Graduate Program Audit Form C—Subject Area Audit for MATHEMATICS

Student's Name _____ Student's ID Number _____

MATHEMATICS (Grades 7-12) ENDORSEMENT

Candidates' academic major must ensure:

- *Acquisition of "knowledge and skills specified for endorsement in Mathematics 7-12."*
- *Experience that reflects use of "vocabulary, language, terminology, and grammatical constructions, syntax and notation specific to professionals in mathematics."*
- *Study and/or experience that ensures "the ability of candidates to promote the learning of mathematics applications to science, business, and art."*

CONTENT MAJOR _____ **MATH credits** _____

The mathematical concepts and supporting contextual abilities are encompassed in the following:

Check all those standard indicators that have been met and provide evidence (in the space provided) of formal study or equivalent experience:

Standard 1: Mathematical Processes:

All indicators addressed as part of the Peabody M.Ed. Program in Mathematics/Secondary Education.

Standard 2: Numbers and Operations: Evidence = _____

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☐ 2.1 Explore the nature of the types of elements in the real and complexnumbers (integer, whole number, irrational, numbers arising from roots, etc.) and the mathematical imperatives that influenced the study of each type of element

☐ 2.2 Establish an ability to estimate, select appropriate units, evaluate accuracy of calculations and make estimations of error arising from limitations in the technological representation of numbers and in measurements.

☐ 2.3 Explore vectors as elements in a numeric system, focusing on graphic representations as well as ordered n-tuple notation

☐ 2.4 Develop number theory principles including modular arithmetic and the Fundamental Principle of Arithmetic. Explore algebraic principles in his setting for arithmetic and exponents

☐ 2.5 Develop an understanding of equivalent representations of numbers via an equivalence relations and ability to substitute equivalent representation when performing operations

☐ 2.6 Explore a variety of equivalence relations and establish the definition and structure of equivalence classes. Examine these concepts in the context of modular arithmetic

☐ 2.7 Establish set notation and operations; use this structure to analyze logical arguments and apply to real world problems

Standard 3: Functions: Evidence = _____

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☐ 3.1 Develop the definitions of relations and functions from multiple approaches including verbal, numeric, symbolic, graphic, diagrammatic, and subset of a cross-product. Distinguish between relations and functions and move flexibly between different descriptions. Explore oneto- one and onto functions in this setting

☐ 3.2 Develop formal and informal understanding of domain, range and restriction of domain; establish the nature of both algebraic and transcendental functions

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☐ 3.3 Develop a complete understanding of functions as elements in an arithmetic system using composition of the functions as the operation and the inverse function as the inverse element. Explore the relation between a function and its inverse graphically; establish therequirements for the existence of the inverse function

☐ 3.4 Differentiate between continuous and discontinuous functions and establish their importance to the development of the concept of limit and to calculus

☐ 3.5 Establish a thorough understanding of the definition and development of exponential, logarithmic, and trigonometric functions. Include the six fundamental trigonometric functions and their inverses. Explore the domain and range for all these functions

Standard 4: Algebra; Evidence = _____
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☐ 4.1 Perform arithmetic operations involving polynominals and rational expressions, including calculations of substantial complexity. Understand the nature and differences arising from viewing these elements as both formal expressions and as functions with domain restrictions

☐ 4.2 Construct and solve systems of linear equations and inequalities in *n* dimensions. Understand the nature of finite and infinite solution sets and the parametric representation of infinite solutions sets. Be able to write infinite solutions in parametric form

☐ 4.3 Understand the real-world applications and problems that require the use of exponential functions for solutions. Solve problems in settings that provide domain or range information and deduce the other information

☐ 4.4 Apply the processes of linear algebra, calculus of vectors and linear transformations to solving real world applications

☐ 4.5 Explore vectors as elements with algebraic properties, focusing on the properties of the operations in both the geometric as well as n-tuple (arithmetic) context

Standard 5: Geometry and Measurement; Evidence = _____
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☐ 5.1 Use analytic geometry tools to explore geometric problems involving planar figures including parallel and perpendicular lines, circles and special points of a polygon

☐ 5.2 Explore the conic sections, including parabolas, ellipses and hyperbolas. Extend these concepts to the three-dimensional surfaces whose crosssections/ level curves are conic sections (cones, hyperbolic, paraboloids, ellipsoids, etc) Analyze solids using cross-sections and level curves

☐ 5.3 Develop the connections between radians and degrees as methods of angular measurements and the relationships between measurement of angles and measurement of arc length

MEd 5.4 Solve problems using relationships between parts of geometric figures. Use similarities and congruences to solve problems

MEd 5.5 Incorporate an understanding of the use of trigonometric formulas to evaluate some specific values of the trigonometric functions. Prove trigonometric identities and solve trigonometric equations

MEd 5.6 Describe the key characteristics of a curve, identity families of curves, and determine parameters which affect the nature of the particular curve. Parameters to be identified should include those that control vertical and horizontal shifts, periodicity, and amplitude. Include the use of calculus to determine maxima, minima and inflection points

MEd 5.7 Develop an understanding of the nature of geometry, including planar geometry, three-dimensional geometry, Euclidean geometry, non-Euclidean geometries, projective geometry, and non-traditional geometries

