

## Section 4.3 The Multiplication Property of Equality

**1. Multiplication Property of Equality:** Let A, B, and C represent algebraic expressions.

$$\begin{array}{l} \text{If } A = B \\ \text{then } AC = BC \end{array}$$

Multiplying both sides of an equation by the same nonzero quantity does not change the solution for the equation. Because division is defined as multiplication by the reciprocal, the Multiplication Property can be extended to division (as long as you don't divide by zero.)

$$\begin{array}{l} \text{If } A = B \\ \text{then } \frac{A}{C} = \frac{B}{C} \end{array}$$

We use the Multiplication Property of Equality to solve equations. When solving an equation, we want to end up with an expression of the form

$$x = \text{a number} \quad (1x = \text{a number})$$

The number that multiplies the x-term is called the coefficient of x. In your solution, the coefficient of x must be 1. If the x-term has a coefficient other than 1, we can divide both sides by that number to make the coefficient of x be 1.

Example 1: Solve each of the following.

a.  $2x = 12$

b.  $7a = -14$

c.  $-2x = -10$

**2. The Multiplication Property and Fractions:** The Multiplication Property involves dividing both sides of an equation by a number. If that number happens to be a fraction, instead of dividing you can multiply both sides of the equation by the reciprocal of the fraction (since dividing is the same as multiplying by the reciprocal.) If the solution for an equation is a fraction, reduce the fraction to lowest terms.

Example 2: Solve each of the following.

a.  $\frac{1}{3}x = 7$

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

c.  $\frac{2}{3}x = 14$

**3. Solving Equations Using Both the Addition and the Multiplication Property of Equality:** If the x-term in an equation has a quantity added to it or subtracted from it, you must use the Addition Property of Equality to eliminate the added or subtracted term. If the x-term has a coefficient other than 1, you must use the Multiplication Property of Equality to make the coefficient 1. In some equations the x-term has both a quantity added to it or subtracted from it **and** a coefficient other than 1, and you must use both Properties to solve. In such equations, use the Addition Property first and the Multiplication Property second.

Note: Portions of this document are excerpted from the textbook *Prealgebra*, 7<sup>th</sup> ed. by Charles McKeague

Example 3: Solve the given equations.

a.  $3x - 5 = -26$

b.  $-\frac{2}{5}a + 6 = 14$

**4. Solving Equations That Require Simplification:** If an equation can be simplified, then simplify it before you begin solving it.

Example 4: Solve the given equation.

$$2(x - 1) - 3x = \frac{3}{5}$$

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Practice Problems: Solve each of the following problems. Show all steps.

a.  $-\frac{1}{2}x = -4$

b.  $-\frac{4}{7}x = \frac{2}{3}$

c.  $7x - 5 = -40$

d.  $\frac{1}{2}x + 2 = -7$

e.  $4x + 8x - 2x = 15 - 10$

Answers to Practice Problems:

a.  $\{8\}$  b.  $\left\{-\frac{7}{6}\right\}$  c.  $\{-5\}$  d.  $\{-18\}$  e.  $\left\{\frac{1}{2}\right\}$

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