

PART I GET STARTED

Today's Mathematics

Write, solve, and check addition and subtraction equations using equivalent equations.

Essential Question

Why does doing the same operation to both sides preserve an equation's solution?

DO NOW

Use expression and rational-number skills from Chapters 2 and 3. Show your work.

1. Simplify $5x + 3 - 2x + 4$.
2. Factor out the coefficient of x from $-3x + 12$.
3. Evaluate $-7.6 + 2.9$.
4. Evaluate $\frac{5}{6} - \frac{7}{4}$.

SEE IT

The model represents $x + 4 = -3$. Each small tile is $+1$ or -1 .

$$\boxed{x} \quad \boxed{+} \quad \boxed{+} \quad \boxed{+} \quad \boxed{+} \quad = \quad \boxed{-} \quad \boxed{-} \quad \boxed{-}$$

What tiles could you add to *both* sides to isolate x ? Sketch or describe the zero pairs, then find x .

QUICK WRITE | 2 MINUTES

Why would removing four positive tiles only from the left side change the equation? Explain using the model or the meaning of equality.

PART II INVESTIGATE

SAME SOLUTION, NEW EQUATION

Work with a partner. Apply one operation to both sides. Record the resulting equation, its solution, and a substitution check.

No.	Equation	Operation on both sides	New equation and check	Solution
1	$x + 6 = -2$			
2	$x - 5 = -11$			
3	$-3 = x + 4$			
4	$x + (-2) = -9$			

THINK LIKE A MATHEMATICIAN

1. Compare solving $x + (-2) = -9$ by subtracting -2 with solving it by adding 2. Why do both methods work?

2. Are $x + 6 = -2$ and $x - 3 = -11$ equivalent equations? Explain what you must compare.

CREATE

Write two different equations with solution $x = -4$: one using addition and one using subtraction. Check both.

PART III MAKE SENSE AND PRACTICE**WHAT WE CAN CONCLUDE**

Equivalent equations have the same solutions. Adding or subtracting the same number on both sides produces an equivalent equation.

If $a = b$, then $a + c = b + c$ and $a - c = b - c$. Use inverse operations to isolate the variable. Check by substituting into the *original* equation.

WORKED MODEL

Solve $y - \frac{3}{4} = -\frac{5}{6}$. Add $\frac{3}{4}$ to both sides:

$$y = -\frac{5}{6} + \frac{3}{4} = -\frac{1}{12}. \quad \text{Check: } -\frac{1}{12} - \frac{3}{4} = -\frac{10}{12} = -\frac{5}{6}.$$

For $y + 2.7 = -1.6$, subtract 2.7 from both sides: $y = -4.3$.

Check: $-4.3 + 2.7 = -1.6$.

TRY IT

Solve each equation. Check your solution in the original equation.

1. $x + 9 = -4$

2. $-6.8 = m - 2.5$

3. $t + \frac{5}{8} = -\frac{7}{12}$

4. A submarine is at an elevation of -14.5 meters. This is 32.8 meters below a helicopter. Define a variable; write and solve an equation for the helicopter's elevation. Interpret and check your result.

MATH WRITE | 5 MINUTES

A student solves $t - (-5) = -8$ by adding 5 to both sides and reports $t = -3$. Identify the error, give the correct solution, and use substitution to show why it works.

PART IV PUZZLE PRACTICE

Homework

Name _____

Date _____

Solve each equation. Find its solution in the answer bank and write the matching letter in the numbered box. The message names where you must perform an operation.

1. $x + 7 = 4$

2. $x - (-4) = -2$

3. $5 = x - 3$

4. $x + 2.6 = -1.9$

5. $x - \frac{5}{6} = \frac{1}{4}$

6. $x + \frac{3}{8} = -\frac{1}{2}$

7. $x - 6 = -11$

8. $x + (-2.4) = 1.7$

9. A library lends some books. After 9 are returned, 15 are still on loan. Write and solve an equation for the original number of books on loan.

ANSWER BANK

I $-\frac{7}{8}$	T 8	S 24
B -3	E 4.1	O -6
H -4.5	S $\frac{13}{12}$	D -5

1

2

3

4

5

6

7

8

9