EXHIBIT A-2
3-13-12

Advanced Mathematical Decision Making

Background and Materials

Advanced Mathematical Decision Making (AMDM) is a mathematics course that follows Algebra I, Geometry, and Algebra II. Students benefit from studying mathematics every year, and in Texas and a growing number of other states, students will be required to complete four years of mathematics as part of increasing graduation requirements (in Texas, the "4-by-4" requirement).

AMDM is an engaging and rigorous course that prepares students for a range of future options in nonmathematics-intensive college majors or for entering workforce training programs; it may also be an appealing elective for students pursuing precalculus and calculus. The course emphasizes statistics and financial applications, and it prepares students to use algebra, geometry, trigonometry, and discrete mathematics to model a range of situations and solve problems.

The Charles A. Dana Center, in partnership with the Texas Association of Supervisors of Mathematics, has developed the following materials:

- Course outline with proposed student expectations—revised December 1, 2009 (pdf 127kb). The proposed student expectations may change if the State Board of Education chooses to consider the course for statewide adoption.

  As of December 1, 2009, the AMDM proposed course expectations have been slightly modified in three ways that do not change the purpose or content of the course as piloted during the 2009-2010 school year:

  1. A new knowledge and skills statement (DM.1) has been added, making more explicit the emphasis on college and career readiness that is intended in the course (and already happening in pilot classrooms).
  2. The revised expectations have been tightened to omit overly specific examples previously listed with some statements.
  3. The knowledge and skills statements have been resequenced for content flow and coherence, in particular making the inclusion of finance more obvious.

- Student information sheet (updated January 2010, pdf 300kb)

As part of this initiative, free downloadable instructional materials are available for course implementation in the 2010-2011 school year. (Click here for an overview of instructional materials (pdf 203kb).)

A comprehensive system of professional development and support is also planned.

Project staff have compiled a list of additional resources (pdf 88kb) that may be of interest. These materials, however, are provided only as background; they are not expected as part of the implementation of the course.

Related links

Achieve/Dana Center information on fourth-year/capstone mathematics courses

University of Arizona's Institute on Mathematics and Education report on fourth-year mathematics

Background and research related to early Texas discussions on fourth-year math (from 2006)

Contact Us

Contact us at amdm@austin.utexas.edu

AMDM Slideshow

At multiple conferences in 2010, AMDM developers conducted presentations overviewing AMDM. Download a pdf of the slideshow:

AMDM Overview (pdf 6.4mb)

Get Adobe Reader

Advanced Mathematical Decision Making

Factsheet for U.S. schools implementing AMDM in 2011–2012

A project of the Charles A. Dana Center at
The University of Texas at Austin in partnership with
the Texas Association of Supervisors of Mathematics
with generous support for development by the Greater Texas Foundation

What is AMDM?

Advanced Mathematical Decision Making (AMDM) is a mathematics course for high school seniors that follows Algebra I, Geometry, and Algebra II or Integrated Mathematics 1, 2, 3. It builds on and extends what students have learned and covers a range of mathematics topics that are not part of most school mathematics programs. AMDM does not review or remediate skills from the first three years of high school mathematics, but students will reinforce these skills as they study new topics in mathematics in relevant and engaging contexts. The course also helps students develop college and career skills such as collaborating, conducting research, and making presentations. AMDM was designed by mathematics and education professionals, organized by the Charles A. Dana Center at the University of Texas at Austin, working with the Texas Association of Supervisors of Mathematics (TASM).

How does AMDM fit with the Common Core State Standards?

AMDM is the kind of course called for in the Common Core State Standards as an appropriate, rigorous fourth-year option to follow either the three-year integrated/international high school mathematics pathway or the pathway organized around traditional course titles (Algebra I, Geometry, and Algebra II). The course is in use or planned for implementation as a fourth-year option in several states that have adopted the Common Core State Standards.

Materials

The Dana Center, in collaboration with TASM and educators and other mathematics experts, has developed AMDM course materials for teachers and students that provide comprehensive support for the course. Development grants from the Greater Texas Foundation have allowed us to provide license to use the 2010 edition of AMDM course materials for the education of Texas students. Educators and schools outside of Texas can contract for license to use materials and receive professional development and online support.

Cost

Fees for professional development and online support are established to recover costs for course delivery and support outside Texas, including providing each teacher one copy of student and teacher instructional materials in print and electronic form, with perpetual rights to use these materials with students in the classroom.

For the 2011–2012 school year, the cost for these rights and the professional support package is $2,500 per teacher, including a five-day summer institute, one follow-up day each semester of the school year, and access to an online community providing additional resources and collegial interactions related to AMDM. Schools should plan to cover costs of reproducing student materials or purchasing bound copies of student materials for $30 per student. Customized contract arrangements are also possible.

Professional development

In-depth professional development is an essential part of AMDM teacher support. The unique combination of content taught in this course is not likely to have been part of any teacher preparation or mathematics program. And the course calls for teaching in ways that place a high level of responsibility on students as they develop college and career skills such as collaborating, conducting research, and making presentations.

