Texas Mathematics

Advanced Quantitative Reasoning

Adopted 2012

Mathematical process standards.

1. The student uses mathematical processes to acquire and demonstrate mathematical understanding AQR.9-12.1

(A) apply mathematics to problems arising in everyday life, society, and the workplace AQR.9-12.1.A

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution AQR.9-12.1.B

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems AQR.9-12.1.C

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate AQR.9-12.1.D

(E) create and use representations to organize, record, and communicate mathematical ideas AQR.9-12.1.E

(F) analyze mathematical relationships to connect and communicate mathematical ideas AQR.9-12.1.F

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication AQR.9-12.1.G

Numeric reasoning

2. The student applies the process standards in mathematics to generate new understandings by extending existing knowledge. The student generates new mathematical understandings through problems involving numerical data that arise in everyday life, society, and the workplace. The student extends existing knowledge and skills to analyze real-world situations AQR.9-12.2

(A) use precision and accuracy in real-life situations related to measurement and significant figures AQR.9-12.2.A

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(B) apply and analyze published ratings, weighted averages, and indices to make informed decisions AQR.9-12.2.B

(C) solve problems involving quantities that are not easily measured using proportionality AQR.9-12.2.C

(D) solve geometric problems involving indirect measurement, including similar triangles, the Pythagorean Theorem, Law of Sines, Law of Cosines, and the use of dynamic geometry software AQR.9-12.2.D

(E) solve problems involving large quantities using combinatorics AQR.9-12.2.E

(F) use arrays to efficiently manage large collections of data and add, subtract, and multiply matrices to solve applied problems, including geometric transformations AQR.9-12.2.F

(G) analyze various voting and selection processes to compare results in given situations AQR.9-12.2.G

(H) select and apply an algorithm of interest to solve real-life problems such as problems using recursion or iteration involving population growth or decline, fractals, and compound interest; the validity in recorded and transmitted data using checksums and hashing; sports rankings, weighted class rankings, and search engine rankings; and problems involving scheduling or routing situations using vertex-edge graphs, critical paths, Euler paths, and minimal spanning trees and communicate to peers the application of the algorithm in precise mathematical and nontechnical language AQR.9-12.2.H

Algebraic reasoning (expressions, equations, and generalized relationships)

3. The student applies the process standards in mathematics to create and analyze mathematical models of everyday situations to make informed decisions related to earning, investing, spending, and borrowing money by appropriate, proficient, and efficient use of tools, including technology. The student uses mathematical relationships to make connections and predictions. The student judges the validity of a prediction and uses mathematical models to represent, analyze, and solve dynamic real-world problems AQR.9-12.3

(A) collect numerical bivariate data to create a scatterplot, select a function to model the data, justify the model selection, and use the model to interpret results and make predictions AQR.9-12.3.A

(B) describe the degree to which uncorrelated variables may or may not be related and analyze situations where correlated variables do or do not indicate a cause-and-effect relationship AQR.9-12.3.B

(C) determine or analyze an appropriate growth or decay model for problem situations, including linear, exponential, and logistic functions AQR.9-12.3.C

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determine or analyze an appropriate cyclical model for problem situations that can be modeled with periodic functions AQR.9-12.3.D

(E) determine or analyze an appropriate piecewise model for problem situations AQR.9-12.3.E

(F) create, represent, and analyze mathematical models for various types of income calculations to determine the best option for a given situation AQR.9-12.3.F

(G) create, represent, and analyze mathematical models for expenditures, including those involving credit, to determine the best option for a given situation AQR.9-12.3.G

(H) create, represent, and analyze mathematical models and appropriate representations, including formulas and amortization tables, for various types of loans and investments to determine the best option for a given situation AQR.9-12.3.H

Probabilistic and statistical reasoning

4. The student uses the process standards in mathematics to generate new understandings of probability and statistics. The student analyzes statistical information and evaluates risk and return to connect mathematical ideas and make informed decisions. The student applies a problem-solving model and statistical methods to design and conduct a study that addresses one or more particular question(s). The student uses multiple representations to communicate effectively the results of student-generated statistical studies and the critical analysis of published statistical studies AQR.9-12.4

(A) use a two-way frequency table as a sample space to identify whether two events are independent and to interpret the results AQR.9-12.4.A

(B) use the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), in mathematical and real-world problems AQR.9-12.4.B

(C) calculate conditional probabilities and probabilities of compound events using tree diagrams, Venn diagrams, area models, and formulas AQR.9-12.4.C

(D) interpret conditional probabilities and probabilities of compound events by analyzing representations to make decisions in problem situations AQR.9-12.4.D

(E) use probabilities to make and justify decisions about risks in everyday life AQR.9-12.4.E

(F) calculate expected value to analyze mathematical fairness, payoff, and risk AQR.9-12.4.F

(G) determine the validity of logical arguments that include compound conditional statements by constructing truth tables AQR.9-12.4.G

(H) identify limitations and lack of relevant information in studies reporting statistical information, especially when studies are reported in condensed form AQR.9-12.4.H

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(I) interpret and compare statistical results using appropriate technology given a margin of error AQR.9-12.4.I

(J) identify potential misuses of statistics to justify particular conclusions, including assertions of a cause-and-effect relationship rather than an association, and missteps or fallacies in logical reasoning AQR.9-12.4.J

(K) 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 AQR.9-12.4.K

(L) 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 AQR.9-12.4.L

(M) identify the population of interest for a statistical investigation, select an appropriate sampling technique, and collect data AQR.9-12.4.M

(N) identify the variables to be used in a study AQR.9-12.4.N

(O) determine possible sources of statistical bias in a study and how bias may affect the validity of the results AQR.9-12.4.O

(P) create data displays for given data sets to investigate, compare, and estimate center, shape, spread, and unusual features of the data AQR.9-12.4.P

(Q) analyze possible sources of data variability, including those that can be controlled and those that cannot be controlled AQR.9-12.4.Q

(R) 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 AQR.9-12.4.R

(S) justify the design and the conclusion(s) of statistical studies, including the methods used AQR.9-12.4.S

(T) communicate statistical results in oral and written formats using appropriate statistical and nontechnical language AQR.9-12.4.T