

Algebraic Literacy (AL) New Life Project October 2013 update

AMATYC Developmental Mathematics Committee

Purposes of Algebraic Literacy Course:

The Algebraic Literacy (AL) course prepares students for mathematics pathways which include college algebra, pre-calculus, and other courses requiring a background beyond the Mathematical Literacy (MLCS) course. The focus of the AL course is on building understanding of mathematical systems with a dual emphasis on symbolism and application. The Algebraic Literacy course includes quantitative topics from areas besides algebra, which supports the needs of both STEM (Science, Technology, Engineering, and Math) bound students and other students. Use of graphing technology is assumed throughout. Some students will take Algebraic Literacy as their first math experience at college, while others will be taking AL after completing the Mathematical Literacy course.

Prerequisites to Algebraic Literacy Course:

Basic proportional reasoning and algebraic reasoning skills, and some function skills, are required prior to the Algebraic Literacy course. Students should be able to do the following prior to this course:

- Understand proportional relationships in a variety of settings, including paired data and graphs.
- Apply properties of algebraic expressions, including distributing, like terms, and integer exponents.
- Construct equations and inequalities to represent relationships
- Understand how to solve linear equations by reasoning
- Understand how to write and use linear and exponential functions

The New Life Project recommends that students needing minor remediation be provided any needed instruction for these areas in either a short-term format ('boot-camp') or just-in-time (within the course). Students needing extensive learning experiences in these skills or prerequisites to these skills should take a course like Mathematical Literacy for College Students, or beginning algebra, prior to the AL course.

Content Goals of Algebraic Literacy:

1. Numbers and Polynomials
2. Functions
3. Geometry and Trigonometry
4. Modeling and Statistics

The content is intended to be integrated and connected.

Learning Outcomes of Algebraic Literacy:

These are listed within the content goal structure, even though some outcomes would be addressed in multiple goals. Some outcomes are clarified by selected exemplar(s). Courses preparing students for STEM-pathways should consider the Additional Outcomes listed.

1. Numbers and Polynomials: **Students will develop and apply concepts of polynomials to investigate and describe relationships and solve problems.**

- A. Understand the use of parameters and variables, including appropriate replacement sets. [Identify which symbols represent parameters and which represent variables. Represent situations with polynomials or equations. Identify domain and range.]
- B. Show procedural fluency with polynomial expressions, including basic factoring. [Perform flexibly operations of adding, subtracting, and multiplying on polynomials. Perform limited division. Understand and perform limited factoring, such as common factors and difference of squares.]
- C. Use equations, inequalities, and systems of equations & inequalities to represent situations, and find solutions via symbolic, numeric and graphic methods. [Solve linear equations and inequalities flexibly by multiple methods. Use systems of equations in two or three variables, and solve by multiple methods.]
- D. Use exponential and power equations to represent situations, and find solutions via numeric and graphic methods. [Recognize which model – linear, exponential, or power – is appropriate. Solve exponential and power equations with technology.]
- E. Use symbolic procedures to manipulate formulas and literal equations. [Solve for a stated variable. Paraphrase a formula in alternate forms, such as without fractions.]
- F. Additional Outcomes for STEM pathways:
 - i. Solve power equations by symbolic methods.
 - ii. Understand radical expressions, and simplify roots with indices 2 and 3.
 - iii. Understand rational exponent notation, and simplify expressions.
 - iv. Solve radical and rational equations of limited complexity by symbolic methods.
 - v. Understand additional factoring methods, such as trinomials.
- G. {Optional} Using logarithmic equations to represent situations, and find solutions via numeric and graphic methods.

2. Functions: **Students will understand the basic algebraic functions in terms of fundamental concepts such as rate of change, input/output variables, domain & range, and parameters, and use multiple representations of functions.**

- A. Understand basic algebraic functions – linear, exponential, and power. [Represent functions in alternate forms – symbolic, graphic, and numeric. Identify appropriate replacement sets for a function in a given situation. Determine the range for a function given a domain.]
- B. Identify and write the appropriate function for a situation or set of ordered pairs. [Determine the correct pattern for the data. Determine the initial value. Determine the slope or multiplier or coefficient for the function.]
- C. Determine whether a discrete or continuous model is appropriate for a situation.
- D. Understand properties of basic algebraic functions. [Determine a rate of change in an interval for any function. Determine an extreme value (minimum or maximum) for functions by using technology. Predict the effects of changing a parameter in a given function.]
- E. Additional Outcomes for STEM pathways:
 - i. Identify relations that are not functions.
 - ii. Understand radical functions (indices 2 and 3) including domain and range.
 - iii. Understand rational functions of limited complexity including domain.
 - iv. Understand basic conic sections (parabola, circle, and ellipse in particular)

3. Geometry and Trigonometry: **Students will apply basic relationships of shapes and angles to investigate, represent and solve problems.**

- A. Use properties of basic geometric shapes. [Identify regular and irregular figures. Determine interior angle size for a regular plane figure. Solve problems by determining perimeter, area, and/or volume.]
- B. Understand the patterns of measurement – perimeter, area and volume.
- C. Understand the three basic trigonometric functions in the context of right triangles. [Given a right triangle with known sides, calculate the sine, cosine, and tangent of each acute angle. Given the sine and cosine of an angle, calculate the tangent. Given a rate of change on a graph, calculate the tangent.]
- D. Use the three basic trigonometric functions. [Use technology to calculate the sine, cosine, or tangent of an acute angle. Use trigonometric functions to solve problems in a right triangle.]

4. Modeling and Statistics: **Students will develop and apply basic concepts of modeling and statistics to investigate and describe situations and solve problems.**

- A. Use basic concepts of measurement and data. [Determine precision and accuracy of basic measurements. Identify a measurement as being nominal, ordinal, or interval.]
- B. Understand theoretical and modeled relationships. [Know when errors from predicted values has two components versus one. Understand the predictive validity and reliability of each type of relationship. Know when extrapolation is reasonable.]
- C. Use technology to generate models (linear, exponential, or power) given appropriate data. [Use regression to generate a model. Use a model to make predictions.]
- D. Understand how to judge which model is a better choice. [Understand the difference between correlation and causation. Make reasonable interpretations of correlation values for a regression. Given a scatterplot, identify which type of model is the best fit when the pattern is relatively clear.]

Cross Reference of Outcomes

Target / Purpose	1. Numbers & Polynomials	2. Functions	3. Geometry & Trig	4. Modeling & Statistics
STEM/Calc	A, B, C, E, F	A, B, D, E	A, B, C, D	B
Reform Coll Alg	A, B, C, D	A, B, C, D	A, B	A, B, C, D
Biology	A, C, D, G	A, B, C, D	B	A, B, C, D
Technical Prog.	A, C, D	A, B, C, D	A, B, C, D	A, B, C, D