505-3-.27 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 GaPSC Rule 505-3-.01, REQUIREMENTS AND STANDARDS FOR APPROVING EDUCATOR PREPARATION PROVIDERS AND EDUCATOR PREPARATION PROGRAMS.

(2) Requirements.

(a)   To receive approval, a GaPSC-approved educator preparation provider shall offer an educator preparation program described in program planning forms, catalogs, and syllabi addressing the following standards revised in 2012 by the National Council of Teachers of Mathematics (NCTM):

1. <u>Content Knowledge.</u> Candidates of secondary mathematics demonstrate conceptual understanding and apply knowledge of major mathematics concepts, algorithms, procedures, connections, and applications within and among mathematical content domains.

(i) Candidates demonstrate conceptual understanding and apply knowledge of major mathematics concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains including Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics as outlined in the 2012 NCTM NCATE Mathematics Content for Secondary.

2. <u>Mathematical Practices.</u> Candidates of secondary mathematics solve problems, represent mathematical ideas, reason, prove, use mathematical models, attend to precision, identify elements of structure, generalize, engage in mathematical communication, and make connections as essential mathematical practices. Candidates understand that these practices intersect with mathematical content and that understanding relies on the ability to demonstrate these practices within and among mathematical domains and in their teaching.

(i) Candidates use problem solving to develop conceptual understanding and build new mathematical knowledge, make sense of a wide variety of problems and persevere in solving them, apply and adapt a variety of strategies in solving problems confronted within the field of mathematics and other contexts, and formulate and test conjectures in order to frame generalizations, while monitoring and reflecting on the process of mathematical problem solving.

(ii) Candidates reason abstractly, reflectively, and quantitatively with attention to units, constructing viable arguments and proofs, and critiquing the reasoning of others; represent and model generalizations using mathematics; recognize structure and express regularity in patterns of mathematical reasoning; use multiple representations to model and describe mathematics; translate fluidly among multiple representations; and utilize appropriate mathematical vocabulary and symbols to communicate mathematical ideas to others.

(iii) Candidates formulate, represent, analyze, and interpret mathematical models derived from real-world contexts or mathematical problems.

(iv) Candidates organize mathematical thinking and use the language of mathematics to express ideas precisely, both orally and in writing to multiple audiences.

(v) Candidates demonstrate the interconnectedness of mathematical ideas and how they build on one another and recognize and apply mathematical connections among mathematical ideas and across various content areas and real-world contexts.

(vi) Candidates model how the development of mathematical understanding within and among mathematical domains intersects with the mathematical practices of problem solving, reasoning, communicating, connecting, and representing.

3. Content Pedagogy. Candidates of secondary mathematics apply knowledge of curriculum standards for mathematics and their relationship to student learning within and across mathematical domains. Candidates incorporate research-based mathematical experiences and include multiple instructional mathematical understanding and proficiency. Candidates provide students with opportunities to do mathematics by allowing students to talk about it and connect it to both theoretical and real-world contexts. Candidates plan, select, implement, interpret, and use formative and summative assessments for monitoring student learning, measuring student mathematical understanding, and informing practice.

(i) Candidates apply knowledge of curriculum standards for secondary mathematics and their relationship to student learning within and across mathematical domains.

(ii) Candidates analyze and consider research in planning for and leading students in rich mathematical learning experiences.

(iii) Candidates plan lessons and units that incorporate a variety of strategies, differentiated instruction for diverse populations, and mathematics-specific and instructional technologies in building all students' conceptual understanding and procedural proficiency.

(iv) Candidates provide students with opportunities to communicate about mathematics and make connections among mathematics, other content areas, everyday life, and the workplace.

(v) Candidates implement techniques related to student engagement and communication including selecting high quality tasks, guiding mathematical discussions, identifying key mathematical ideas, identifying and addressing student misconceptions, and employing a range of questioning strategies.

(vi) Candidates plan, select, implement, interpret, and use formative and summative assessments to inform instruction by reflecting on mathematical proficiencies essential for all students.

(vii) Candidates monitor students' progress, make instructional decisions, and measure students' mathematical understanding and ability using formative and summative assessments.

4. Mathematical Learning Environment. Candidates of secondary mathematics exhibit knowledge of adolescent learning, development, and behavior. They use this knowledge to plan and create sequential learning opportunities grounded in mathematics education research where students are actively engaged in the mathematics they are learning and building from prior knowledge and skills. Candidates demonstrate a positive disposition toward mathematical practices and learning, include culturally relevant perspectives in teaching, and demonstrate equitable and ethical treatment of and high expectations for all students. Candidates use instructional tools such as manipulatives, digital tools, and virtual resources to enhance learning while recognizing the possible limitations of such tools.

