NAME _____ DATE _____ PERIOD ____

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*.

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. $-4c^2 + 19c - 21$
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. $18 + 11y + 2y^2$

Lesson 9-4

NAME _____ DATE _____ PERIOD ____

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*.

1. $2x^2 - 3x - 2$ — $(2x + 1)(x - 2)$
2. $3m^2 - 8m - 3$ — $(3m + 1)(m - 3)$
3. $16r^2 - 8r + 1$ — $(4r - 1)(4r - 1)$
4. $6x^2 + 5x - 6$ — $(2x + 3)(3x - 2)$
5. $3x^2 + 2x - 8$ — $(3x - 4)(x + 2)$
6. $18x^2 - 27x - 5$ — $(3x - 5)(6x + 1)$
7. $2a^2 + 5a + 3$ — $(2a + 3)(a + 1)$
8. $18y^2 + 9y - 5$ — $(6y + 5)(3y - 1)$
9. $-4c^2 + 19c - 21$ — $(4c - 7)(3 - c)$
10. $8x^2 - 4x - 24$ — $(4x - 8)(2x + 3)$
11. $28p^2 + 60p - 25$ — $(2p + 5)(14p - 5)$
12. $48x^2 + 22x - 15$ — $(6x + 5)(8x - 3)$
13. $3y^2 - 6y - 24$ — $3(y + 2)(y - 4)$
14. $4x^2 + 26x - 48$ — $2(x + 8)(2x - 3)$
15. $8m^2 - 44m + 48$ — $4(2m - 3)(m - 4)$
16. $6x^2 - 7x + 18$ — prime
17. $2a^2 - 14a + 18$ — $2(a^2 - 7a + 9)$
18. $18 + 11y + 2y^2$ — prime