EXAMPLE 3 Factor by grouping

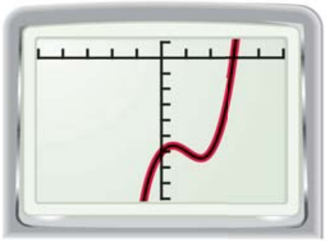
Factor $x^3 - 6 + 2x - 3x^2$.

Solution

The terms x^2 and -6 have no common factor. Use the commutative property to rearrange the terms so that you can group terms with a common factor.

$$x^3 - 6 + 2x - 3x^2 = x^3 - 3x^2 + 2x - 6 \quad \text{Rearrange terms.}$$
$$= (x^3 - 3x^2) + (2x - 6) \quad \text{Group terms.}$$
$$= x^2(x - 3) + 2(x - 3) \quad \text{Factor each group.}$$
$$= (x - 3)(x^2 + 2) \quad \text{Distributive property}$$

CHECK Check your factorization using a graphing calculator. Graph $y_1 = x^3 - 6 + 2x - 3x^2$ and $y_2 = (x - 3)(x^2 + 2)$. Because the graphs coincide, you know that your factorization is correct.



✓ GUIDED PRACTICE for Examples 1, 2, and 3

Factor the expression.

1. $x(x - 2) + (x - 2)$
2. $a^3 + 3a^2 + a + 3$
3. $y^2 + 2x + yx + 2y$

READING
If a polynomial has two or more terms and is unfactorable, it is called a *prime polynomial.*

FACTORING COMPLETELY You have seen that the polynomial $x^2 - 1$ can be factored as $(x + 1)(x - 1)$. This polynomial is factorable. Notice that the polynomial $x^2 + 1$ cannot be written as the product of polynomials with integer coefficients. This polynomial is unfactorable. A factorable polynomial with integer coefficients is **factored completely** if it is written as a product of unfactorable polynomials with integer coefficients.

CONCEPT SUMMARY — *For Your Notebook*

Guidelines for Factoring Polynomials Completely

To factor a polynomial completely, you should try each of these steps.

1. Factor out the greatest common monomial factor. *(Lesson 9.4)*	$3x^2 + 6x = 3x(x + 2)$
2. Look for a difference of two squares or a perfect square trinomial. *(Lesson 9.7)*	$x^2 + 4x + 4 = (x + 2)^2$
3. Factor a trinomial of the form $ax^2 + bx + c$ into a product of binomial factors. *(Lessons 9.5 and 9.6)*	$3x^2 - 5x - 2 = (3x + 1)(x - 2)$
4. Factor a polynomial with four terms by grouping. *(Lesson 9.8)*	$x^3 + x - 4x^2 - 4 = (x^2 + 1)(x - 4)$