Ideally, teachers new to AMDM should participate in at least seven days of professional development during the first year, including a five-day summer institute and two individual follow-up days during the school year. Several such sessions will be conducted in Summer 2011 at various locations throughout Texas, as well as outside of Texas; follow-up days will be scheduled flexibly to meet the needs of teachers and schools. Teachers can also access a variety of online resources throughout the school year, provided by project staff and contributed to by fellow AMDM teachers via online AMDM communities.

AMDM topic list (revised December 2009)

(Note: Materials have been developed thus far to address Topics 1–6 and 8–11.)

(DM.1) **Developing college and career skills.** The student develops and applies skills used in college and careers, including reasoning, planning, and communication, to make decisions and solve problems in applied situations involving numerical reasoning, probability, statistical analysis, finance, mathematical selection, and modeling with algebra, geometry, trigonometry, and discrete mathematics.

(DM.2) **Analyzing numerical data.** The student analyzes numerical data in everyday situations using a variety of quantitative measures and numerical processes.

(DM.3) **Analyzing information using probability.** The student analyzes and evaluates risk and return in the context of everyday situations.

(DM.4) **Critiquing applications of statistics.** The student makes decisions based on understanding, analysis, and critique of reported statistical information and statistical summaries.

(DM.5) **Conducting statistical analyses.** The student applies statistical methods to design and conduct a study that addresses one or more particular questions.

(DM.6) **Communicating statistical information.** The student communicates the results of reported and student-generated statistical studies.

(DM.7) **Mathematical decision making in ranking and selection.** The student analyzes the mathematics behind various methods of ranking and selection.

(DM.8) **Modeling data.** The student models data, makes predictions, and judges the validity of a prediction.

(DM.9) **Modeling change and relationships.** The student uses mathematical models to represent, analyze, and solve problems involving change.

(DM.10) **Mathematical decision making in finance.** The student creates and analyzes mathematical models to make decisions related to earning, investing, spending, and borrowing money.

(DM.11) **Network modeling for decision making.** The student uses a variety of network models represented graphically to organize data in quantitative situations, make informed decisions, and solve problems.

(DM.12) **Modeling with geometric tools.** The student uses a variety of tools and methods to represent and solve problems involving static and dynamic situations.

Contact

For more information, or to be part of the AMDM email list, contact **amdm@austin.utexas.edu**, or visit the AMDM website at **www.utdanacenter.org/amdm**.

Advanced Mathematical Decision Making

Revised December 1, 2009

Advanced Mathematical Decision Making is proposed as a fourth-year course to follow Algebra I, Geometry, and Algebra II (or the equivalent). Its primary purpose is to prepare students for college majors that may not require calculus, for technical training, or for a range of career options. This course may also be useful to other students as an elective. Basic course instructional materials and supporting professional development are being piloted during 2009–2010, with full implementation available in 2010–2011. For more information, go to www.utdanacenter.org/amdm.

(a) General requirements: This course is proposed as a one-credit course. Recommended prerequisite: Algebra II.

(b) Introduction:

(1) Students continue to build upon their K–8, algebra, and geometry foundations and expand their understanding through further mathematical experiences. The primary focal points of Advanced Mathematical Decision Making include the analysis of information using statistical methods and probability, modeling change and mathematical relationships, mathematical decision making in finance, and spatial and geometric modeling for decision making. In Advanced Mathematical Decision Making, students learn to become critical consumers of the quantitative data that surround them every day, knowledgeable decision makers who use logical reasoning, and mathematical thinkers who can use their quantitative skills to solve problems related to a wide range of situations. They develop critical skills for success in college and careers, including investigation, research, collaboration, and both written and oral communication of their work, as they solve problems in many types of applied situations.

(2) As students work with these mathematical topics, they continually rely on mathematical processes, including problem-solving techniques, appropriate mathematical language and communication skills, connections within and outside mathematics, and reasoning. Students also use multiple representations, technology, applications and modeling, and numerical fluency in problem-solving contexts.

(c) (DM.1) **Developing college and career skills.** The student develops and applies skills used in college and careers, including reasoning, planning, and communication, to make decisions and solve problems in applied situations involving numerical reasoning, probability, statistical analysis, finance, mathematical selection, and modeling with algebra, geometry, trigonometry, and discrete mathematics.

The student is expected to:

(A) gather data, conduct investigations, and apply mathematical concepts and models to solve problems in mathematics and other disciplines;

(B) demonstrate reasoning skills in developing, explaining, and justifying sound mathematical arguments, and analyze the soundness of mathematical arguments of others; and

(C) communicate with and about mathematics orally and in writing as part of independent and collaborative work, including making accurate and clear presentations of solutions to problems.

