

Wisconsin Content Standards - Math 351

APPENDIX C

All professional education content courses leading to certification shall include teaching and assessment of the Wisconsin Content Standards in the content area.

<p>In this column, list the Wisconsin Content Standards that are included in this course. The Standards for each content area are found in the Wisconsin Content Standards document.</p>	<p>In this column, indicate the nature of the performance assessments used in this course to evaluate student proficiency in each standard.</p>
<p>The structures within the discipline, the historical roots and evolving nature of mathematics, and the interaction between technology and the discipline.</p>	<p>Classroom discussions are used to assess student's understanding of the evolution of the notion of 'number' and the underlying axioms of algebra.</p>
<p>Facilitating the building of student conceptual and procedural understanding.</p>	<p>In class discussions combined with homework assignments are used to measure understanding of both the procedural as well as the conceptual nature of algebra.</p>
<p>Helping all students build understanding of the discipline including:</p> <ul style="list-style-type: none"> • Confidence in their abilities to utilize mathematical knowledge. • Awareness of the usefulness of mathematics. • The economic implications of fine mathematical preparation. 	<p>Assignments are used to assess the students' knowledge of applications of ideas from abstract algebra.</p>
<p>Exploring, conjecturing, examining and testing all aspects of problem solving.</p>	<p>Students' ability to use various problem-solving strategies is assessed through classroom discussions.</p>
<p>Formulating and posing worthwhile mathematical tasks, solving problems using several strategies, evaluating results, generalizing solutions, using problem solving approaches effectively, and applying mathematical modeling to real-world situations.</p>	<p>The students are expected to be able to see how to formulate clear axioms for the various abstract number systems. The students' ability to do this is then assessed on an exam.</p>
<p>Making convincing mathematical arguments, framing mathematical questions and conjectures, formulating counter-examples, constructing and evaluating arguments, and using intuitive, informal exploration and formal proof.</p>	<p>Students' skill in constructing proofs using the direct, indirect, contradiction, and induction methods is assessed using exam questions. The exams are also used to ascertain whether they know when and how to produce counter-examples.</p>
<p>Expressing ideas orally, in writing, and visually-, using mathematical language, notation, and symbolism; translating mathematical ideas between and among contexts.</p>	<p>Students' participation in classroom discussions on the topics is used to measure their oral mathematical ability. Students' written skill with mathematical language is assessed through solutions to the exercises.</p>
<p>Connecting the concepts and procedures of mathematics, drawing connections between mathematical strands, between mathematics and other disciplines, and with daily life.</p>	<p>Students skill in describing the connections between ideas in abstract algebra and 6-12 algebra are ascertained in classroom discussions.</p>

<p>Selecting appropriate representations to facilitate mathematical problem solving and translating between and among representations to explicate problem-solving situations.</p>	<p>On the assignments, how well students are able to work with various representations of the abstract number systems - one example is using symmetry to help illustrate the notion of a group - is measured.</p>
<p>Mathematical processes including:</p> <ul style="list-style-type: none"> • Problem solving. • Communication. • Reasoning and formal and informal argument. • Mathematical connections. • Representations. • Technology. 	<p>Each exam and each homework assignment is used to assess the students' ability to communicate mathematically.</p>
<p>Number operations and relationships from both abstract and concrete perspectives identifying real world applications, and representing and connecting mathematical concepts and procedures including:</p> <ul style="list-style-type: none"> • Number sense. • Set theory. • Number and operation. • Composition and decomposition of numbers, including place value, primes, factors, multiples, inverses, and the extension of these concepts throughout mathematics. • Number systems through the real numbers, their properties and relations. • Computational procedures. • Proportional reasoning. • Number theory. 	<p>Assignments are used as an assessment of students ability to illustrate their work with various concrete number systems and show that they can abstract the key properties of each system.</p>
<p>Mathematical concepts and procedures, and the connections among them for teaching upper level number operations and relationships including:</p> <ul style="list-style-type: none"> • Advanced counting procedures, including union and intersection of sets, and parenthetical operations. • Algebraic and transcendental numbers. • The complex number system, including polar coordinates. • Approximation techniques as a basis for numerical integration, fractals, and numerical-based proofs. • Situations in which numerical arguments presented in a variety of classroom and real-world situations (e.g., political, economic, scientific, social) can be created and critically evaluated. • Opportunities in which acceptable limits of error can be assessed (e.g., evaluating strategies, testing the reasonableness of results, and using technology to carry out computations). 	<p>Students work on assignments is used to measure how well they are able to perform operations with the rational, real and complex number systems. The students' ability with these operations is also assessed on the exams.</p>

Geometry and measurement from both abstract and concrete perspectives and to identify real world applications, and mathematical concepts, procedures and connections among them including:

