Effective November 15, 2005

505-3-.25 MATHEMATICS EDUCATION PROGRAM

(1) Purpose. This rule states field-specific content standards for approving initial educator preparation programs that prepare individuals to teach mathematics in grades 6-12 and supplements requirements in Rule 505-3-.01, Requirements and Standards for Approving Professional Education Units and Educator Preparation Programs.

(2) Requirements.

(a) To receive approval, a state-approved professional education unit shall offer a preparation program described in program planning forms, catalogs, and syllabi addressing the following standards published by the National Council of Teachers of Mathematics:

1. Candidates know, understand and apply the process of mathematical problem solving.

(i) Candidates apply and adapt a variety of appropriate strategies to solve problems.

(ii) Candidates solve problem that arise in mathematics and those involving mathematics in other contexts.

(iii) Candidates build new mathematical knowledge through problem solving.

(iv) Candidates monitor and reflect on the process of mathematical problem solving.

2. Candidates reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry.

(i) Candidates recognize reasoning and proof as fundamental aspects of mathematics.

(ii) Candidates make and investigate mathematical conjectures.

(iii) Candidates develop and evaluate mathematical arguments and proofs.

(iv) Candidates select and use various types of reasoning and methods of proof.

3. Candidates communicate their mathematical thinking orally and in writing to peers, faculty and others.

(i) Candidates communicate their mathematical thinking coherently and clearly to peers, faculty, and others.

(ii) Candidates use the language of mathematics to express ideas precisely.

(iii) Candidates organize mathematical thinking through communication.

(iv) Candidates analyze and evaluate the mathematical thinking and strategies of others.

4. Candidates recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding.

(i) Candidates recognize and use connections among mathematical ideas.

(ii) Candidates recognize and apply mathematics in contexts outside of mathematics.

(iii) Candidates demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole.

5. Candidates use varied representations of mathematical ideas to support and deepen students' mathematical understanding.

(i) Candidates use representations to model and interpret physical, social, and mathematical phenomena.

(ii) Candidates create and use representations to organize, record, and communicate mathematical ideas.

(iii) Candidates select, apply, and translate among mathematical representations to solve problems.

6. Candidates embrace technology as an essential tool for teaching and learning mathematics.

(i) Candidates use knowledge of mathematics to select and use appropriate technological tools, such as but not limited to, spreadsheets, dynamic graphing tools, computer algebra systems, dynamic statistical packages, graphing calculators, data-collection devices, and presentation software.

7. Candidates support a positive disposition toward mathematical processes and mathematical learning.

(i) Candidates attend to equity.

(ii) Candidates use stimulating curricula.

(iii) Candidates teach effectively.

(iv) Candidates are committed to learning with understanding.

(v) Candidates use various assessments.

(vi) Candidates use various teaching tools, including technology.

8. Candidates possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning.

(i) Candidates select, use, and determines suitability of the wide variety of available mathematics curricula and teaching materials for all students including those with special needs such as the gifted, challenged, and speakers of other languages.

(ii) Candidates select and use appropriate concrete materials for learning mathematics.

(iii) Candidates use multiple strategies, including listening to and understanding the ways students think about mathematics, to assess students' mathematical knowledge.

(iv) Candidates plan lessons, units, and courses that address appropriate learning goals, including those that address local, state, and national mathematics standards and legislative mandates.

(v) Candidates participate in professional mathematics organizations and uses their print and on-line resources.

(vi) Candidates demonstrate knowledge of research results in the teaching and learning of mathematics.

(vii) Candidates use knowledge of different types of instructional strategies in planning mathematics lessons.

(viii) Candidates demonstrate the ability to lead classes in mathematical problem solving and in developing in-depth conceptual understanding, and to help students develop and test generalizations.

(ix) Candidates develop lessons that use technology's potential for building understanding of mathematical concepts and developing important mathematical ideas.

9. Candidates demonstrate computational proficiency, including a conceptual understanding of numbers, ways of representing number, relationships among number and number systems, and the meaning of operations.

(i) Candidates analyze and explain the mathematics that underlies the procedures for operations involving integers, rational, real, and complex numbers.

(ii) Candidates use properties involving number and operations, mental computation, and computational estimation.

(iii) Candidates provide equivalent representations of fractions, decimals, and percents.

(iv) Candidates create, solve, and apply proportions.

(v) Candidates apply the fundamental ideas of number theory.

(vi) Candidates make sense of large and small numbers and number systems.

(vii) Candidates compare and contrast properties of numbers and number systems.

(viii) Candidates represent, use, and apply complex numbers.