MEd 5.8 Use geometry to develop a cogent and detailed understanding of the formulation of transitions in logic and reasoning: a. from measuring the concrete, b. analyzing the concrete, c. establishing a sense of the abstract classification. Include comparisons and classifications of quadrilateral figures

and properties of circles
_____5.9 Use geometry and trigonometry methods to address scientific problems which arise from scientific inquiry
MEd 5.10 Use geometry to establish deductive and inductive reasoning in particular, perform substantial logical arguments to establish classical geometric theorems involving points, lines, angles and triangles
MEd 5.11 Be able to perform geometric constructions with straightedge/compass and with technology and understand the historical, mathematical and pedagogical implications to yield desired effects
MEd 5.12 Explore the effect of transformations on geometric figures and shapes in the coordinate plane. Include perspectives originating in geometry and linear algebra as well as the functional implications and discovering appropriate compositions to yield desired results

Standard 6: Data Analysis, Probability and Statistical Analysis; Evidence = _____
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_____6.1 Develop an understanding of the different methods of presenting data and the characteristics that determine the selection of the most appropriate method
_____6.2 Use data and statistical thinking to draw inferences, make predictions, justify conclusions and identify and explain misleading uses of data
_____6.3 Develop the concept of sample space and probability distributions. Perform simulations to address the development of sample space and distributions
_____6.4 Compute permutations and combinations and explore their occurrence
_____6.5 Explore independent and dependent events; establish the context and understanding for Bayes Theorem
_____6.6 Use probabilistic and statistical processes to understand the accurate construction of experiments, collection of data, analysis of data and the production of logically consistent conclusions
_____6.7 Understand the difference between univariate, bivariate and categorical data and methods of presenting and analyzing
_____6.8 Describe the basic probability models and the relationship between these models and statistics. Include the development and use of Chi-square, binomial, normal and t-distributions
_____6.9 Understand how sample statistics reflect population parameters and determine appropriate modeling. Explore informal inferences that can appropriately be drawn from sample statistics
_____6.10 Produce data plots and curves of best fit using linear regression, polynomial, regression and exponential regression. Understand correlation and least-squares measurement of fit
_____6.11 Know the characteristics of well-designed studies and understand the appropriate inclusion of randomness in a study
_____6.12 Construct reports and descriptions of experiments that correctly incorporate and interpret confidence intervals
_____6.13 Develop an informal/intuitive understanding of the Law of Large Numbers, establish methods of concretely illustrating the Law and address commonly held misconceptions related to the Law of Large Numbers
_____6.14 Understand construction of statistically valid experiments, including datacollection and sampling. Discuss the construction of appropriate hypothesis
_____6.15 Discuss, evaluate and propose corrections for fallacious presentation of data and outcomes of experiments. Include specific examples from current print/web sources

Standard 7: Discrete and Finite Mathematics; Evidence = _____
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_____7.1 Apply counting techniques to collect and organize information in order to solve problems
MEd 7.2 Understand basic principles of symbolic logic, including converse, inverse and contrapositive

statements as well as negation of implications and the use of counterexamples
_____7.3 Use Venn Diagrams and tabular data to calculate probabilities. Include the use of Venn Diagrams in the analysis of arguments and quantifiers
_____7.4 Model real-world problems using graph theory, linear programming and matrices
_____7.5 Practice the analysis of error in calculations and the propagation of that error in multi-step procedures; in particular, study the error that arises when irrational numbers represented by symbols are replaced with decimal approximations
_____7.6 Be aware of the fundamental questions and theorems posed in elementary number theory. Understand the importance and historical context of these problems
_____7.7 Be aware of the fundamental questions and theorems posed in discrete mathematics. Understand the importance and historical context of these problems
_____7.8 Develop sequences and series, including open and closed notation as well as limits in this context. Understand truncation and error induced by truncation
MEd 7.9 Use appropriate functions and calculations to solve contextual problems from financial decision-making, including simple and compound interest, future and present value of annuities and amortization
_____7.10 Establish the methodology of Markov Chains to solve real world problems. Explore the concept of limit in this context
_____7.11 Develop and analyze algorithms including iterative and recursive techniques

Standard 8: Calculus; Evidence = _____
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_____8.1 Develop an intuitive and a formal understanding of the concept of limit, including an informal explanation (verbal and diagrammatic) of the purpose and meaning of the definition. Establish means for determining that a limit does not exist and provide multiple representations
_____8.2 Extend the definition of limit to limits of sequences and to end behavior of functions and functional behavior at asymptotes
_____8.3 Develop the connections between the existence of the tangent line, existence of the derivative and continuous functions
_____8.4 Develop an understanding of the derivative as a measure of rate of change of tangible quantities (such as velocity) as well as a geometric description of change in a curve (slope of tangent line). Use first and second derivatives to completely describe planar curves and specific characteristics
_____8.5 Calculate derivatives of polynomial, exponential and trigonometric functions and compositions of these functions using the derivative and the limit theorems. Approximate derivatives numerically
_____8.6 Perform standard integration techniques and establish integration as a method of calculating volume. Approximate values of definite integrals numerically
_____8.7 Extend the concept of rectangular area to approximation of area of irregular shapes. Use the approximation to specifically develop Riemann sums and the concept of the integral
_____8.8 Develop an intuitive verbal and pictorial understanding of the Mean Value Theorem and the Fundamental Theorem of Calculus

COMMENTS:_____
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DEFICIENCIES:_____
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ADVISER APPROVAL:
_____ (Date)