Transforming High School Mathematics Using Transformations

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What is a transformation?

- an act, process, or instance of transforming or being transformed

- (1) **:** the operation of changing (as by rotation or mapping) one configuration or expression into another in accordance with a mathematical rule; *especially* **:** a change of variables or coordinates in which a function of new variables or coordinates is substituted for each original variable or coordinate (2) **:** the formula that effects a transformation

Merriam-Webster Online Dictionary
http://www.merriam-webster.com/dictionary/transformation

Transformations in the NCTM Standards

"Through their high school experiences, they stand to develop deeper understandings of the fundamental mathematical concepts of function and relation, invariance, and transformation."

Principles and Standards for School Mathematics, NCTM, p. 287

Transformations in Geometry

Apply transformations **and use symmetry to analyze mathematical situations**

Expectations: In grades 9–12 all students should—

- understand and represent translations, reflections, rotations, and dilations of objects in the plane by using sketches, coordinates, vectors, function notation, and matrices;

- use various representations to help understand the effects of simple transformations and their compositions.

- Principles and Standards for School Mathematics, NCTM, p. 287
  - Principles and Standards for School Mathematics, NCTM, p. 308

RICE UNIVERSITY
SCHOOL MATHEMATICS PROJECT

RUSMP Geometry Module

Introduction

The Rice University School Mathematics Project (RUSMP) developed the *Geometry Module* as a comprehensive teacher training module with funding from the Texas Education Agency and the Texas Higher Education Coordinating Board. The *Geometry Module* effectively assists teachers in developing a deeper understanding of the underlying concepts that support the *Texas Essential Knowledge and Skills* (TEKS) in Geometry and helps teachers develop the pedagogical tools necessary to provide their students the opportunity to meet Texas' challenging state content and student performance standards. The *Geometry Module* also supports related TExES Mathematics Competencies. The rigor of the *Geometry Module* is of sufficient nature as to allow participating teachers who have not yet met the requirements of a "highly qualified" teacher, as defined by the United States NO CHILD LEFT BEHIND ACT of 2001 (NCLB), to progress towards this goal.

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Useful External Links

Region IV Education Service Center Resources

    Utilizing the Graphing Calculator in Secondary Mathematics

    The Geometer's Sketchpad Tutorial

NonEuclid Interactive Constructions in Hyperbolic Geometry

Rice Geometry Module Activities for Geometer's Sketchpad
A collection of activities for the The Geometer's Sketchpad that are correlated to the Geometry Module. These activities were developed by Elaine Young, Assistant Professor of Mathematics at Texas A&M University-Corpus Christi, with funding by the Teacher Quality grant program.

Transformations in Algebra

Understand patterns **, relations, and functions**

Expectations: In grades 9-12 all students should—

- generalize patterns using explicitly defined and recursively defined functions;
- understand relations and functions and select, convert flexibly among, and use various representations for them;
- analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior;
- ***understand and perform transformations*** such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more-complicated symbolic expressions;
- understand and compare the properties of classes of functions, including exponential, polynomial, rational, logarithmic, and periodic functions;
- interpret representations of functions of two variables

Principles and Standards for School Mathematics, NCTM, p. 296

Using Transformations to Make Connections

Using matrices, students can also see connections among major strands of mathematics: they can use matrices to solve systems of linear equations, to represent geometric transformations (some of which can involve creating computer graphics), and to represent and analyze vertex-edge graphs.

Principles and Standards for School Mathematics, NCTM, p. 292