

Lesson 13: Solving Equations with Rational Numbers

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Let's solve equations that include negative values.

13.1: Number Talk: Opposites and Reciprocals

The variables a through h all represent different numbers. Mentally find numbers that make each equation true.

$\frac{3}{5} \cdot \frac{5}{3} = a$ $a = 1$

$7 \cdot b = 1$ $b = \frac{1}{7}$

$c \cdot d = 1$ $c = 1$
 $d = 1$

$-6 + 6 = e$ $e = 0$

$11 + f = 0$ $f = -11$

$g + h = 0$ $g = 5$
 $h = -5$

Practice

★ Do opposite operation

① $y + 7 = 10$
~~-7~~ ~~-7~~
 $y = 8$

② $x - 11 = 27$
 $+11$ $+11$
 $x = 38$

③ $7x = 42$
 $\frac{7x}{7} = \frac{42}{7}$
 $x = 6$

④ $\frac{x}{20} = 8 \cdot 20$
 ~~$\frac{x}{20} = 8 \cdot 20$~~
 $x = 160$

Add / Subtract

Use opposite

$$\begin{array}{r} -5 + y = \frac{1}{4} \\ +5 \quad +5 \end{array} = \textcircled{5\frac{1}{4}}$$

$$\begin{array}{r} y + (-3) = 2 \\ +3 \quad +3 \end{array}$$

$$\textcircled{y=5}$$

Multiplication / Division

use reciprocal

$$\begin{array}{r} \cancel{4} \\ \frac{4}{3} \cdot \frac{3}{4}x = -3 \cdot \frac{4}{3} = \frac{-12}{3} = \textcircled{-4} \end{array}$$

$$\frac{10}{1} \cdot \frac{x}{10} = -5 \cdot \frac{10}{1} = \frac{-50}{1} = \textcircled{-50}$$

13.2: Match Solutions

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Match each equation to its solution. Be prepared to explain your reasoning.

A. $\frac{1}{2}x = -5$ $\frac{2}{1} \cdot \frac{1}{2}x = -5 \times \frac{2}{1} = -10$ 1. $x = -4.5$ **E**

B. $-2x = -9$ $\frac{-2x}{-2} = \frac{-9}{-2}$ $2 \overline{) 9.0}$ 2. $x = -\frac{1}{2}$ **C**

C. $-\frac{2}{1} - \frac{1}{2}x = \frac{1}{4} - \frac{2}{1}$ $-\frac{2}{1} = -\frac{2}{1}$ $\frac{-2}{1} = -\frac{2}{1}$ 3. $x = -10$ **A**

D. $\frac{-2x}{-2} = \frac{7}{-2}$ $2 \overline{) 3.5}$ 4. $x = 4.5$ **B**

E. $x + (-2) = -6.5$ $-\frac{10}{10} = -1.0$ 5. $x = 2\frac{1}{2}$ **F**

F. $-2 + x = \frac{1}{2}$ $+\frac{2}{2} = 2\frac{1}{2}$ 6. $x = -3.5$ **D**

13.3: Trip to the Mountains

The Hiking Club is on a trip to hike up a mountain.

1. The members increased their elevation 290 feet during their hike this morning. Now they are at an elevation of 450 feet.
 - a. Explain how to find their elevation before the hike.
 - b. Han says the equation $e + 290 = 450$ describes the situation. What does the variable e represent?
 - c. Han says that he can rewrite his equation as $e = 450 + (-290)$ to solve for e . Compare Han's strategy to your strategy for finding the beginning elevation.