

## 9-4

## Study Guide and Intervention

**Factoring Trinomials:  $ax^2 + bx + c$** 

**Factor  $ax^2 + bx + c$**  To factor a trinomial of the form  $ax^2 + bx + c$ , find two integers,  $m$  and  $n$  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 whose sum is 15 and whose product is  $2 \cdot 18$  or 36. Make a list of the factors of 36 and look for the pair of factors whose sum is 15.

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

Use the pattern  $ax^2 + mx + nx + c$ , with  $a = 2$ ,  $m = 3$ ,  $n = 12$ , 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  $-6$  whose sum is  $-1$ .

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

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

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

The complete factorization is

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

**Exercises**

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

- $2x^2 - 3x - 2$
- $3m^2 - 8m - 3$
- $16r^2 - 8r + 1$
- $6x^2 + 5x - 6$
- $3x^2 + 2x - 8$
- $18x^2 - 27x - 5$
- $2a^2 + 5a + 3$
- $18y^2 + 9y - 5$
- $-4c^2 + 19c - 21$
- $8x^2 - 4x - 24$
- $28p^2 + 60p - 25$
- $48x^2 + 22x - 15$
- $3y^2 - 6y - 24$
- $4x^2 + 26x - 48$
- $8m^2 - 44m + 48$
- $6x^2 - 7x + 18$
- $2a^2 - 14a + 18$
- $18 + 11y + 2y^2$