

## 5-8 Factoring Pattern for $x^2 + bx + c$ , $c$ negative

**Objective:** To factor quadratic trinomials whose quadratic coefficient is 1 and whose constant term is negative.

### Patterns

Factoring pattern for  $x^2 + bx + c$  when  $c$  is negative:  $(x + ?)(x - ?)$

**Example 1** Factor  $x^2 - x - 12$ .

**Solution** 1. List the factors of  $-12$  by writing them down or reviewing them mentally.

2. Find the pair of factors with sum  $-1$ :  
3 and  $-4$ .

3. Therefore  $x^2 - x - 12 = (x + 3)(x - 4)$ .

Factors of -12		Sum of the factors
1	-12	-11
-1	12	11
2	-6	-4
-2	6	4
3	-4	-1 ←
-3	4	1

**Example 2** Factor  $a^2 + 12a - 45$ .

**Solution** 1. The factoring pattern is  $(a + ?)(a - ?)$ .

2. Find the pair of factors of  $-45$  whose sum is 12: 15 and  $-3$ .

3. Therefore  $a^2 + 12a - 45 = (a + 15)(a - 3)$ .

Factors of -45		Sum of the factors
1	-45	-44
-1	45	44
3	-15	-12
-3	15	12 ←
5	-9	-4
-5	9	4

**Factor.** Check by multiplying the factors. If the polynomial is not factorable, write *prime*.

1.  $a^2 - 2a - 3$

2.  $x^2 + x - 6$

3.  $y^2 + 3y - 4$

4.  $b^2 - 3b - 10$

5.  $c^2 - 9c - 8$

6.  $r^2 + 12r - 28$

7.  $x^2 - 7x - 18$

8.  $y^2 + 4y - 21$

9.  $a^2 + 5a - 14$

10.  $k^2 - 6k - 40$

11.  $z^2 + 6z - 27$

12.  $r^2 - 2r - 35$

13.  $p^2 - 4p - 12$

14.  $a^2 - 3a - 40$

15.  $y^2 - 8y - 20$

16.  $z^2 - z - 56$

17.  $y^2 - 14y - 72$

18.  $t^2 + 16t - 30$

**5-8 Factoring Pattern for  $x^2 + bx + c$ ,  $c$  negative** (continued)**Example 3** Factor  $x^2 - 5kx - 24k^2$ .

**Solution**

- The factoring pattern is  $(x + ?)(x - ?)$ .
- Find the pair of factors of  $-24k^2$  with a sum of  $-5k$ :  $3k$  and  $-8k$ .
- Therefore  $x^2 - 5kx - 24k^2 = (x + 3k)(x - 8k)$ .

**Factor.** Check by multiplying the factors. If the polynomial is not factorable, write *prime*.

19.  $a^2 - ab - 20b^2$

20.  $y^2 - yz - 12z^2$

21.  $u^2 - 3uv - 18v^2$

22.  $a^2 - 5ab - 24b^2$

23.  $x^2 - 7xy - 30y^2$

24.  $h^2 - 2hk - 24k^2$

25.  $x^2 + 5xy - 50y^2$

26.  $c^2 - 2cd - 35d^2$

27.  $x^2 - 11xy - 42y^2$

**Example 4** Factor  $1 - 8x - 20x^2$ .

**Solution** Find the pair of factors of  $-20x^2$  whose sum is  $-8x$ :  $2x$  and  $-10x$ .

$$1 - 8x - 20x^2 = (1 + 2x)(1 - 10x)$$

**Factor.** Check by multiplying the factors. If the polynomial is not factorable, write *prime*.

28.  $1 + 2c - 24c^2$

29.  $1 + 9c - 36c^2$

30.  $1 + 5x - 24x^2$

31.  $1 + 5x - 36x^2$

32.  $1 - 14y - 72y^2$

33.  $1 - 12x - 45x^2$

34.  $1 - 4x - 21x^2$

35.  $1 - 7x - 30x^2$

36.  $1 + 7x - 44x^2$

**Mixed Review Exercises****Simplify.**

1.  $(8x^2y)(4xy^2)(3y^2)$

2.  $(3x - 2)(2x + 3)$

3.  $-5x(2x^2 - x + 3)$

4.  $(2x - 3)^2$

5.  $(5x^4y^2)^3$

6.  $4y(2y^2 + 5y + 3)$

7.  $\frac{4(xy)^4}{8(xy)^2}$

8.  $\frac{-3ab}{-18a^2b^3}$

9.  $\frac{(-n)^4}{-n^8}$

10.  $(m + 2n)^2$

11.  $(a - 4)(3a + 2)$

12.  $(2y + 5)^2$

**Factor.**

13.  $10m - 14n + 2$

14.  $81k^2 - 25$

15.  $a^2 + 8a + 16$

16.  $a^2 - 11ab + 24b^2$

17.  $18x^2 + 12x$

18.  $49 - n^2$

19.  $u^2 - 18u + 81$

20.  $27 + 12y + y^2$

21.  $6a^3b^2 - 18a^2b$

22.  $25w^4 - 9x^2$

23.  $m^2 + 3m + 2$

24.  $c^2 - 9c - 22$