

STRAND 3: QUADRATIC FUNCTIONS

TOPIC 3.2: DIGGING DEEPER

Topic Notes

Mathematical focus

This topic gets to the nitty-gritty about quadratic functions. Participants investigate how parameter changes affect the solutions of quadratic equations both graphically and algebraically and derive the quadratic formula for solving quadratic equations.

Topic overview

This topic makes the connection between the graph of a quadratic function and the solution to a quadratic equation. Participants will explore multiple ways to represent a quadratic function: algebraically (standard and vertex form) and graphically using the ideas of transforming a parent function.

This topic includes 2 tasks:

Task 3.2.1: Putting It Together

Task 3.2.2: When Does a Quadratic Function Do That?

TE_xES standards focus

TE_xES Standard II.006 Patterns and algebra. The teacher understands linear and quadratic functions, analyzes their algebraic and graphical properties, and uses them to model and solve problems. The beginning teacher:

(D) Analyzes the zeros (real and complex) of quadratic functions.

(E) Makes connections between the $y = ax^2 + bx + c$ and the $y = a(x - h)^2 + k$ representations of a quadratic function and its graph.

(F) Solves problems involving quadratic functions using a variety of methods (e.g., factoring, completing the square, using the quadratic formula, using a graphing calculator).

TEKS/TAKS focus

TEKS 2A.2 Foundations for functions. The student understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations.

The student is expected to:

(B) use complex numbers to describe the solutions of quadratic equations.

TEKS 2A.4 Algebra and geometry. The student connects algebraic and geometric representations of function. The student is expected to:

(B) extend parent function with parameters such as a in $f(x) = a/x$ and

describe the effects of the parameter changes on the graph of parent functions.

TEKS 2A.6 Quadratic and square root functions. The student understands that quadratic functions can be represented in different ways and translates among their various representations.

TEKS 2A.7 Quadratic and square root functions. The student interprets and describes the effects of changes in the parameters of quadratic functions in applied and mathematical situations. The student is expected to:

- (A) use characteristics of the quadratic parent function to sketch the related graphs and connect between the $y = ax^2 + bx + c$ and the $y = a(x - h)^2 + k$ symbolic representations of quadratic functions; and
- (B) use the parent function to investigate, describe, and predict the effects of changes in a , h , and k on the graphs of $y = a(x - h)^2 + k$ form of a function in applied and purely mathematical situations.

TEKS 2A.8 Quadratic and square root functions. The student formulates equations and inequalities based on quadratic functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. The student is expected to:

- (A) analyze situations involving quadratic functions and formulate quadratic equations or inequalities to solve problems;
- (B) analyze and interpret the solutions of quadratic equations using discriminants and solve quadratic equations using the quadratic formula; and
- (C) compare and translate between algebraic and graphical solutions of quadratic equations.

High School TAKS Objective 1: The student will describe functional relationships in a variety of ways.

High School TAKS Objective 2: The student will demonstrate an understanding of the properties and attributes of functions.

High School TAKS Objective 5: The student will demonstrate an understanding of quadratic and other nonlinear functions.

Materials

	Task 3.2.1 Putting it Together	Task 3.2.2 When does a quadratic function do that?
Graphing calculator	X	X
Transparencies & transparency pens	X	X
Chart paper & markers		X

Procedure

Both of these tasks are important for participants to experience and are tied together. Once the quadratic formula is derived in the first task, the connection between parameter changes and the types of solutions to quadratic equations are explored in the second task. For the first task, have participants begin by working separately, and then have them share their work within their group to see how many different methods there are for completing the square. As the class works through the problems, ask participants to present their solutions to the class on the overhead.

For the second task, it would work well to begin the task as a group, and then assign the remainder of the task as homework to be presented the next meeting. Participants will need time at the beginning of the next session to transcribe their findings to a transparency or chart paper.

Summary

There is a connected interplay between the algebraic representation of a quadratic function, its graph, and the solutions to the corresponding quadratic equation. These tasks scaffold the building of solutions to quadratic equations by analyzing parameters in isolation and then bringing them all together.

Assessment

Either the teacher or student journal would be appropriate for these tasks. In fact, it might be useful to complete both journals on either of the tasks.

	Teacher use only	Modify for students	Ready for students
Task 3.2.1		*	
Task 3.2.2			*