

8-6 Choosing a Factoring MethodWarm UpLesson PresentationLesson Quiz**8-6** Choosing a Factoring Method

$$3x - 5y$$

Warm Up**Factor each trinomial.**

1. $x^2 + 13x + 40$ $(x + 5)(x + 8)$

2. $5x^2 - 18x - 8$ $(5x + 2)(x - 4)$

3. Factor the perfect-square trinomial
 $16x^2 + 40x + 25$ $(4x + 5)(4x + 5)$

4. Factor $9x^2 - 25y^2$ using the difference of two squares. $(3x + 5y)(3x - 5y)$

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Objectives

Choose an appropriate method for factoring a polynomial.

Combine methods for factoring a polynomial.

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Example 1: Determining Whether a Polynomial is Completely Factored

Tell whether each polynomial is completely factored. If not factor it.

A. $3x^2(6x - 4)$

$$3x^2 \cdot 2(3x - 2)$$

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

B. $(x^2 + 1)(x - 5)$

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$$x^2 + 4$$

$$-1(-x^2 - 4)$$

Caution

$x^2 + 4$ is a *sum* of squares, and cannot be factored.

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Check It Out! Example 1

Tell whether the polynomial is completely factored. If not, factor it.

A. $5x^2(x - 1)$

B. $(4x + 4)(x + 1)$

$$4(x+1)(x+1)$$

$$4(x+1)^2$$

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To factor a polynomial completely, you may need to use more than one factoring method. Use the steps below to factor a polynomial completely.

Factoring Polynomials	
Step 1	Check for a greatest common factor.
Step 2	Check for a pattern that fits the difference of two squares or a perfect-square trinomial.
Step 3	To factor $x^2 + bx + c$, look for two numbers whose sum is b and whose product is c . To factor $ax^2 + bx + c$, check factors of a and factors of c in the binomial factors. The sum of the products of the outer and inner terms should be b .
Step 4	Check for common factors. (Grouping)

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Example 2A: Factoring by GCF and Recognizing Patterns

Factor $10x^2 + 48x + 32$ completely. Check your answer.

$$10x^2 + 48x + 32$$

$$2(5x^2 + 24x + 16)$$

$$2(5x + 4)(x + 4)$$

$$\begin{array}{c}
 \begin{array}{cc}
 80 & 4 \\
 20 & 4
 \end{array} \\
 \times \begin{array}{|c|c|}
 \hline
 5x^2 & 4x \\
 \hline
 20x & 16 \\
 \hline
 \end{array}
 \end{array}$$

Check $2(5x + 4)(x + 4) = 2(5x^2 + 20x + 4x + 16)$

$$= 10x^2 + 40x + 8x + 32$$

$$= 10x^2 + 48x + 32 \checkmark$$

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Example 2B: Factoring by GCF and Recognizing Patterns

Factor $8x^6y^2 - 18x^2y^2$ completely. Check your answer.

$$8x^6y^2 - 18x^2y^2$$

$$2x^2y^2(4x^4 - 9)$$

$$2x^2y^2(2x^2 - 3)(2x^2 + 3) \quad a = 2x, b = 3$$

Factor out the GCF. $4x^4 - 9$ is a perfect-square trinomial of the form $a^2 - b^2$.

$$\text{Check } 2x^2y^2(2x^2 - 3)(2x^2 + 3) = 2x^2y^2(4x^4 - 9)$$

$$= 8x^6y^2 - 18x^2y^2 \quad \checkmark$$

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Check It Out! Example 2a

Factor each polynomial completely. Check your answer.

$$4x^3 + 16x^2 + 16x$$

$$4x^3 + 16x^2 + 16x$$

$$4x(x^2 + 4x + 4)$$

$$4x(x + 2)^2$$

Factor out the GCF. $x^2 + 4x + 4$ is a perfect-square trinomial of the form $a^2 + 2ab + b^2$.

$$a = x, b = 2$$

$$\text{Check } 4x(x + 2)^2 = 4x(x^2 + 2x + 2x + 4)$$

$$= 4x(x^2 + 4x + 4)$$

$$= 4x^3 + 16x^2 + 16x \quad \checkmark$$

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Check It Out! Example 2b

Factor each polynomial completely. Check your answer.

$$2x^2y - 2y^3$$

$$2x^2y - 2y^3$$

$$2y(x^2 - y^2)$$

$$2y(x + y)(x - y)$$

Factor out the GCF. $2y(x^2 - y^2)$ is a perfect-square trinomial of the form $a^2 - b^2$.

$$a = x, b = y$$

Check $2y(x + y)(x - y) = 2y(x^2 + xy - xy - y^2)$

$$= 2x^2y + 2xy^2 - 2xy^2 - 2y^3$$

$$= 2x^2y - 2y^3$$

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Example 3A: Factoring by Multiple Methods

Factor each polynomial completely.

$$9x^2 + 3x - 2$$

Handwritten work for factoring $9x^2 + 3x - 2$:

- Factors of 18: $18, -1x, -2x, -3x$
- Factors of 9: $9x, 6x$
- Factored form: $(3x + 2)(3x - 1) - 1$
- AC method grid:

$3x$	2
$9x^2$	$6x$
$-3x$	-2

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Example 3B: Factoring by Multiple Methods

Factor each polynomial completely.

$$12b^3 + 48b^2 + 48b$$

$$12b(b^2 + 4b + 4)$$

$$12b(b+2)^2$$

b^2	$2x$
$2x$	4

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Example 3C: Factoring by Multiple Methods

Factor each polynomial completely.

$$4y^2 + 12y - 72$$

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Example 3D: Factoring by Multiple Methods.

Factor each polynomial completely.

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

$$x^2(x^2 - 1)$$

$$x^2(x + 1)(x - 1)$$

Factor out the GCF.

$x^2 - 1$ is a difference of two squares.

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$$\begin{array}{c} 24 \\ \swarrow \searrow \\ 12 \quad 2 \end{array}$$

Check It Out! Example 3c

Factor each polynomial completely.

$$9q^6 + 30q^5 + 24q^4$$

$$3q^4(3q^2 + 10q + 8)$$

$$3q^4(3q + 4)(q + 2)$$

	q	2
3q	3q ²	6q
4	4q	8

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Lesson Quiz

Tell whether the polynomial is completely factored. If not, factor it.

1. $(x + 3)(5x + 10)$ 2. $3x^2(x^2 + 9)$

$(x+3)5(x+2)$

Factor each polynomial completely. Check your answer.

3. $(x^3 + 4x^2) + (3x + 12)$ 4. $4x^2 + 16x - 48$

$x^2(x+4) + 3(x+4)$ $4(x^2 + 4x - 12)$
 $(x^2+3)(x+4)$

5. $18x^2 - 3x - 3$

6. $18x^2 - 50y^2$

7. $(5x - 20x^3) + (7 - 28x^2)$

$5x(1-4x^2) + 7(1-4x^2)$
 $(5x+7)(1-4x^2)$