



#9932 FACTORING IS FANTASTIC: PART TWO--QUADRATIC TRINOMIALS

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Grade Level: 6-12

19 mins.

1 Instructional Graphic Enclosed

DESCRIPTION

What is a quadratic expression? How can it be factored, or separated, into its parts? Examples teach step by step the process of factoring quadratic trinomials and using the FOIL method to check the results. Explains how to find the middle term in the trinomial. Includes negative numbers, test problems, and a review.

ACADEMIC STANDARDS

Subject Area: Mathematics

- Standard: Uses a variety of strategies in the problem-solving process
 - ◆ Benchmark: Uses a variety of strategies to understand problem-solving situations and processes (e.g., considers different strategies and approaches to a problem, restates problem from various perspectives) (See INSTRUCTIONAL GOALS 2, 3, and 5.)
- Standard: Understands and applies basic and advanced properties of the concepts of numbers
 - ◆ Benchmark: Uses number theory concepts (e.g., divisibility and remainders, factors, multiples, prime, relatively prime) to solve problems (See INSTRUCTIONAL GOALS 2, 3, 4, and 5.)
 - ◆ Benchmark: Understands the role of positive and negative integers in the number system (See INSTRUCTIONAL GOALS 4.)
- Standard: Understands and applies basic and advanced properties of functions and algebra
 - ◆ Benchmark: Understands appropriate terminology and notation used to define functions and their properties (e.g., domain, range, function composition, inverses) (See INSTRUCTIONAL GOALS 1 and 2.)

INSTRUCTIONAL GOALS

1. To define the terms *quadratic trinomial* and *binomial expression*.

2. To explain how to use the FOIL method to multiply two binomial terms to make a quadratic trinomial.
3. To show how to use clues to factor quadratic trinomials.
4. To review how to work with negative factors.
5. To explain how to solve an expression when there is no middle term.

BACKGROUND INFORMATION

Factoring quadratic trinomials is one of the key issues in algebra. The factoring of trinomials can be often used for solving quadratic equations. On the other hand, solving quadratic equations helps to factor quadratic trinomials. In this part of the course, trinomials are factored by means of educated guessing and checking (by “some detective work,” as the on-camera host says). Obviously, not all quadratic trinomials can be factored in this way. Some that cannot be factored in this way can still be factored using another approach, while others cannot be factored at all. In addition, it may be mentioned here that all polynomials of the third, fourth, fifth, etc. degree, can be factored; although the proof and even the discussion of this statement is far beyond the level of the standard algebra course, it may be pointed out that quadratic trinomials are in this respect unique.

VOCABULARY

- | | | |
|------------------------|------------------------|--------------|
| 1. binomial expression | 6. like terms | 11. positive |
| 2. common factor | 7. multiply | 12. square |
| 3. expression | 8. negative | 13. terms |
| 4. factor | 9. quadratic trinomial | |
| 5. FOIL method | 10. parentheses | |

BEFORE SHOWING

1. Review factoring an expression to present it as a product as explained in *Factoring is Fantastic: Part One—Common Factors*, CMP #9931. Include these steps:
 - a. Present each term as a product.
 - b. Find the greatest common factor (GCF) of all the terms.
 - c. Write the GCF in front of the parentheses.
 - d. Put the sum of all the remaining factors of the terms inside the parentheses.
2. Practice factoring expressions as a warm-up activity.
 - a. $6t - 24$
 - b. $3t - t^2$
 - c. $5s + 15y - 25z$
 - d. $2pk + p + 7p^2$
3. As a challenge in preparation for this video try to factor: $x(x - 4) + x - 4$. Discuss possible options and strategies.
4. Explain that there will be problems to solve throughout the video, so paper and pencil will be necessary.

DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause to allow students time to complete the problems shown on the screen. Discuss solutions then check the answers by continuing the video.
3. Additional pauses may be desired to review content after presentation of particular concepts.

AFTER SHOWING

Discussion Items and Questions

1. What is a *quadratic trinomial*?
2. Discuss what it means to factor a quadratic trinomial.
3. Explain the FOIL method for checking the answers of factoring a quadratic trinomial.
4. Describe how a person can figure out which numbers are used for the “last” terms.
5. Describe an expression that is a perfect square.
6. Discuss how to solve an expression with no middle term.
7. Name two types of quadratic trinomials that the video didn’t explain how to factor.

