Transforming High School Mathematics Using Transformations

Richard Parr Rice University School Mathematics Project NCTM Annual Meeting April 14, 2010

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

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."

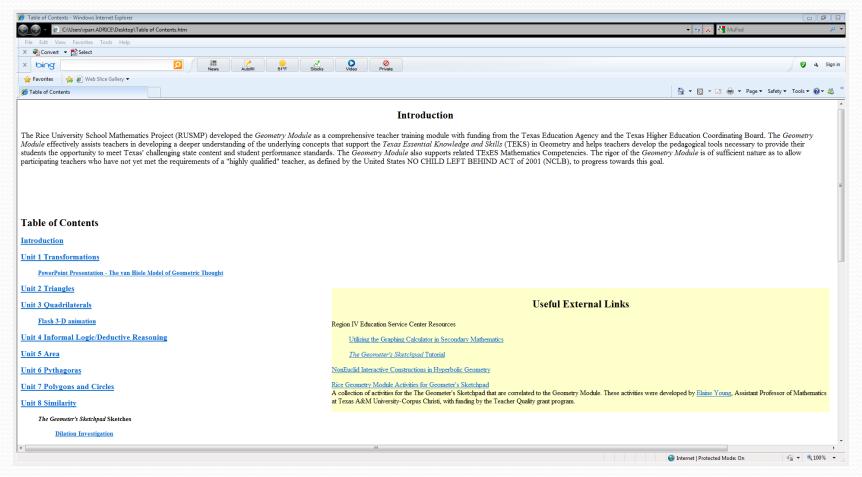
Transformations in Geometry

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

RUSMP Geometry Module



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

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.