

# #9748

## ALGEBRA: QUADRATIC EQUATIONS

CEREBELLUM CORP., 2002

Grade Levels: 11-13+

26 minutes

1 Instructional Graphic Enclosed

### DESCRIPTION

This introduction to quadratic equations highlights: squares, square roots, and the radical sign; the foil method of multiplying binomials; and closes with how to graph a quadratic equation with its axis of symmetry, vertex, and parabola. Examples clearly teach terminology and concepts in this college algebra lesson. Program 4 of 7.

### ACADEMIC STANDARDS

#### Subject Area: Mathematics

- ★ 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 compositions, inverses) (See Instructional Goals #1, 2, 3, 4, 5, and 6.)
  - Benchmark: Understands special values (e.g., minimum and maximum values, x- and y-intercepts, slope, constant ratio or difference) of patterns, relationships, and functions (See Instructional Goal #10.)
  - Benchmark: Understands properties of graphs and the relationship between a graph and its corresponding expression (e.g., maximum and minimum points) (See Instructional Goal #8.)
  - Benchmark: Understands the general properties and characteristics of many types of functions (e.g., direct and inverse variation, general polynomial, radical, step, exponential, logarithmic, sinusoidal) (See Instructional Goals #7 and 9.)

### INSTRUCTIONAL GOALS

1. To define the term quadratic.
2. To explain about squares and square roots.
3. To show two ways square roots can be designated.
4. To list some perfect squares.
5. To demonstrate how the FOIL method of multiplying two binomials together is used.
6. To write the standard form for quadratic equations.
7. To compare linear equations and quadratic equations.
8. To show that the rate of change for quadratic equations is not constant.
9. To explain the characteristics of a parabola.
10. To show how to compute the axis of symmetry from a quadratic equation.

## VOCABULARY

1. axis of symmetry
2. binomial
3. coefficient
4. commutative property
5. distributive property
6. exponent
7. FOIL
8. fractional exponent
9. linear equation
10. monomial
11. parabola
12. perfect square
13. polynomial
14. quadratic equation
15. radical sign
16. slope
17. square root
18. squares
19. standard form
20. trinomial
21. vertex
22. y-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*)

Using the name Indiana Jones, create other names substituting other states and words that rhyme with Jones.

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 linear functions and their graphs.

## DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause at the section showing the fractional exponent being used to designate square root. Discuss why this symbol is appropriate and meaningful.
3. Pause at the section showing the list of perfect squares. Discuss why it is a good idea to memorize simple square roots.
4. Pause at the section showing the use of the FOIL method to multiply two binomials. Select a few basic binomials to try to multiply mentally.
5. Pause at the graph of the falling object. Discuss why the falling object is expected to speed up as time increases.
6. Pause at the scene showing the parabola changing shape as the value of "a" is altered. Discuss why "a" will never equal 0 in a quadratic equation.
7. Pause at the section showing how the axis of symmetry is computed. Discuss how the coordinate of the vertex can be determined once the axis of symmetry is known.

## AFTER SHOWING

### Discussion Items and Questions

1. What is the highest exponent that can appear in a linear equation? In a quadratic equation?
2. How does the term "quadratic" refer to a squared variable?
3. What are two ways that a square root can be designated?
4. Why are there two square roots for each number? How can both the positive and negative square roots be written together?
5. What are some examples of perfect squares?

6. What are some examples of monomials, binomials, and trinomials? What term is used to denote monomials, binomials, and trinomials in general?
7. What do the letters in the acronym FOIL stand for?
8. What is the standard form for a quadratic equation?
9. What term is found in a quadratic equation and not in a linear equation?
10. How does the rate of change compare in a linear equation and a quadratic equation?
11. What shape does the graph of a quadratic equation take? What is the point where the graph turns and changes direction called? What is the axis of symmetry?
12. How does the sign of the value "a" change the shape of the parabola? What happens to the shape of the parabola as the value of "a" gets smaller? Bigger?
13. Which value of the quadratic equation is the y-intercept?
14. What formula is used to find the axis of symmetry?

