

# 3-2 Solving Equations by Using Addition and Subtraction (Pages 128–134)

You can add or subtract the same number on each side of an equation and the result is an **equivalent equation**. Equivalent equations have the same solution.

<b>Addition Property of Equality</b>	For any numbers $a$ , $b$ , and $c$ , if $a = b$ , then $a + c = b + c$ .
<b>Subtraction Property of Equality</b>	For any numbers $a$ , $b$ , and $c$ , if $a = b$ , then $a - c = b - c$ .
<b>Solving Equations</b>	To <b>solve an equation</b> means to get the variable (with a coefficient of 1) by itself on one side of the equation. You can do this by undoing what has been done to the variable, using the properties of equality.

### Examples

**a. Solve  $x - \frac{2}{3} = \frac{1}{3}$ .**

The number  $\frac{2}{3}$  has been subtracted from  $x$ . The opposite of subtracting  $\frac{2}{3}$  is adding  $\frac{2}{3}$ . Add  $\frac{2}{3}$  to each side of the equation.  $x - \frac{2}{3} + \frac{2}{3} = \frac{1}{3} + \frac{2}{3}$  is an equivalent equation. Simplify to obtain  $x = 1$ .  
 Check: Is  $1 - \frac{2}{3} = \frac{1}{3}$ ? Yes.  
 The solution is 1.

**b. Solve  $9 + y = 13$ .**

Write an equivalent equation by subtracting 9 from each side of the original equation.  
 $9 + y - 9 = 13 - 9$ , so  $y = 4$ .  
 Check: Does  $9 + 4 = 13$ ? Yes.  
 The solution is 4.

### Try These Together

**1. Solve  $a + (-8) = 17$ .**

*HINT: Add 8 to each side.*

**2. Solve  $b - (-18) = 4$ .**

*HINT: This equation is equivalent to  $b + 18 = 4$ .*

### Practice

**Solve each equation. Check your solution.**

**3.**  $11 - c = -16$

**4.**  $5.4 = d + 6.2$

**5.**  $e - (-23) = 31$

**6.**  $4.8 + f = 9.6$

**7.**  $g - (-20) = 11$

**8.**  $14 = h - 21$

**9.**  $-2.8 = j + (-5.1)$

**10.**  $-12 + k = -19$

**11.**  $m + (-8) = \frac{1}{2}$

**12. Age** Minya is 30 years younger than her mom, and the sum of their ages is 58. How old is Minya?

**13. Standardized Test Practice** If the low temperature for the day is  $-14^\circ\text{F}$  and the high is  $22^\circ\text{F}$ , by how much did the temperature increase?

**A**  $8^\circ\text{F}$

**B**  $18^\circ\text{F}$

**C**  $28^\circ\text{F}$

**D**  $36^\circ\text{F}$

Answers: 1. 25 2. -14 3. 27 4. -0.8 5. 8 6. 4.8 7. -9 8. 35 9. 2.3 10. -7 11.  $8\frac{1}{2}$  12. 14 13. D