(i) Candidates exhibit knowledge of adolescent learning, development, and behavior and demonstrate a positive disposition toward mathematical processes and learning.

(ii) Candidates plan and create developmentally appropriate, sequential, and challenging learning opportunities grounded in mathematics education research in which students are actively engaged in building new knowledge from prior knowledge and experiences.

(iii) Candidates incorporate knowledge of individual differences and the cultural and language diversity that exists within classrooms and include culturally relevant perspectives as a means to motivate and engage all students.

(iv) Candidates demonstrate equitable and ethical treatment of and high expectations for all students.

(v) Candidates apply mathematical content and pedagogical knowledge to select and use instructional tools such as manipulatives and physical models, drawings, virtual environments, spreadsheets, presentation tools, and mathematics-specific technologies such as graphing tools, interactive geometry software, computer algebra systems, and statistical packages; and make sound decisions about when such tools enhance teaching and learning, recognizing both the insights to be gained and possible limitations of such tools.

5. Impact on Student Learning. Candidates of secondary mathematics provide evidence demonstrating that as a result of their instruction, secondary students' conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and application of major mathematics concepts in varied contexts have increased. Candidates support the continual development of a productive disposition toward mathematics. Candidates show that new student mathematical knowledge has been created as a consequence of their ability to engage students in mathematical experiences that are developmentally appropriate, require active engagement, and include mathematical-specific technology in building new knowledge.

(i) Candidates verify that secondary students demonstrate conceptual understanding; procedural fluency; the ability to formulate, represent, and solve problems; logical reasoning and continuous reflection on that reasoning; productive disposition toward mathematics; and the application of mathematics in a variety of contexts within major mathematical domains.

(ii) Candidates engage students in developmentally appropriate mathematical activities and investigations that require active engagement and include mathematics-specific technology in building new knowledge.
(iii) Candidates collect, organize, analyze, and reflect on diagnostic, formative, and summative assessment evidence and determine the extent to which students' mathematical proficiencies have increased as a result of their instruction.

6. Professional Knowledge and Skills. Candidates of secondary mathematics are lifelong learners and recognize that learning is often collaborative. They participate in professional development experiences specific to mathematics and mathematics education, draw upon mathematics education research to inform practice, continuously reflect on their practice, and utilize resources from professional mathematics organizations.

(i) Candidates take an active role in their professional growth by participating in professional development experiences that directly relate to the learning and teaching of mathematics.

(ii) Candidates engage in continuous and collaborative learning that draws upon research in mathematics education to inform practice, enhance learning opportunities for all students' mathematical knowledge development; involve colleagues, other school professionals, families, and various stakeholders; and advance their development as a reflective practitioner.

(iii) Candidates utilize resources from professional mathematics education organizations such as print, digital, and virtual resources/collections.

7. <u>Secondary Mathematics Field Experiences and Clinical Practice.</u> Candidates of secondary mathematics engage in a planned sequence of field experiences and clinical practice under the supervision of experienced and highly qualified mathematics teachers. They develop a broad experiential base of knowledge, skills, effective approaches to mathematics teaching and learning, and professional behaviors across both middle and high school settings that involve a diverse range and varied groupings of students. Candidates experience a full-time student teaching/internship in secondary mathematics directed by university and college faculty with secondary mathematics teaching experience or equivalent knowledge base.

(i) Candidates engage in a sequence of planned field experiences and clinical practice prior to a full-time student teaching/internship experience that include observing and participating in both middle and high school mathematics classrooms and working with a diverse range of students individually, in small groups, and in large class settings under the supervision of experienced and highly qualified mathematics teachers in varied settings that reflect cultural, ethnic, linguistic, gender, and learning differences.

(ii) Candidates experience full-time student teaching/internship in secondary mathematics that is supervised by a highly qualified mathematics teacher and a university or college supervisor with secondary mathematics teaching experience or equivalent knowledge base.

(iii) Candidates develop knowledge, skills, and professional behaviors across both middle and high school settings, examine the nature of mathematics, how mathematics should be taught, and how students learn mathematics; and observe and analyze a range of approaches to mathematics teaching and learning, focusing on tasks, discourse, environment, and assessment.

b) The program shall meet all requirements specified in Rule 505-3-01, REQUIREMENTS AND STANDARDS FOR APPROVING EDUCATOR PREPARATION PROVIDERS AND EDUCATOR PREPARATION PROGRAMS.

Authority O.C.G.A. § 20-2-200