(ix) Candidates recognize matrices and vectors as systems that have some of the properties of the real number system.

(x) Candidates demonstrate knowledge of the historical development of number and number systems including contributions from diverse cultures.

10. Candidates emphasize relationships among quantities including functions, ways of representing mathematical relationships, and the analysis of change.

(i) Candidates analyze patterns, relations, and functions of one and two variables.

(ii) Candidates apply fundamental ideas of linear algebra.

(iii) Candidates apply the major concepts of abstract algebra to justify algebraic operations and formally analyze algebraic structures

(iv) Candidates use mathematical models to represent and understand quantitative relationships.

(v) Candidates .use technological tools to explore algebraic ideas and representations of information and in solving problems.

(vi) Candidates demonstrate knowledge of the historical development of algebra including contributions from diverse cultures.

11. Candidates use spatial visualization and geometric modeling to explore and analyze geometric shapes, structures, and their properties.

(i) Candidates demonstrate knowledge of core concepts and principles of Euclidean and non-Euclidean geometries in two and three dimensions from both formal and informal perspectives.

(ii) Candidates exhibit knowledge of the role of axiomatic systems and proofs in geometry.

(iii) Candidates analyze characteristics and relationships of geometric shapes and structures.

(iv) Candidates build and manipulate representations of two- and three-dimension objects and visualize objects from different perspectives.

(v) Candidates specify locations and describe spatial relationships using coordinate geometry, vectors, and other representational systems.

(vi) Candidates apply transformations and use symmetry, similarity, and congruence to analyze mathematical situations.

(vii) Candidates use concrete models, drawings, and dynamic geometric software to explore geometric ideas and their applications in real-world contexts.

(vii) Candidates demonstrate knowledge of the historical development of Euclidean and non-Euclidean geometries including contributions from diverse cultures.

12. Candidates demonstrate a conceptual understanding of limit, continuity, differentiation, and integration and a thorough background in techniques and application of the calculus.

(i) Candidates demonstrate a conceptual understanding of and procedural facility with basic calculus concepts.

(ii) Candidates apply concepts of function, geometry, and trigonometry in solving problems involving calculus.

(iii) Candidates use the concepts of calculus and mathematical modeling to represent and solve problems taken from real-world contexts.

(iv) Candidates use technological tools to explore and represent fundamental concepts of calculus.

(v) Candidates demonstrate knowledge of the historical development of calculus including contributions from diverse cultures.

13. Candidates apply the fundamental ideas of discrete mathematics in the formulation and solution of problems.

(i) Candidates demonstrate knowledge of basic elements of discrete mathematics such as graph theory, recurrence relations, finite difference approaches, linear programming, and combinatorics.

(ii) Candidates apply the fundamental ideas of discrete mathematics in the formulation and solution of problems arising from real-world solutions.

(iii) Candidates use technological tools to solve problems involving the use of discrete structures and the application of algorithms.

(iv) Candidates demonstrate knowledge of the historical development of discrete mathematics including contributions from diverse cultures.

14. Candidates demonstrate an understanding of concepts and practices related to data analysis, statistics, and probability.

(i) Candidates design investigations, collect data, and use a variety of ways to display data and interpret data representations that may include bivariate data, conditional probability and geometric probability.

(ii) Candidates use appropriate methods such as random sampling or random assignment of treatments to estimate population characteristics, test conjectured relationships among variables, and analyze data.

(iii) Candidates use appropriate statistical methods and technological tools to describe shape and analyze spread and center.

(iv) Candidates use statistical inference to draw conclusions from data.

(v) Candidates identify misuses of statistics and invalid conclusions from probability.

(vi) Candidates draw conclusions involving uncertainty by using hands-on and computer-based simulation for estimating probabilities and gathering data to make inferences and conclusions.

(vii) Candidates determine and interpret confidence intervals.

(viii) Candidates demonstrate knowledge of the historical development of statistics and probability including contributions from diverse cultures.

15. Candidates apply and use measurement concepts and tools.

(i) Candidates recognize the common representations and uses of measurement and choose tools and units for measuring.

(ii) Candidates apply appropriate techniques, tools, and formulas to determine measurements and their application in a variety of contexts.

(iii) Candidates complete error analysis through determining the reliability of the numbers obtained from measures.

(iv) Candidates demonstrate knowledge of the historical development of measurement and measurement systems including contributions from diverse cultures.

b) The program shall meet all requirements specified in Rule 505-3-01 (4.f.), Special Georgia Requirements.

Authority O.C.G.A. § 20-2-200