Quantitative Literacy

Content Standards

2022

Course Title:	Quantitative Literacy
Course/Unit Credit:	1
Course Number:	439120
Teacher Licensure:	Please refer to the Course Code Management System (https://adedata.arkansas.gov/ccms/) for the most current licensure codes.
Grades:	9-12
Prerequisite:	Algebra 1

Course Description: This course builds on Algebra I to explore mathematical topics and relationships. Emphasis will be placed on applying modeling as the process of choosing and using appropriate mathematics and statistics to analyze, to better understand, and improve mathematical understanding in real-world situations. Students will represent and process their reasoning and conclusions numerically, graphically, symbolically, and verbally. Quantitative Literacy will help students develop conceptual understanding by supporting them in making connections between concepts and applying previously learned material to new contexts. Students will be expected to use technology, including graphing calculators, computers, or data-gathering tools throughout the course. Quantitative Literacy is a transitional course and should prepare students for success in future courses. Quantitative Literacy does not require Arkansas Department of Education approval.

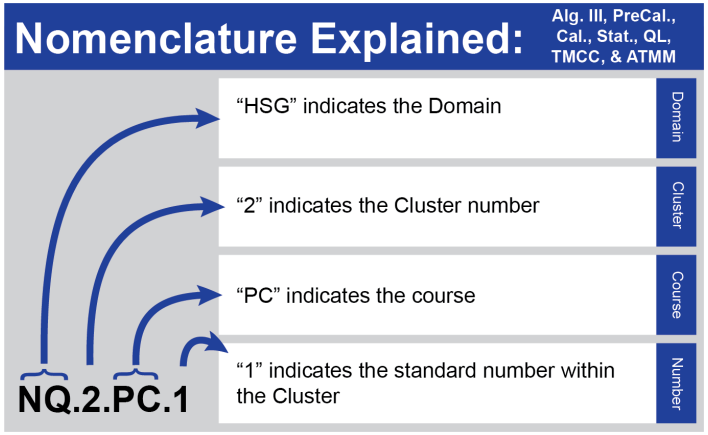
ACT 480: Please refer to the Mathematics Transitional Courses document (https://rb.gy/ne4ul6) for transitional math course options.

Introduction to Secondary Arkansas Mathematics Standards

When the Division of Elementary and Secondary Education (DESE) began the process of revising math standards, a diverse group of qualified educators from across the state came together to craft Arkansas standards specific to the schools and students in the state. The result of this work, the Arkansas Mathematics Standards, is contained in this document. These standards reflect what educators across the state know to be best for Arkansas students.

Standards Organization: The revision committee maintained the organizational structure and nomenclature of the previous standards. Secondary Arkansas Mathematics Standards are categorized into domains, clusters, and standards.

- **Domains** represent the big ideas to be studied in each course and sometimes across grade bands. These big ideas support educators in determining the proper amount of focus and instructional time to be given to each of these topics.
- **Clusters** represent collections of standards grouped to help educators understand the building blocks of rich and meaningful instructional units. These units help students make connections within clusters and avoid seeing mathematics as a discrete list of skills they must master.
- **Standards** represent the foundational building blocks of math instruction. The standards outlined in this document work together to ensure that students are college and career ready and on track for success.



Standards Support: The revision of the Arkansas Mathematics Standards represent the work of the committee to provide greater clarity, strength, and support of the standards. Additionally, the revised mathematics standards are designed to help educators better understand the areas of emphasis and the focus within the standards. Educators should address the bulleted content as more than a checklist of items that they must teach individually. Content is bulleted to provide specificity of learning expectations included within some extensive standards. In some instances, the standard document includes Arkansas examples, teacher notes, specifications, and italicized words to assist educators with planning, teaching, and student learning.

- **Examples** included in the original standards were either changed for clarity or separated from the body of the actual standard. The examples included in the body of the standards document in no way reflect all of the possible examples. Likewise, these examples do not mandate curriculum or problem types. Local districts are free to select the high-quality curricula and instructional methods that best meet the needs of their students.
- **Teacher notes** offer clarification of the standards. These notes are intended to clarify, for teachers, what the expectations are for the learner. Likewise, these notes provide instructional guidance and limitations so that educators can better understand the scope of the standard. This will help with determining what is developmentally appropriate for students when working with specific standards.
- **Standard specifications** are to strengthen standards. The specifications are precise statements highlighting the need for mastery or function-type parameters for specific standards. This will assist educators in pinpointing the best opportunities for students to gain and master the knowledge and skills needed to succeed in a progression.
- **Asterisks (*)** are denoted to represent the modeling component of the standards. These standards should be presented in a modeling context which allows students to engage in the modeling process that is outlined in the Standards for Mathematical Process. (See Appendix A)
- **Italicized words** are defined in the glossary.

