

Honors Mathematics

Introduction and Definition of Honors Mathematics

Honors Mathematics courses are intended to be more challenging than standard courses and provide multiple opportunities for students to take greater responsibility for their learning. Honors Mathematics courses should be distinguished by a difference in the quality of the work expected rather than merely by the quantity of the work required.

Honors Mathematics courses are designed for students who have demonstrated an advanced level of interest and achievement in mathematics. The rationale for honors courses is not to provide a means to attract students to enroll in classes for additional credit, but rather to offer challenging, higher level courses for students who aspire to an advanced level of learning. Furthermore, students and parents should be informed that Honors Mathematics courses are more demanding and have requirements beyond those of standard Mathematics courses.

Honors Mathematics courses will follow goals and objectives built upon the standard versions of the same courses from the Mathematics Standard Course of Study. Honors Mathematics courses should reflect a differentiation of curriculum, both in breadth and depth of study.

Honors Mathematics courses should provide opportunities for the following:

- Problem-seeking and problem-solving
- Participation in scholarly and creative processes
- Use of imagination
- Critical analysis and application
- Personalized learning experiences
- Learning to express/defend ideas
- Learning to accept constructive criticism
- Becoming a reflective thinker
- Becoming an initiator of learning

Teachers of Honors Mathematics Courses

Teachers of Honors Mathematics courses should possess the skills, knowledge, and dispositions to challenge and inspire thought processes of honors level students. In addition, these teachers should be able to implement diverse kinds of best teaching practices for high school learners. The capability of developing, implementing, and evaluating defensibly differentiated curriculum is a key characteristic of teachers who work with honors students. They should know and use a variety of teaching techniques. They should be proficient in the use of both indirect and direct modes of instruction. They should be confident in

their teaching roles as facilitator, model, and coach. Furthermore, they should be aware of current curriculum innovations and research in Mathematics in order to be able to develop and implement Honors Mathematics courses that are both challenging and rigorous.

Curriculum Guide for Honors Mathematics Courses

In order to offer Honors Mathematics courses, teachers and districts must develop a Curriculum Guide for each honors course. The Curriculum Guide for Honors Mathematics should clearly and concisely include, but is not limited to, the following elements:

- Course description
- Competency goals and objectives
- Issues particular to the course
- Expectations of performance
- Assignments
- Timetables and deadlines
- Pacing guide
- Assessments, including rubrics
- A system for grading
- Instructional materials, equipment, and technologies required

Course Descriptions, Competency Goals and Objectives

Honors Mathematics Course Descriptions and Competency Goals and Objectives are provided by NCDPI. These are the minimum content expectations for each Honors Mathematics course.

Expectations of Performance

Students in Honors Mathematics courses may have a different set of performance expectations than students in standard Mathematics courses. The Curriculum Guide provides a place where teachers can compare the expectations of students in standard courses to those in honors courses.

Assignments

Students in Honors Mathematics courses will have assignments that reflect the inherent rigor of honors level courses. Included should be long-term project- or problem-based assignments that offer students the opportunity to directly apply Mathematics at a more complex level.

Timetables and Deadlines

Timetables and deadlines for Honors Mathematics course projects and activities are helpful in course planning and communication with students. These should be provided to students in a timely fashion.

Pacing Guides

A pacing guide is a calendar showing the pace of instruction, with time allocated for teaching and applying each essential concept. The pacing guide is a useful tool for teachers to ensure that instructional time is carefully used. Pacing guides should be planned in advance with the flexibility to accurately depict time allocations for units and objectives being taught.

Assessments

Good instruction involves assessment by multiple and varied means. The *Indicators* provided for most Mathematics courses provide a beginning point. A wide variety of evaluation methods and forms of assessments should be used in Mathematics courses to measure what students know and what they know how to do. This is particularly important in honors courses. These assessments should include both cognitive and performance-based tasks. Where appropriate, rubrics should be developed and provided to students and evaluators.

The following types of assessments should be included:

- Student written response – extended free response, proofs, essays, research papers, scenarios, journals, questionnaires
- Performance tasks - labs, projects, extended problems, original designs, portfolios, lesson plans, self-evaluations
- Conversation assessments - interviews, annotated discussions, panel discussions, debates, focus groups
- Observation assessments - case studies, anecdotal records, observation reports

A System for Grading

Each Honors Mathematics honors course should have a clear, concise system for grading so that students will be accountable for course requirements and know in advance the relative weight of each component of their grades. The system for grading should be explained in the Curriculum Guide. The grading system, along with timetables and deadlines, assignments, and expectations for students, should be explained clearly in a course syllabus that is made available to students at the beginning of the course.

Instructional Materials, Equipment, and Technologies

In many Mathematics courses, being able to complete honors-level learning experiences and assignments may be dependent upon having the necessary resources with which to work. In such instances, having a list of essential instructional materials, equipment, and technologies helps administrators and teachers plan course offerings and make program decisions.

Honors Discrete Mathematics

Honors Discrete Mathematics introduces students to the mathematics of networks, social choice, and decision making. The course extends students' application of matrix arithmetic and probability. Applications and modeling are central to this course of study. In-depth investigations of municipal, state, and national elections and legislative and congressional apportionment will be conducted. Appropriate technology should be used regularly for instruction and assessment.

Prerequisites

- Describe phenomena as functions graphically, algebraically and verbally; identify independent and dependent quantities, domain, and range, input/output, mapping.
- Translate among graphic, algebraic, numeric, tabular, and verbal representations of relations.
- Define and use linear and exponential functions to model and solve problems.
- Operate with matrices to model and solve problems.
- Define complex numbers and perform basic operations with them.

Strands: Number and Operations, Geometry and Measurement, Data Analysis and Probability, Algebra

COMPETENCY GOAL 1: The learner will use matrices and graphs to model relationships and solve problems.

Objectives

- 1.01 Use matrices to model and solve problems.
 - a) Display and interpret data.
 - b) Write and evaluate matrix expressions to solve problems.
- 1.02 Use graph theory to model relationships and solve problems.

COMPETENCY GOAL 2: The learner will analyze data and apply probability concepts to solve problems.

Objectives

- 2.01 Describe data to solve problems.
 - a) Apply and compare methods of data collection.
 - b) Apply statistical principles and methods in sample surveys.
 - c) Determine measures of central tendency and spread.
 - d) Recognize, define, and use the normal distribution curve.
 - e) Interpret graphical displays of data.
 - f) Compare distributions of data.
- 2.02 Use theoretical and experimental probability to model and solve problems.
 - a) Use addition and multiplication principles.
 - b) Calculate and apply permutations and combinations.
 - c) Create and use simulations for probability models.
 - d) Find expected values and determine fairness.
 - e) Identify and use discrete random variables to solve problems.
 - f) Apply the Binomial Theorem.
- 2.03 Model and solve problems involving fair outcomes:
 - a) Apportionment.
 - b) Election Theory.
 - c) Voting Power.
 - d) Fair Division.
 - e) Conduct in-depth investigations of municipal, state, and national elections as they occur. Include pre-election polls, election law, and voting patterns.
 - f) Conduct in-depth investigations of legislative and congressional apportionment with respect to a recent census. Include legal and historical perspectives.

COMPETENCY GOAL 3: The learner will describe and use recursively-defined relationships to solve problems.

Objective

- 3.01 Use recursion to model and solve problems.
 - a) Find the sum of a finite sequence.
 - b) Find the sum of an infinite sequence.
 - c) Determine whether a given series converges or diverges.
 - d) Write explicit definitions using iterative processes, including finite differences and arithmetic and geometric formulas.
 - e) Verify an explicit definition with inductive proof.