

ATTACHMENT II
Text of Proposed New 19 TAC

Chapter 111. Texas Essential Knowledge and Skills for Mathematics

Subchapter C. High School

§111.37. Advanced Quantitative Reasoning (One Credit).

- (a) General requirements. Students shall be awarded one credit for successful completion of this course.
Prerequisite: Algebra II.
- (b) Introduction.
- (1) In Advanced Quantitative Reasoning, students continue to build upon the K-8, Algebra I, Algebra II, and Geometry foundations as they expand their understanding through further mathematical experiences. Advanced Quantitative Reasoning includes the analysis of information using statistical methods and probability, modeling change and mathematical relationships, and spatial and geometric modeling for mathematical reasoning. Students learn to become critical consumers of real-world quantitative data, knowledgeable problem solvers who use logical reasoning, and mathematical thinkers who can use their quantitative skills to solve authentic problems. Students 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) Knowledge and skills.
- (1) 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 mathematics orally and in writing as part of independent and collaborative work, including making accurate and clear presentations of solutions to problems.
- (2) The student analyzes real-world numerical data using a variety of quantitative measures and numerical processes. The student is expected to:
- (A) apply, compare, and contrast ratios, rates, ratings, averages, weighted averages, or 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.

- (3) The student analyzes and evaluates risk and return in the context of real-world problems. 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.
- (4) 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, including 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; and
 - (D) describe strengths and weaknesses of sampling techniques, data and graphical displays, and interpretations of summary statistics or other results appearing in a study.
- (5) The student applies statistical methods to design and conduct a study that addresses one or more particular question(s). The student is expected to:
- (A) determine the 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, including those that can be controlled and those that cannot be controlled.
- (6) The student communicates the results of reported and student-generated statistical studies. The student is expected to:
- (A) report results of statistical studies, 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 language.
- (7) The student analyzes the mathematics behind various methods of ranking and selection. The student is expected to:
- (A) apply, analyze, and compare various ranking algorithms to determine an appropriate method to solve a real-world problem; and
 - (B) analyze and compare various voting and selection processes to determine an appropriate method to solve a real-world problem.

- (8) The student models data, makes predictions, and judges the validity of a prediction. The student is expected to:
- (A) determine if 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;
 - (B) collect numerical bivariate data; use the data to create a scatterplot; and select a function such as linear, exponential, logistic, or trigonometric to model the data; and
 - (C) justify the selection of a function to model data, and use the model to make predictions.
- (9) The student uses mathematical models to represent, analyze, and solve real-world problems involving change. The student is expected to:
- (A) analyze and determine appropriate growth or decay models, including linear, exponential, and logistic functions;
 - (B) analyze and determine an appropriate cyclical model that can be modeled with trigonometric functions;
 - (C) analyze and determine an appropriate piecewise model; and
 - (D) solve problems using recursion or iteration.
- (10) The student creates and analyzes mathematical models to make decisions related to earning, investing, spending, and borrowing money to evaluate real-world situations. The student is expected to:
- (A) determine, represent, and analyze mathematical models for various types of income calculations;
 - (B) determine, represent, and analyze mathematical models for expenditures, including those involving credit; and
 - (C) determine, represent, and analyze mathematical models for various types of loans and investments.
- (11) 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 methods such as a vertex-edge graph using 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.
- (12) 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 such as those encountered when building a bridge, constructing a skyscraper, or mapping planetary distances.