



#9751

ALGEBRA: THE QUADRATIC FORMULA

CEREBELLUM CORP., 2002

Grade Levels: 11-13+

26 minutes

1 Instructional Graphic Enclosed

DESCRIPTION

Reviews shortcuts and patterns that make factoring easier before introducing the quadratic formula, discriminants, imaginary, and complex numbers. Teaches how to find the square root of negative numbers and explains practical uses of quadratic equations. Program 6 of 7.

ACADEMIC STANDARDS

Subject Area: Mathematics

- ★ Standard: Understands and applies basic and advanced properties of functions and algebra
 - Benchmark: Uses expressions, equations, inequalities, and matrices to represent situations that involve variable quantities and translates among these representations (See Instructional Goals #1, 4, 5, 6, and 7.)
 - Benchmark: Understands basic concepts (e.g., roots) applications (e.g., determining cost, revenue, and profit situations), and solution methods (e.g., factoring, approximation using sign changes) of polynomial equations (See Instructional Goal #2.)
 - Benchmark: Understands the general properties and characteristics of many types of function (e.g., direct and inverse variation, general polynomial, radical, step, exponential, logarithmic, sinusoidal) (See Instructional Goals #2 and 3.)

INSTRUCTIONAL GOALS

1. To review factoring patterns of special products.
2. To point out when the quadratic formula can be used to find the roots of a quadratic equation.
3. To demonstrate how to plug values into the quadratic formula.
4. To define discriminant and explain how the sign of the discriminant affects the number of roots of the equation.
5. To list the three types of numbers.
6. To define imaginary numbers and complex numbers and explain how they are used in algebra.
7. To point out the difference between $-\sqrt{1}$ and $\sqrt{-1}$.
8. To show a practical application of the quadratic formula.

VOCABULARY

1. acceleration of gravity
2. binomial square
3. coefficient
4. complex numbers
5. constant term
6. discriminant
7. factorization
8. FOIL
9. imaginary numbers
10. initial height
11. initial velocity
12. perfect square
13. quadratic formula
14. radical
15. root
16. single-root equation
17. trial and error
18. x-intercept

BEFORE SHOWING

1. Review the themes and plots of the Indiana Jones movies. (*Raiders of the Lost Ark*, *The Temple of Doom*, *The Last Crusade*)
 - a. Using the name Indiana Jones, create other names substituting other states and words that rhyme with Jones.
 - b. Explain that the video is a spoof of the Indiana Jones movies.
2. Discuss the importance of learning algebra and how it can be applied to real-life situations.
3. Review using the FOIL method to factor quadratic equations.
4. Present several quadratic trinomials that cannot be factored. Discuss possible ways to find the roots.

DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause at the section showing the special kinds of factoring. Discuss why there is no middle term in the second kind of example.
3. Pause at the section showing the man walking on the cakes. Explain the meaning of "It's a cakewalk".
4. Pause at the section showing the two ways of writing the answer to the quadratic formula. Discuss the advantages and disadvantages of the radical form and the decimal form.
5. Pause at the section showing the symbol used for imaginary numbers. Emphasize that it is not to be confused with the variable.
6. Pause at the section explaining the form $(a + bi)$ for complex numbers. Differentiate between a purely real complex number and a purely imaginary complex number.
7. Pause at the section explaining the practical application example at the end of the video. Go through each part step-by-step as the numbers are plugged in.

AFTER SHOWING

► Discussion Items and Questions

1. How many roots does a quadratic equation made up of binomial squares have?
2. If a quadratic equation cannot be factored, how can the roots be found?
3. In what two different forms can the answer to the quadratic equation be written?
4. What is the part of the quadratic equation under the square root called?
5. How many roots will the equation have if the discriminant is positive? If the discriminant is zero? If the discriminant is negative?

6. What are imaginary numbers? How are imaginary numbers written?
7. What is the value of $\sqrt{-25}$? What is the value of $\sqrt{-5}$?
8. What is a complex number?
9. What is the acceleration of gravity constant?
10. In the example where Galileo Galilei drops a bowling ball, why is the initial velocity 0 meters per second? In this example, why can't the value for x be negative?

► **Applications and Activities**

1. Complete a worksheet that summarizes the content of the video. (See Instructional Graphic.)
2. The video contains sentences that twist meanings or play with words. Write other sentences using these words or phrases:
 - a. You can FOIL the check.
 - b. We tried and erred, we couldn't factor it.
 - c. We didn't know what route (root) to take.
 - d. Radical, dude!
 - e. I'm considered a negative person, and I moved around a lot growing up, so I have no real roots.
3. Demonstrate various methods and tools used to calculate the square root of a number. Consider the conventional method, estimation method, square root table, slide rule, calculator, and computer.
4. Research and report on the history of the quadratic formula.
5. Starting with the standard form for quadratic equations $ax^2 + bx + c = 0$, show the step-by-step process to solve for x . State which algebraic properties are used to move from one step to another.
6. Display the quadratic formula in the classroom in different ways such as banners (paper or cloth), posters, newspaper headlines, mobiles, or bookmarks.
7. Some math supply catalogs sell T-shirts with the quadratic formula printed on them. Order these shirts for the class or have them printed at a local business.
8. Research the mathematical time line to find when imaginary numbers and complex roots were first used.
9. Research other quadratic formulas that have practical applications.

RELATED RESOURCES

- [Algebra: A Piece of Cake! Part One #9544](#)
- [Algebra: A Piece of Cake! Part Two #9545](#)
- [Algebra: The Basics #9750](#)
- [Algebra: Functions #9745](#)
- [Algebra: Linear Equations #9746](#)
- [Algebra: Polynomials #9747](#)
- [Algebra: Quadratic Equations #9748](#)
- [Algebra: Quadratic Roots #9749](#)





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**

<http://www.mathforum.com/>

Contains links to math resources by subject and a question/answer section by Dr. Math. Topics covered in the video are included.

- **QUADRATIC FORMULA**

<http://school.discovery.com/homeworkhelp/webmath/quadform.html>

Contains an interactive solver where the values for a, b, and c are typed in and the roots are calculated.

- **IMAGINARY NUMBERS ARE NOT IMAGINARY**

<http://www.mathnstuff.com/math/spoken/here/3essay/eimage.htm>

Contains information about the different kinds of numbers and gives examples of each.

INSTRUCTIONAL GRAPHICS

- **AN OVERVIEW**



$$(y - 3)(y + 3)$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$(x+5)^2$$

An Overview

FACTORIZING SPECIAL PRODUCTS

Factor the trinomials below:

1. $y^2 + 8y + 16$
2. $r^2 - 18r + 81$
3. $25x^2 - 9$
4. $36d^2 + 12d + 1$
5. $81 - 4m^2$

QUADRATIC FORMULA

Use the quadratic formula to solve each equation:

1. $x^2 - 7x - 8 = 0$
2. $a^2 + 10a + 12 = 0$
3. $3b^2 - 7b - 20 = 0$
4. $2x^2 + 4x = 30$
5. $2n^2 - 7n - 3 = 0$

IMAGINARY NUMBERS

Write the imaginary numbers for each:

1. $\sqrt{-36}$
2. $\sqrt{-144}$
3. $\sqrt{-3}$
4. $\sqrt{-16}$
5. $\sqrt{-24}$