- Formal and informal argument.
- Names, properties, and relationships of two- and three-dimensional shapes.
- Spatial sense.
- Spatial reasoning and the use of geometric models to represent, visualize, and solve problems.
- Transformations and the ways in which rotation, reflection, and translation of shapes can illustrate concepts, properties, and relationships.
- Coordinate geometry systems including relations between coordinate and synthetic geometry, and generalizing geometric principles from a two-dimensional system to a three-dimensional system.
- Concepts of measurement, including measurable attributes, standard and non-standard units, precision and accuracy, and use of appropriate tools.
- The structure of systems of measurement, including the development and use of measurement systems and the relationships among different systems. Measurement including length, area, volume, size of angles, weight and mass, time, temperature, and money.
- Measuring, estimating, and using measurement to describe and compare geometric phenomena.
- Indirect measurement and its uses, including developing formulas and procedures for determining measure to solve problems.

Students ability to illustrate the connection between the ideas of symmetry from geometry and the idea of group from algebra is measured by tests.

Mathematical concepts, procedures, and the connections among them for teaching upper level geometry and measurement including:

- Systems of geometry, including Euclidean, non-Euclidean, coordinate, transformational, and projective geometry.
- Transformations, coordinates, and vectors and their use in problem solving. Three-dimensional geometry and its generalization to other dimensions. Topology, including topological properties and transformations.
- Opportunities to present convincing arguments by means of demonstration, informal proof, counter-examples, or other logical means to show the truth of statements and/or generalizations.

Not assessed in this course

Statistics and probability from both abstract and concrete perspectives and to identify real world applications, and the mathematical concepts, procedures and the connections between them including:

- Use of data to explore real-world issues.
- The process of investigation including formulation of a problem, designing a data collection plan, and collecting, recording, and organizing data.
- Data representation through graphs, tables, and summary statistics to describe data distributions, central tendency, and variance.
- Analysis and interpretation of data.
- Randomness, sampling, and inference.
- Probability as a way to describe chances or risk in simple and compound events.
- Outcome prediction based on experimentation or theoretical probabilities.

Not assessed in this course.

<p>Mathematical concepts, procedures, and the connections among them for teaching upper level statistics and probability including:</p> <ul style="list-style-type: none"> • Use of the random variable in the generation and interpretation of probability distributions. • Descriptive and inferential statistics, measures of disbursement, including validity and reliability, and correlation. • Probability theory and its link to inferential statistics. • Discrete and continuous probability distributions as bases for inference. • Situations in which students can analyze, evaluate, and critique the methods and conclusions of statistical experiments reported in journals, magazines, news media, advertising, etc. 	<p>Not assessed in this course.</p>
<p>Functions, algebra, and basic concepts underlying calculus from both abstract and concrete perspectives and to identify real world applications, and the mathematical concepts, procedures and the connections among them including:</p> <ul style="list-style-type: none"> • Patterns. • Functions as used to describe relations and to model real world situations. • Representations of situations that involve variable quantities with expressions, equations and inequalities and that include algebraic and geometric relationships. • Multiple representations of relations, the strengths and limitations of each representation, and conversion from one representation to another. • Attributes of polynomial, rational, trigonometric, algebraic, and exponential functions. • Operations on expressions and solution of equations, systems of equations and inequalities using concrete, informal, and formal methods. • Underlying concepts of calculus, including rate of change, limits, and approximations for irregular areas. 	<p>Not assessed in this course.</p>

<p>Mathematical concepts, procedures, and the connections among them for teaching upper level functions, algebra, and concepts of calculus including:</p> <ul style="list-style-type: none"> • Concepts of calculus, including limits (epsilon-delta) and tangents, derivatives, integrals, and sequences and series. • Modeling to solve problems. • Calculus techniques including finding limits, derivatives, integrals, and using special rules. • Calculus applications including modeling, optimization, velocity and acceleration, area, volume, and center of mass. • Numerical and approximation techniques including Simpson's rule, trapezoidal rule, Newton's Approximation, and linearization. • Multivariate calculus. • Differential equations. 	<p>Not assessed in this course.</p>
<p>Discrete processes from both abstract and concrete perspectives and to identify real world applications, and the mathematical concepts, procedures and the connections among them including:</p> <ul style="list-style-type: none"> • Counting techniques. • Representation and analysis of discrete mathematics problems using sequences, graph theory, arrays, and networks. • Iteration and recursion. 	<p>Not assessed in this course.</p>
<p>Mathematical concepts, procedures, and the connections among them for teaching upper level discrete mathematics including:</p> <ul style="list-style-type: none"> • Topics, including symbolic logic, induction, linear programming, and finite graphs. • Matrices as a mathematical system, and matrices and matrix operations as tools for recording information and for solving problems. • Developing and analyzing algorithms. 	<p>The students' ability to produce proofs, work with matrix rings, and use the notion of isomorphism are all ascertained by tests in this course and by classroom discussions on the subject of discrete mathematics.</p>