9.8 Factor Polynomials Completely

TEKS A.1.C, A.4.A

Before You factored polynomials.

Now You will factor polynomials completely.

Why? So you can model the height of a projectile, as in Ex. 71.

Key Vocabulary
- **factor by grouping**
- **factor completely**

You have used the distributive property to factor a greatest common monomial from a polynomial. Sometimes, you can factor out a common binomial.

EXAMPLE 1 Factor out a common binomial

Factor the expression.

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

b. $3y^2(y - 2) + 5(2 - y)$

Solution

a. $2x(x + 4) - 3(x + 4) = (x + 4)(2x - 3)$

b. The binomials $y - 2$ and $2 - y$ are opposites. Factor -1 from $2 - y$ to obtain a common binomial factor.

$3y^2(y - 2) + 5(2 - y) = 3y^2(y - 2) - 5(y - 2)$ **Factor −1 from (2 − y).**

$= (y - 2)(3y^2 - 5)$ **Distributive property**

GROUPING You may be able to use the distributive property to factor polynomials with four terms. Factor a common monomial from pairs of terms, then look for a common binomial factor. This is called **factor by grouping**.

EXAMPLE 2 Factor by grouping

Factor the polynomial.

a. $x^3 + 3x^2 + 5x + 15$

b. $y^2 + y + yx + x$

Solution

a. $x^3 + 3x^2 + 5x + 15 = (x^3 + 3x^2) + (5x + 15)$ **Group terms.**

$= x^2(x + 3) + 5(x + 3)$ **Factor each group.**

$= (x + 3)(x^2 + 5)$ **Distributive property**

b. $y^2 + y + yx + x = (y^2 + y) + (yx + x)$ **Group terms.**

$= y(y + 1) + x(y + 1)$ **Factor each group.**

$= (y + 1)(y + x)$ **Distributive property**

CHECK WORK
Remember that you can check a factorization by multiplying the factors.