewrite the equation: (2/5)x = 2.

$$\frac{5}{2} \cdot \frac{2}{5}x = 2 \cdot \frac{5}{2}$$

INVERSE 2 x is multiplied by 2/5, so multiply both sides by the reciprocal, 5/2.

$$x = 5$$

REWRITE Rewrite: x = 5.

$$\frac{2}{5} \cdot 5 - 5 = 2 - 5 = -3 \quad \checkmark$$

CHECK Substitute 5 for x in the original equation. Both sides match ✓

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PRACTICE TIME
TURN TO THE SHEET:
Practice A, B or C

A: getting started • B: on level • C: challenge (fractions). Your teacher will tell you which.
 Get rid of the number, by the variable first, then the coefficient. Check each answer.

15 MINUTES
 Start the timer. Work on your own first, then check with a partner.

Directions: Getting started. Whole numbers, positive answers. Get rid of the number by the variable first, then undo the coefficient. Check each answer.

PRACTICE A • GETTING STARTED

Examples: use the additive inverse first, then the multiplicative inverse

$$4 + 3x = 12$$

$$\begin{array}{r} -4 \quad -4 \\ 4 + 3x = 12 \\ \hline \end{array}$$

$$\frac{3x}{3} = \frac{8}{3}$$

$$x = \frac{8}{3}$$

Step 1: additive inverse

Rewrite

Step 2: multiplicative inverse

Rewrite (reduce if you can)

$$7 + \frac{4}{3}x = 4$$

$$\begin{array}{r} -7 \quad -7 \\ 7 + \frac{4}{3}x = 4 \\ \hline \end{array}$$

$$\frac{4}{3}x = -3$$

$$\frac{3}{4} \cdot \frac{4}{3}x = -3 \cdot \frac{3}{4}$$

$$x = -\frac{9}{4}$$

Step 1: additive inverse

Rewrite

Step 2: multiplicative inverse

Rewrite (reduce if you can)

1. $2x + 2 = 24$	2. $2x + 1 = 17$	3. $4x + 8 = 24$
4. $3x + 1 = 19$	5. $2x + 9 = 19$	6. $2x + 21 = 23$
7. $2x + 5 = 25$	8. $3x + 13 = 22$	9. $6x + 1 = 13$
10. $2x + 4 = 22$	11. $2x + 1 = 25$	12. $3x + 1 = 22$

Directions: Each student made ONE mistake. Circle the first wrong line, explain what went wrong, then solve it correctly.

1. *Jordan solved:*

$$4x + 9 = 37$$

$$x + 9 = 9.25$$

$$x = 0.25$$

What went wrong?

Solve it correctly:

2. *Casey solved:*

$$4x + 5 = 29$$

$$4x = 34$$

$$x = 8.5$$

What went wrong?

Solve it correctly:

3. *Taylor solved:*

$$2x + 6 = 14$$

$$8x = 14$$

$$x = 1.75$$

What went wrong?

Solve it correctly:

4. *Quinn solved:*

$$-2x = 4$$

$$x = 2$$

What went wrong?

Solve it correctly:

5. *Sam solved:*

$$6x + 2 = 14$$

$$x + 2 = 2.33$$

$$x = 0.33$$

What went wrong?

Solve it correctly:

6. *Alex solved:*

$$4x + 6 = 38$$

$$4x = 44$$

$$x = 11.0$$

What went wrong?

Solve it correctly:

Directions: Solve the problem in each box. Follow the connector labeled with your answer to the next box. Trace your path from START to STOP.

START

1. $-4x - 29 = -17$				2. $x + 8 = -9$				3. $4x - 14 = 26$				4. $15x - 17 = 13$		
			-3				-19				10			
-11			-17		-8		15		9		13		2	
5. $x - 17 = -6$				6. $-18x = -234$				7. $-4x + 24 = -12$				8. $3x - 7 = 8$		
			-21				1				-19			
11			28		13		11		-8		9		5	
9. $x + 3 = 31$				10. $8x = -232$				11. $x - 1 = -9$				12. $2x - 25 = -13$		
			7				-29				7			
-8			2		10		15		5		-19		6	
13. $x + 9 = -10$				14. $x + 15 = 30$				15. $-2x + 9 = 3$				16. $x - 17 = -28$		
			18				6				-11			
28			6		11		5		28		3		9	
17. $x - 7 = 11$				18. $x + 15 = 22$				19. $x - 1 = -22$				20. $-5x - 4 = -9$		
			2				18				3			

STOP