Finally, the Arkansas Mathematics Standards will be a living document. As these standards are implemented across schools in the state, DESE welcomes further suggestions related to notes of clarification, examples, professional development needs, and future revisions of the standards.

K - 12 Standards for Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Quantitative Literacy Standards: Overview

Abbreviations: The following abbreviations are for the domains for the Arkansas Mathematics Standards.

Modeling - M	
	1. Students will use appropriate mathematical models to solve problems throughout this course.
Numerical Reasoning - NR	
	2. Students will use number sense and proportional reasoning in real world settings to make and communicate decisions in order to draw conclusions based on quantitative analysis.
Statistics and Probability - SP	
	3. Students will apply statistical and probabilistic reasoning to draw conclusions, to make decisions, and to evaluate outcomes of decisions.
Personal Financial Literacy - PF	
	4. Students will apply mathematics to make informed personal financial decisions.
Business Financial Literacy - BF	
	5. Students will understand the principles and mathematics in business as it applies to economics.

Modeling	
Cluster 1: Students will use appropriate mathematical models to solve problems throughout this course.	
M.1.QL.1*	Use mathematical models to: ● Demonstrate understanding of the meaning of a solution in context. ● Identify when insufficient information is given to solve a problem. Teacher Note: ● Students should be able to discuss: ○ Does the solution make sense? ○ What to do next if insufficient information is given? ● Modeling is not an isolated topic and therefore should be integrated throughout the course.
M.1.QL.2*	Analyze mathematical models, describe limitations, and suggest improvements. Teacher Note: Modeling is not an isolated topic and therefore should be integrated throughout the course.
M.1.QL.3*	Use mathematical models created with spreadsheets or other tools to: ● Estimate solutions for contextual questions. ● Identify patterns. ● Identify how changing parameters affect results. Teacher Note: Modeling is not an isolated topic and therefore should be integrated throughout the course.
M.1.QL.4*	Use mathematical models to make decisions about purchases (e.g., buying a vehicle, home improvement, fashion trends) bivariate. Teacher Note: Modeling is not an isolated topic and therefore should be integrated throughout the course.
M.1.QL.5*	Create and use mathematical models for *bivariate data* sets to: ● Answer questions. ● Draw conclusions. ● Make decisions. Teacher Note: Modeling is not an isolated topic and therefore should be integrated throughout the course.

Numerical Reasoning	
Cluster 2: Students will use number sense and proportional reasoning in real world settings to make and communicate decisions in order to draw conclusions based on quantitative analysis.	
NR.2.QL.1*	Solve real world problems and interpret results involving calculations with percentages, decimals, and fractions: ● Conversions ● Percent change (absolute vs relative) ● Percent of quantities
NR.2.QL.2*	Use estimation in real world situations: ● Know when ● Know how ● Know why Teacher Notes: ● Real world situations should be based on the context of the backgrounds of your students. ● Students should be able to provide an estimate that is reasonably accurate and justify their method and reasoning.
NR.2.QL.3*	Numeric and contextual benchmarks: ● Identify appropriate numeric benchmarks (e.g., use 10% as an estimation for 12%) for estimating calculations. ● Identify appropriate contextual benchmarks (e.g., population for Arkansas, the United States, and the world) to compare to other numbers (e.g., reasonableness of statistical claims, giving context to numbers).
NR.2.QL.4*	Compare magnitudes of numbers in context in different forms (e.g., millions, billions, trillions, national debt, Richter scale, scientific notation).
NR.2.QL.5*	Use *dimensional analysis* to solve problems involving multiple units of measurement (e.g., converting between currencies, determine miles per gallon, appropriate dosages of medicine).
NR.2.QL.6*	Solve real world problems requiring interpretation and comparison of various representations of rates and ratios.
NR.2.QL.7*	Distinguish between proportional and non-proportional real world situations.

Statistics and Probability	
Cluster 3: Students will apply statistical and probabilistic reasoning to draw conclusions, to make decisions, and to evaluate outcomes of decisions.	
SP.3.QL.1*	Create and use charts, tables, and graphs of real world data (with and without technology).
SP.3.QL.2*	Use real world data to: ● Analyze charts, tables and graphs (e.g detailed examination of the elements or structure of the visual representation of the data). ● Interpret charts, tables and graphs. ● Compare and contrast charts, tables and graphs. Teacher Note: Real world data should be based on the context of the backgrounds of your students.
SP.3.QL.3*	Analyze statistical information from studies, surveys, and polls to make informed judgements as to the validity of claims or conclusions (e.g., bias, limitations, sampling, causation vs correlation, misuse of statistics).