### Applications and Activities

1. Complete a worksheet that summarizes the content of the video. (See Instructional Graphics.)
2. Mathematical terms often have other literal meanings. Examples from the video are listed below. Write other sentences using the same words.
  - a. "Oh, square. You mean like you?"
  - b. "It's radical, man!"
  - c. "Foiled again."
  - d. "Quadratics are square."
  - e. "Nobody but your professor or Stephen Hawkins knows how to find a square root in his head."
  - f. "When I was younger, I was strictly monomial. When in high school, I was binomial. In college, I went trinomial. And now? Polynomial."
3. Research different resources for finding square roots. (conventional computation, slide rule, square root table, calculator)
4. Make a list of perfect squares up to 625. Create memory games to help become familiar with the most common ones.
5. Use algebra tiles to model the multiplication of two binomials.
6. FOIL is an acronym. Research other common acronyms. (IBM, LASER, SALT, ASL, GPA)
7. Create posters illustrating the FOIL method.
8. Make a list of everyday objects that have a parabolic shape.
9. The Gateway Arch in St. Louis, Missouri, is shaped like a parabola. The shape of the arch can be approximated by the graph of the function  $y = -.00635x^2 + 4.0005x - .07875$ .
  - a. Referring to the value of "a" in the equation, describe what the parabola looks like.
  - b. Find the axis of symmetry.

### 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: The Quadratic Formula #9751](#)
- [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.

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- **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.

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- **MULTIPLYING BINOMIALS**

[http://regentsprep.org/Regents/math/polymult/Smul\\_bin.htm](http://regentsprep.org/Regents/math/polymult/Smul_bin.htm)

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

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- **MULTIPLYING POLYNOMIALS**

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

Contains a solver that uses the FOIL method to multiply two binomials.

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- **SQUARE ROOTS**

[http://mcs.explorelarning.com/Content/Alg36/Preview/HTML/8\\_ExploreSquareRoots/P1000/Page.htm](http://mcs.explorelarning.com/Content/Alg36/Preview/HTML/8_ExploreSquareRoots/P1000/Page.htm)

Contains an interactive Gizmo that teaches concepts about squares and square roots.

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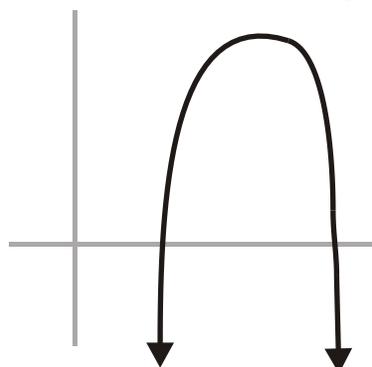
## INSTRUCTIONAL GRAPHICS

- **AN OVERVIEW**



## An Overview

$$(x + 3)(x - 9)$$



### SQUARES AND SQUARE ROOTS

Complete:

1. The square of 25 is \_\_\_\_\_.
2. \_\_\_\_\_ is the square of 36.
3. The square root of 196 is \_\_\_\_\_.
4. \_\_\_\_\_ is the square root of 576.
5. The square root of 43 is between \_\_\_\_\_ and \_\_\_\_\_.

### FOIL

Use the FOIL method to find each product:

1.  $(x + 5)(x + 6)$
2.  $(n - 8)(n - 4)$
3.  $(y + 3)(y - 8)$
4.  $(2n + 3)(n - 4)$
5.  $(5b - 3)(2b + 1)$

### QUADRATIC EQUATIONS

1. Write the equations in standard form:

- a.  $3x + 9 = 4x^2$
- b.  $13 + 2x^2 = 9x$
- c.  $5x + 9 = 3x^2 + 8x$

2. Set up a table of x and y values.  
Graph the equations.

- a.  $y = x^2 + 2x + 18$
- b.  $y = -x^2 + 4x - 1$
- c.  $y = 2x^2 + 12x - 11$

3. Find the axis of symmetry for each equation:

- a.  $y = x^2 + 2$
- b.  $y = x^2 + 4x - 9$
- c.  $y = -2x + 4x + 6.5$