Board of Education Agenda Item

Item: G.   **Date:**   February 28, 2007

Topic: First Review of Standards of Learning for a New, Optional High School Mathematics Course

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Origin:

_____   Topic presented for information only (no board action required)

  X   Board review required by
         _____   State or federal law or regulation
          X   Board of Education regulation
         _____   Other: _____

_____   Action requested at this meeting   X   Action requested at future meeting: late spring 2007

Previous Review/Action:

_____   No previous board review/action

  X   Previous review/action
         date   October 25, 2006
         action   Permission to develop new Standards of Learning for a new, optional high school
                      mathematics course

Background Information: Recent research indicates that many students would benefit from additional instruction in the areas of algebra and data analysis as they prepare to enter postsecondary instruction and work. Achieve, The Education Trust, and the Thomas B. Fordham Foundation worked with two- and four-year postsecondary faculty and front-line managers in high-growth, high-skill occupations to define the core knowledge and skills that high school graduates need to succeed in these kinds of occupations. Among the skills required is a critical understanding of higher levels of algebra and data analysis.

Recognizing that some students need additional time and instruction to gain these skills, in May 2006, the Department of Education convened a representative statewide group of stakeholders to discuss the desirability of creating a new mathematics course focusing on the advanced study of relations, functions, and data analysis. During this same time frame, professionals involved in mathematics education in Virginia were informally polled about this topic. Respondents indicated that there appears to be a gap in Virginia's course offerings that could be filled by a course focusing on advanced study of relations, functions, and data analysis. On October 25, 2006, the Board granted approval for the Department to proceed with the development of Standards of Learning for this optional high school mathematics course.

Summary of Major Elements: During December 2006, the Department convened a team of secondary mathematics educators and developed a set of proposed Standards of Learning for a new, optional mathematics course. The new offering, tentatively titled, "Algebra, Functions, and Data Analysis," is intended to assist students in building more advanced mathematical foundations in preparation for higher level mathematics coursework. The new course would help students to:

- model real world phenomena using algebra;
- analyze and represent algebraic relationships and functions using tables, equations, and graphs;
- translate easily between representations of functions;
- select and use appropriate statistical methods to analyze data; and
- develop and evaluate inferences and predictions that are based on data.

The course would be above the level of algebra and geometry. With approval by the Board, this new, optional course could be used to satisfy a mathematics credit for graduation.

Attachment A contains the proposed Algebra, Functions, and Data Analysis Standards of Learning.

Superintendent's Recommendation: The Superintendent of Public Instruction recommends that the Board of Education accept the proposed Algebra, Functions, and Data Analysis Standards of Learning for first review.

Impact on Resources: The resources needed to develop the curriculum framework for this course may be absorbed by the Department's existing resources at this time. School divisions implementing the proposed course would need to provide textbooks and other instructional materials for students.

Timetable for Further Review/Action: The Standards of Learning Development Work Plan calls for public hearings, final review and adoption of the Standards of Learning by late spring 2007, to be followed by the development of a curriculum framework.

Algebra, Functions, and Data Analysis

The following standards outline the content for a one-year course in Algebra, Functions, and Data Analysis. This course is designed for students who have successfully completed the standards for Algebra I. Within the context of mathematical modeling and data analysis, students will study functions and their behaviors, systems of inequalities, probability, experimental design and implementation, and analysis of data. Data will be generated by practical applications arising from science, business, and finance. Students will solve problems that require the formulation of linear, quadratic, or exponential equations or a system of equations.

Through the investigation of mathematical models and interpretation/analysis of data from real life situations, students will strengthen conceptual understandings in mathematics and further develop connections between algebra and statistics. Students should use the language and symbols of mathematics in representations and communication throughout the course.

These standards include a transformational approach to graphing functions and writing equations when given the graph of the equation. Transformational graphing builds a strong connection between algebraic and graphic representations of functions.

The infusion of technology (graphing calculator and/or computer software) in this course will assist in modeling and investigating functions and data analysis.

Algebra, Functions, and Data Analysis

Algebra and Functions

AFDA.1   The student will investigate and analyze function (linear, quadratic, and exponential) families and their characteristics. Key concepts include:
a) continuity
b) local and absolute maxima and minima
c) domain and range
d) zeros
e) intercepts
f) intervals in which the function is increasing/decreasing
g) end behaviors
h) asymptotes

AFDA.2   The student will use knowledge of transformations to write an equation given the graph of a function (linear, quadratic, and exponential).

AFDA.3   The student will collect data and generate an equation for the curve (linear, quadratic, and exponential) of best fit to model real-world problems or applications. Students will use the best fit equation to extrapolate function values, make decisions, and justify conclusions with algebraic and/or graphical models.

AFDA.4   The student will transfer between and analyze multiple representations of functions including algebraic formulae, graphs, tables, and words. Students will select and use appropriate representations for analysis, interpretation, and prediction.

AFDA.5   The student will determine optimal values in problem situations by identifying constraints and using linear programming techniques.

Data Analysis

AFDA.6   The student will calculate probabilities. Key concepts include:
a) conditional probability
b) dependent and independent events
c) addition and multiplication rules
d) counting techniques (permutations and combinations)

AFDA.7   The student will analyze the normal distribution. Key concepts include:
a) characteristics of normally distributed data
b) percentiles
c) normalizing data using z-scores
d) area under the standard normal curve and probability

AFDA.8   The student will design and conduct an experiment/survey. Key concepts include:
a) sample size
b) sampling technique
c) controlling sources of bias and experimental error
d) data collection
e) data analysis and reporting