

STRAND 1: FOUNDATIONS OF FUNCTIONS

TOPIC 1.1: LINKING FOUNDATIONS

Topic Notes

Mathematical focus

The mathematical focus of this topic rests in emphasizing the connections between what Algebra II students come to the course having experienced—transformations in geometry—and the new notation and algebraic/function-based notation in Algebra II. We investigate these connections to link the foundational work on transformations done in geometry to that done in Algebra II.

Topic overview

There are 3 tasks included in this topic.

Task 1.1.1: Patty Paper Transformations

Task 1.1.2: Transformations with Technology

Task 1.1.3: Exploring Notation Differences in Geometry and Algebra

This topic is an opener for the Foundations of Functions Strand of the module. The tasks were written to connect the ways transformations are expressed in geometry with the manner in which they are expressed algebraically for functions and relations. These tasks will foster participant conversations on the differing perspective of transformation between algebra and geometry.

TEXES standards focus

TEXES Standard II.004 Patterns and algebra. The teacher uses patterns to model and solve problems and formulate conjectures. The beginning teacher:

(A) Recognizes and extends patterns and relationships in data presented in tables, sequences, or graphs.

TEXES Standard II.005 Patterns and algebra. The teacher understands attributes of functions, relations, and their graphs. The beginning teacher:

(E) Applies basic transformations [e.g., $k f(x)$, $f(x) + k$, $f(x - k)$, $f(kx)$, $| f(x) |$] to a parent function, f , and describes the effects on the graph of $y = f(x)$.

TEXES Standard III.014 Geometry and measurement. The teacher understands coordinate, transformational, and vector geometry and their connections. The beginning teacher:

(A) Identifies transformations (i.e., reflections, translations, glide-reflections, rotations, dilations) and explores their properties.

(D) Applies transformations in the coordinate plane.

TEXES Standard V.019 Mathematical processes and perspectives. The teacher understands mathematical connections both within and outside of mathematics and how to communicate mathematical ideas and concepts.

(C) Translates mathematical ideas between verbal and symbolic forms.

(D) Communicates mathematical ideas using a variety of representations (e.g., numeric, verbal, graphical, pictorial, symbolic, concrete).

(F) Uses appropriate mathematical terminology to express mathematical ideas.

TEExES Standard VI.020 Mathematical learning, instruction and assessment. The teacher understands how children learn mathematics and plans, organizes and implements instruction using knowledge of students, subject matter, and statewide curriculum (Texas Essential Knowledge and Skills [TEKS]). The beginning teacher:

(C) Uses students' prior mathematical knowledge to build conceptual links to new knowledge and plans instruction that builds on students' strengths and addresses students' needs.

TEKS/TAKS focus

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.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:

(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

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

High School TAKS Objective 6: The student will demonstrate an understanding of geometric relationships and spatial reasoning.

Materials

	Task 1	Task 2	Task 3
Graphing Calculator		*	*
Graphing Calculator Overhead Viewscreen		*	
Transparencies		*	*
Transparency pens		*	*
Markers	*		
Wall Chart Paper	*		
Patty Paper	*		*

Procedure

Many students and teachers of Algebra II encounter an apparent disconnect between the notation used in geometry and the notation used in Algebra II to denote transformations (vertical and horizontal shifts) of functions. There seems to be a contradiction in notation

that is glossed over and students are told “just remember that in algebra the horizontal shifts are ‘backwards’ from the way they were written in geometry.” Participants will get a chance to make these connections and see that the “backwards” phenomenon can be explored as a matter of one’s point of reference.

When facilitating this topic, consider the following suggestions. For task 1.1.1, model how to use the patty paper to perform the transformations for part a, then have the participants work in groups to complete the rest of the task. They will report their findings to exercise 2 on wall chart paper for whole-class discussion. For task 1.1.2, work through this on a transparency with the class as a whole and then model inputting the list on a calculator viewscreen. In task 1.1.3, have each group write a group answer to Exercise 2d on a transparency. Each group will report to the class. This exercise provides a summary for the linking foundations topic.

Summary

Giving participants a concrete experience with coordinate notation from geometry versus function notation in algebra helps them compare and contrast the differences in the notation and develops their understanding for explaining these differences.

Assessments

A variation of Task 1.1.3 Exercises 1 or 2 would make good assessments.

Transitions to the classroom—which of the tasks are appropriate only for teachers? Which for students? How would we modify a teacher-task to make it student appropriate?

	Teacher use only	Modify for students	Ready for students
Task 1			*
Task 2			*
Task 3		*	