

MATH SERIES

FACTORING IS FANTASTIC

Part 2: Quadratic Trinomials

17 Minutes

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FOR USE IN: Mathematics

LEVEL: Grades 7-9, Advanced Grade 6

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EDUCATIONAL OBJECTIVES:

To help students understand:

- **Quadratic trinomials**
- **The FOIL method of expanding bracketed binomials**
- **Factoring quadratic trinomials in different cases**

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.

BEFORE SHOWING THE VIDEO:

The video contains several optional pauses where the students are presented with calculations to complete, while the VCR may be placed on pause. After the pause, correct answers are given. If the teacher plans to use these pauses, the students may be requested to have paper and pens available before starting the video. For a more intensive interaction between students and parts of the video, the teacher may wish to pause the tape after the presentation of a particular concept to inquire if the students have understood it; and/or ask the students before starting the video to signal the teacher to stop at any point for clarification. The video may also be shown in its entirety without pause either as an introduction or a review of the subject. It is always helpful if teachers are able to view the video before showing it to the class.

It is important to remind students of the basic facts explained in the previous part of the video. A polynomial is in factored form if it is expressed as the product of two or more polynomials; in other words, to factor an expression (a polynomial) is to present it in the form of a product. To do this in the examples discussed in Factoring is Fantastic, Part 1, one had to present each term as a product, find the greatest common factor of all the terms, and then write it in front of a parenthesis, putting inside the parenthesis the sum of all the remaining factors of the terms. Several exercises can be suggested to review this technique:

- a) $6t-24$
- b) $3t-t^2$
- c) $5x+15y-25z$
- d) $2pk+p+7p^2$

To prepare the students for the somewhat more difficult exercises they will see in this video as compared to those in Part 1, they can be offered the expression $x(x-4) + x-4$ to factor.

CONTENT OF THE VIDEO:

Several key concepts are explained: what quadratic trinomials are, the FOIL method of expanding bracketed binomials, and factoring quadratic trinomials in different cases.

FOIL (Firsts, Outers, Inners, Lasts). 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 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 not all

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

AFTER SHOWING THE VIDEO:

Several exercises can be offered to make use of the variety of techniques discussed in the video.

Which of the following expressions are quadratic trinomials?

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

Write the given expressions in an expanded form

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

Using FOIL, check whether the factoring was done correctly:

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

Factor the following expressions:

- a) x^2-6x+5
- b) x^2+8x+7
- c) $x^2-11x+10$
- d) x^2+x-2

Factor these expressions:

- a) x^2-4
- b) x^2-16
- c) x^2-144 .

EXPLORING AND INVESTIGATING:

The following questions may be used to lead students into a more detailed discussion:

1. Factor the expression $x^2 - a^2$, where a , is an arbitrary number.
2. Check to see if the given trinomial is factored correctly:

$$x^2 - 2x - 1 = (x - 1 - \sqrt{2})(x - 1 + \sqrt{2})$$

3. Read and analyze the following argument:

The expression $x^2 + 1$ cannot be factored.

Assume that it can be factored. That implies that this expression can be written in the form $x^2 + 1 = (x + a)(x + b)$ for some numbers a and b . Then substituting $-a$ for x in this expression, we should obtain 0. However, for any $-a$, the number $(-a)^2 = a^2$ is non-negative and $a^2 + 1$ is positive. The obtained contradiction shows that our assumption was wrong.

4. Give any other example of a quadratic trinomial that cannot be factored.

The Math Series consists of 10 videos:

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ALGEBRA: A Piece of Cake Part 2

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LINEAR EQUATIONS and Their Graphs: Let's Get It Straight Part 2

INTEGER OPERATIONS: Into the Negative Zone Part 1 Adding and Subtracting

INTEGER OPERATIONS: Into the Negative Zone Part 2 Multiplying and Dividing

FACTORING IS FANTASTIC Part 1: Common Factors

FACTORING IS FANTASTIC Part 2: Quadratic Trinomials

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