Applications and Activities

1. Review and practice using the methods presented in the video by completing the “Fantastic Factoring Practice Exercises.” (See INSTRUCTIONAL GRAPHIC.)
2. Factor the expression $x^2 - a^2$, where a , is an arbitrary number. Discuss.
3. Read and analyze the following argument: “The expression $x^2 + 1$ cannot be factored.”
 - a. Assume that it can be factored. That implies that it can be written in the form: $x^2 + 1 = (x + a)(x + b)$ for some numbers a and b .
 - b. Then substituting $-a$ for x in this expression, we should obtain 0. However, for any $-a$, the number $(-a)^2 = a^2$ is nonnegative and $a^2 + 1$ is positive.
 - c. The obtained contradiction shows that our assumption was wrong.
4. Working in pairs, write examples of quadratic trinomials that can not be factored.

SUMMARY

Several key concepts are explained: what quadratic trinomial are, the FOIL method of expanding bracketed binomials, and factoring quadratic trinomials in different cases. FOIL (First, Outers, Inners, Last) is an acronym for the order in which to multiply the terms within two bracketed binomials. It is a way to remember how to expand brackets and multiply binomials. Several examples of this kind of multiplication are presented. Next, some quadratic trinomials are factored by working backwards and calculating which binomials when multiplied can produce the given trinomial. In this process, one identifies those factors of the constant term of the trinomial whose sum equals the coefficient of the linear term. Work with the negative coefficients is given. Several “difference of two squares” expressions of the form $x^2 - a^2$ are also factored. At the end, it is pointed out that

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not all trinomials can be factored by the methods shown, and that some trinomials cannot be factored at all.

CMP RELATED RESOURCES

- *Algebra: Quadratic Equations* #9748
- *Algebra: The Quadratic Formula* #9751
- *Factoring is Fantastic: Part One—Common Factors* #9931
- *Quadratics: Factoring Quadratics* #3404

World Wide Web



The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and “kid safe” sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

- **MATH FORUM: ASK DR. MATH** <http://forum.swarthmore.edu/dr.math/>

“Ask Dr. Math” allows users to e-mail questions to Dr. Math and access archived material. Choose “Middle School” to find a list of choices of materials that relate to the video, or use the search engine.

- **MULTIPLYING BINOMIALS**

http://regentsprep.org/Regents/math/polymult/Smul_bin.htm

Explains four different ways to multiply two binomials, including the FOIL method.

- **FACTORING TRINOMIALS**

<http://www.mathguide.com/cgi-bin/quizmasters/Factoring.cgi>

Use this interactive online trinomial factoring Web site to practice your factoring skills.

- **ALGEBRA HELP: FOIL METHOD**

<http://www.algebrahelp.com/lessons/simplifying/foilmethod/index.htm>

Visit this site for a very clear step-by-step explanation of the FOIL method. This is followed by a practice page. When you click on any numbered item, its step-by-step solution is provided.

INSTRUCTIONAL GRAPHIC

- FANTASTIC FACTORING PRACTICE EXERCISES



Fantastic Factoring Practice Exercises

Directions: Decide which of the following expressions are quadratic trinomials.

- a. $x^2 + 5x - 11$
- b. $x^3 + 16x^2 - 12x + 4$
- c. $5x - 17$
- d. $6x - 2x^2 + 13$

Directions: Write the given expressions in an expanded form.

- a. $(x + 5)(x - 6)$
- b. $(x + 1)(x - 21)$
- c. $(x - 3)(x - 4)$
- d. $(x + 5)(x + 3)$

Directions: Using FOIL, check whether the factoring was done correctly.

- a. $x^2 - 3x + 2 = (x - 1)(x + 2)$
- b. $x^2 + 4s - 12 = (x + 6)(x - 2)$
- c. $x^2 + 5x - 14 = (x - 7)(x + 2)$

Directions: Factor the following expressions.

- a. $x^2 - 6x + 5$
- b. $x^2 + 8x + 7$
- c. $x^2 - 11x + 10$
- d. $x^2 + x - 2$
- e. $x^2 - 4$
- f. $x^2 - 16$
- g. $x^2 - 144$