SP.3.QL.4*	Make decisions about data summarized numerically using measures of center: ● Compare measures of center of two or more data sets. ● Interpret the differences in context. ● Justify the use of a chosen measure. Teacher Note: A discussion of variability and outliers would be appropriate.
SP.3.QL.5*	Use probabilities to make and justify decisions about risks in everyday life (e.g., types of investments, taking medication, selecting car insurance, playing the lottery).
SP.3.QL.6*	Evaluate the validity of claims based on *experimental* and *theoretical probabilities.*
SP.3.QL.7*	Apply rules of counting and probability to compute probabilities of compound real world events: ● *Addition Rule of Probability* ● *Multiplication Rule of Probability* ● *Fundamental Counting Principle* ● *Permutation and Combinations* ● Visual representations (e.g., Venn diagrams, tree diagrams, lists, two-way tables)

Personal Financial Literacy	
Cluster 4: Students will apply mathematics to make informed personal financial decisions.	
PF.4.QL.1*	Represent and analyze mathematical models for various types of income (e.g., commission, salary, hourly wage, overtime). Teacher Note: Income situations should be based on the context of the backgrounds of your students.
PF.4.QL.2*	Represent and analyze various types of income deductions (e.g., federal and state income taxes, Social Security, Medicare taxes, pre-tax deductions) and employment forms (W-2, W-4, I-9).
PF.4.QL.3*	Analyze expenses to create a household budget utilizing food, shelter, transportation, utilities, insurance, savings, and other expenses (e.g., charitable giving).
PF.4.QL.4*	Analyze various investment instruments for: ● Purposes. ● Advantages. ● Disadvantages. ● Risks. Teacher Note: Savings, checking accounts, certificates of deposit, stocks, social security, individual retirement accounts, bonds, annuities.
PF.4.QL.5*	Analyze the characteristics of various types of loans (e.g., credit cards, personal loans, student loans, auto financing, mortgages).
PF.4.QL.6*	Apply appropriate models to determine the impact of the relationship among loan rates, the term of a loan, the principle amount of a loan, and payments (e.g., amortization table, spreadsheet, compound interest, annual interest rates, continuous rates).
PF.4.QL.7*	Examine consumer protection, bankruptcy, and debt and credit management services for ways in which they affect household budgeting.

Business Financial Literacy	
Cluster 5: Students will understand the principles and mathematics in business as it applies to economics.	
BF.5.QL.1*	Use real world data to determine how a product or service can be profitable in a community. Teacher Note: Real world data should be based on the context of the backgrounds of your students.
BF.5.QL.2*	Determine fixed and variable expenses of running a business (e.g., startup costs, inventory, construction permits, salaries, equipment, taxes, advertisement).
BF.5.QL.3*	Calculate *indices* and solve problems using common *indices:* ● Consumer price index ● Cost of living index ● Determine what constitutes an index Teacher Note: Discussion may include why BMI is not an index.
BF.5.QL.4*	Analyze how stock market averages and *indices* are calculated (e.g., Dow Jones, NASDAQ, S&P 500) with technology.
BF.5.QL.5*	Research how inflation changes the value of the dollar over time. Teacher Note: Discussion may include percentage change with assumed fixed rate or historical variable rates.
BF.5.QL.6*	Prepare for employment by analyzing job skills (e.g., resume building, communication, time management, employer expectations and requirements).

Glossary

Addition Rule of Probability	The probability of the union of two events whether mutually exclusive or not, P(A or B) = P(A) + P(B) - P(A and B)
Bivariate Data	Data that has two variables
Combination	A way of selecting items from a set or collection, such that the order of selection does not matter.
Dimensional analysis	Express a quantity in a specific unit or as a ratio of units.
Experimental probability	The ratio of the number of times an event occurs to the total number of trials or times the activity is performed
Fundamental Counting Principle	If one event has *m* possible outcomes and a second independent event has *n* possibilities, then there are *m*·*n* total possible ways for the two events to occur.
Indices	The product of the ratio of the measurement's value (*v*) to a reference (fixed) value (*f*) for the measurement) and the base value of the index *(b)*. I.e.. $Indice = \left(\frac{v}{f}\right) \cdot b$.
Mathematical Modeling Cycle	See description and diagram after the glossary.
Multiplication Rule of Probability	The probability of the intersection of two events, P(A and B) = P(A)·P(B|A) = P(B)·P(A|B)
Permutation	A way of selecting items from a set or collection, such that the order of selection does matter
Theoretical probability	The number of favorable outcomes divided by the number of possible outcomes

Appendix A.

Mathematical Modeling Cycle

The basic modeling cycle is summarized in this diagram. It involves: (1) identifying variables in the situation and selecting those that represent essential features; (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables; (3) analyzing and performing operations on these relationships to draw conclusions; (4) interpreting the results of the mathematics in terms of the original situation; (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable; (6) reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle.