

**8-4 Study Guide and Intervention** *(continued)***Quadratic Equations:  $ax^2 + bx + c = 0$** 

**Solve Equations by Factoring** Factoring and the Zero Product Property can be used to solve some equations of the form  $ax^2 + bx + c = 0$ .

**Example** Solve  $12x^2 + 3x = 2 - 2x$ . Check your solutions.

$$12x^2 + 3x = 2 - 2x \quad \text{Original equation}$$

$$12x^2 + 5x - 2 = 0 \quad \text{Rewrite equation so that one side equals 0.}$$

$$(3x + 2)(4x - 1) = 0 \quad \text{Factor the left side.}$$

$$3x + 2 = 0 \text{ or } 4x - 1 = 0 \quad \text{Zero Product Property}$$

$$x = -\frac{2}{3} \quad x = \frac{1}{4} \quad \text{Solve each equation.}$$

The solution set is  $\left\{-\frac{2}{3}, \frac{1}{4}\right\}$ .

Since  $12\left(-\frac{2}{3}\right)^2 + 3\left(-\frac{2}{3}\right) = 2 - 2\left(-\frac{2}{3}\right)$  and  $12\left(\frac{1}{4}\right)^2 + 3\left(\frac{1}{4}\right) = 2 - 2\left(\frac{1}{4}\right)$ , the solutions check.

**Exercises**

Solve each equation. Check the solutions.

1.  $8x^2 + 2x - 3 = 0$

2.  $3n^2 - 2n - 5 = 0$

3.  $2d^2 - 13d - 7 = 0$

4.  $4x^2 = x + 3$

5.  $3x^2 - 13x = 10$

6.  $6x^2 - 11x - 10 = 0$

7.  $2k^2 - 40 = -11k$

8.  $2p^2 = -21p - 40$

9.  $-7 - 18x + 9x^2 = 0$

10.  $12x^2 - 15 = -8x$

11.  $7a^2 = -65a - 18$

12.  $16y^2 - 2y - 3 = 0$

13.  $8x^2 + 5x = 3 + 7x$

14.  $4a^2 - 18a + 5 = 15$

15.  $3b^2 - 18b = 10b - 49$

## 8-4 Study Guide and Intervention

### Quadratic Equations: $ax^2 + bx + c = 0$

**Factor  $ax^2 + bx + c$**  To factor a trinomial of the form  $ax^2 + bx + c$ , find two integers,  $m$  and  $p$  whose product is equal to  $ac$  and whose sum is equal to  $b$ . If there are no integers that satisfy these requirements, the polynomial is called a **prime polynomial**.

#### Example 1 Factor $2x^2 + 15x + 18$ .

In this example,  $a = 2$ ,  $b = 15$ , and  $c = 18$ . You need to find two numbers that have a sum of 15 and a product of  $2 \cdot 18$  or 36. Make a list of the factors of 36 and look for the pair of factors with a sum of 15.

Factors of 36	Sum of Factors
1, 36	37
2, 18	20
3, 12	15

Use the pattern  $ax^2 + mx + px + c$ , with  $a = 2$ ,  $m = 3$ ,  $p = 12$ , and  $c = 18$ .

$$\begin{aligned} 2x^2 + 15x + 18 &= 2x^2 + 3x + 12x + 18 \\ &= (2x^2 + 3x) + (12x + 18) \\ &= x(2x + 3) + 6(2x + 3) \\ &= (x + 6)(2x + 3) \end{aligned}$$

Therefore,  $2x^2 + 15x + 18 = (x + 6)(2x + 3)$ .

#### Example 2 Factor $3x^2 - 3x - 18$ .

Note that the GCF of the terms  $3x^2$ ,  $3x$ , and 18 is 3. First factor out this GCF.

$$3x^2 - 3x - 18 = 3(x^2 - x - 6).$$

Now factor  $x^2 - x - 6$ . Since  $a = 1$ , find the two factors of  $-6$  with a sum of  $-1$ .

Factors of -6	Sum of Factors
1, -6	-5
-1, 6	5
-2, 3	1
2, -3	-1

Now use the pattern  $(x + m)(x + p)$  with  $m = 2$  and  $p = -3$ .

$$x^2 - x - 6 = (x + 2)(x - 3)$$

The complete factorization is

$$3x^2 - 3x - 18 = 3(x + 2)(x - 3).$$

### Exercises

Factor each polynomial, if possible. If the polynomial cannot be factored using integers, write *prime*.

1.  $2x^2 - 3x - 2$

2.  $3m^2 - 8m - 3$

3.  $16r^2 - 8r + 1$

4.  $6x^2 + 5x - 6$

5.  $3x^2 + 2x - 8$

6.  $18x^2 - 27x - 5$

7.  $2a^2 + 5a + 3$

8.  $18y^2 + 9y - 5$

9.  $-4t^2 + 19t - 21$

10.  $8x^2 - 4x - 24$

11.  $28p^2 + 60p - 25$

12.  $48x^2 + 22x - 15$

13.  $3y^2 - 6y - 24$

14.  $4x^2 + 26x - 48$

15.  $8m^2 - 44m + 48$

16.  $6x^2 - 7x + 18$

17.  $2a^2 - 14a + 18$

18.  $18 + 11y + 2y^2$