(DM.2)	**Analyzing numerical data**. The student analyzes numerical data in everyday situations using a variety of quantitative measures and numerical processes.	The student is expected to: (A) apply, compare, and contrast published ratios, rates, ratings, averages, weighted averages, and indices to make informed decisions; (B) solve problems involving large quantities that are not easily measured; (C) use arrays to efficiently manage large collections of data and add, subtract, and multiply matrices to solve applied problems; and (D) apply algorithms and identify errors in recording and transmitting identification numbers.
(DM.3)	**Analyzing information using probability.** The student analyzes and evaluates risk and return in the context of everyday situations.	The student is expected to: (A) determine and interpret conditional probabilities and probabilities of compound events by constructing and analyzing representations, including tree diagrams, Venn diagrams, and area models, to make decisions in problem situations; (B) use probabilities to make and justify decisions about risks in everyday life; and (C) calculate expected value to analyze mathematical fairness, payoff, and risk.
(DM.4)	**Critiquing applications of statistics.** The student makes decisions based on understanding, analysis, and critique of reported statistical information and statistical summaries.	The student is expected to: (A) identify limitations or lack of information in studies reporting statistical information, especially when studies are reported in condensed form; (B) interpret and compare the results of polls, given a margin of error; (C) identify uses and misuses of statistical analyses in studies reporting statistics or using statistics to justify particular conclusions, including assertions of cause and effect rather than correlation; and (D) describe strengths and weaknesses of sampling techniques, data and graphical displays, and interpretations of summary statistics and other results appearing in a study, including reports published in the media.

(DM.5) **Conducting statistical analyses.** The student applies statistical methods to design and conduct a study that addresses one or more particular questions.

The student is expected to:

(A) determine the need for and purpose of a statistical investigation and what type of statistical analysis can be used to answer a specific question or set of questions;

(B) identify the population of interest, select an appropriate sampling technique, and collect data;

(C) identify the variables to be used in a study;

(D) determine possible sources of statistical bias in a study and how such bias may affect the ability to generalize the results;

(E) create data displays for given data sets to investigate, compare, and estimate center, shape, spread, and unusual features; and

(F) determine possible sources of variability of data, both those that can be controlled and those that cannot be controlled.

(DM.6) **Communicating statistical information.** The student communicates the results of reported and student-generated statistical studies.

The student is expected to:

(A) report results of statistical studies to a particular audience, including selecting an appropriate presentation format, creating graphical data displays, and interpreting results in terms of the question studied;

(B) justify the design and the conclusion(s) of statistical studies, including the methods used for each; and

(C) communicate statistical results in both oral and written formats using appropriate statistical and nontechnical language.

(DM.7) **Mathematical decision making in ranking and selection**. The student analyzes the mathematics behind various methods of ranking and selection.

The student is expected to:

(A) apply and analyze various ranking algorithms to determine an appropriate method for a given situation; and

(B) analyze various voting and selection processes to determine an appropriate method for a given situation.

(DM.8) **Modeling data.** The student models data, makes predictions, and judges the validity of a prediction.	The student is expected to: (A) determine whether or not there is a linear relationship in a set of bivariate data by finding the correlation coefficient for the data, and interpret the coefficient as a measure of the strength and direction of the linear relationship; and (B) collect numerical bivariate data; use the data to create a scatterplot; select a function to model the data, justify the selection, and use the model to make predictions.
(DM.9) **Modeling change and relationships**. The student uses mathematical models to represent, analyze, and solve problems involving change.	The student is expected to: (A) determine or analyze an appropriate growth or decay model for problem situations, including linear, exponential, and logistic functions; (B) determine or analyze an appropriate cyclical model for problem situations that can be modeled with trigonometric functions; (C) determine or analyze an appropriate piecewise model for problem situations; and (D) solve problems using recursion or iteration, including those involving population growth or decline and compound interest.
(DM.10) **Mathematical decision making in finance**. The student creates and analyzes mathematical models to make decisions related to earning, investing, spending, and borrowing money.	The student is expected to: (A) determine, represent, and analyze mathematical models for various types of income calculations to determine the best option for a given situation; (B) determine, represent, and analyze mathematical models for expenditures, including those involving credit, to determine the best option for a given situation; and (C) determine, represent, and analyze mathematical models and appropriate representations for various types of loans and investments to determine the best loan or investment plan for a given situation.

(DM.11) **Network modeling for decision making**. The student uses a variety of network models represented graphically to organize data in quantitative situations, make informed decisions, and solve problems.

The student is expected to:

(A) solve problems involving scheduling or routing situations that can be represented by a vertex-edge graph, and find critical paths, Euler paths, or minimal spanning trees; and

(B) construct, analyze, and interpret flow charts in order to develop and describe problem solving procedures.

(DM.12) **Modeling with geometric tools**. The student uses a variety of tools and methods to represent and solve problems involving static and dynamic situations.

The student is expected to:

(A) create and use two- and three-dimensional representations of authentic situations using paper techniques or dynamic geometric environments for computer-aided design and other applications;

(B) use vectors to represent and solve applied problems;

(C) use matrices to represent geometric transformations and solve applied problems; and

(D) solve geometric problems involving inaccessible distances.