Huntsville City Schools — Pacing Guide

2017 – 2018

Course: Algebra II   Grade: 12

Math Practices	Online Resources
The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy). 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 .	Dan Meyer's Ted Talk about teaching math: https://youtu.be/qocAoN4jNwc Links to his 3-act activities, sorted by standard: https://docs.google.com/spreadsheet/ccc?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE#gid=0 Granite City Math Vocabulary: http://www.graniteschools.org/mathvocabulary/
For more:	**Other online resources**
Elaboration on each practice from the Common Core website: www.corestandards.org/Math/Practice/	www.desmos.com is a free online graphing calculator. Excellent for working with linear equations, scatterplots, and best-fit lines.
Kid-friendly language: www.buncombe.k12.nc.us/Page/37507	https://teacher.desmos.com/ has some great activities for introducing and working with functions.

PLEASE NOTE: This course is designed for seniors who need Algebra2 to graduate. It is assumed that students will need to refresh Algebra1 skills. If you have students who plan to take pre-calculus (in high school or in college) or who could move faster than the pace provided here, they may be misplaced and should be taking Algebra2/Trig.

The standards are organized by *concept*, the textbook is organized by *skill*. It is recommended that the teacher follow the textbook, with attention paid to connecting the concepts across the chapters, as there are sections throughout the book that apply only to Alg2/Trig, not to Alg2. The following standards are applied to almost every chapter:

30) Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* [F-IF7]

31) Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. [F-IF8]

The power standards for each chapter are highlighted, marked with two asterisks, and annotated.

1st Nine Weeks: Chapters 1, 2, 3

Chapter 1: Expressions, Equations, and Inequalities

Standards	Text	Days
12) Interpret expressions that represent a quantity in terms of its context.* [A-SSE1] 12b. Interpret complicated expressions by viewing one or more of their parts as a single entity. [A-SSE1b] Example: Interpret $P(1+r)n$ as the product of P and a factor not depending on P. 15) Understand that polynomials form a system analogous to the integers; namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. [A-APR1] *20) Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. [A-CED1] *Students are expected to solve and graph inequalities, write and solve compound inequalities, and write and solve equations and inequalities involving absolute values.* 23) Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. [A-CED4]	Chapter 1, sections 3-6	5 days

Vocabulary: equation, inequality, compound inequality, absolute value.

Chapter 2: Functions, Equations, and Graphs

Vocabulary: linear equation, transformation

Note: Direct variation and slope-intercept from are not taught in Alg2 standards, but a review of 2-2 & 2-3 may be called for leading into linear relationships.

Standards	Text	Days

**30a) Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. [F-IF7b] Example f(x) = 2x3 or f(x) = (x+1)/(x-1) for x ≠ 1.
    Students are expected to transform absolute value functions only. Square root, etc. come in later chapters.
 	
32) Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). [F-IF9]
 	
33) Write a function that describes a relationship between two quantities.* [F-BF1]
 	
**34) Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. [F-BF3]
    Students are expected to transform absolute value functions only.
 	
35a) Solve an equation of the form f(x) = c for a simple function f that has an inverse, and write an expression for the inverse. [F-BF4a]
	Chapter 2, sections 3-8	**15 days**

Chapter 3: Linear Systems

Vocabulary: model, slope, predictions, two-variable inequality, systems of equations, constraints, solutions, maximum, minimum

Note: Section 3-5 (systems with three variables) is not covered, and Section 3-6 (matrices) is moved to 4th quarter. Systems of linear equalities is Alg1, although it may require review.

Standards	Text	Days
**21) Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. [A-CED2] **22) Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. [A-CED3] Example: Represent inequalities describing nutritional and cost constraints on combinations of different foods. *Students are expected to graph systems of inequalities, as well as find & use solutions in constraint systems to maximize or minimize a function.* 27) Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* [A-REI11]	**Chapter 3, sections 1-4**	**15 days**

SECOND NINE WEEKS, Chapters 4 and 5

Chapter 4: Quadratic Functions and Equations

Vocabulary: quadratic, binomial factor, Quadratic Formula, discriminant, complex number

Note: Completing the Square (4-6) is an Alg1 standard and will not be explicitly tested.

Standards	Text	Days

1) Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real. [N-CN1]
 	
**2) Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. [N-CN2]
   Students are expected to add, subtract, and multiply complex numbers.
 	
3) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. [N-CN3]
 	
4) Solve quadratic equations with real coefficients that have complex solutions. [N-CN7]
 	
5) Extend polynomial identities to the complex 12a) Interpret parts of an expression such as terms, factors, and coefficients. [A-SSE1a]
 	
13) Use the structure of an expression to identify ways to rewrite it. [A-SSE2]
 	
32) Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). [F-IF9]
 	
**25) Recognize when the quadratic formula gives complex solutions, and write them as $a \pm bi$ for real numbers a and b. [A-REI4b]
   Students are expected to use Quadratic Formula to solve quadratic equations with complex solutions.
 	
29) Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.* [F-IF5]
number
 	
**34) Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. [F-BF3]
   Students are expected to graph quadratic functions, to recognize zeroes of quadratic functions, and recognize the graph of a quadratic function that only has complex solutions.
	Chapter 4, sections 1-5. 7-9	**20 days**

Chapter 5: Polynomials and Polynomial Functions

Vocabulary: polynomial, end behavior, factored form, zero, polynomial division, synthetic division

Note: Section 5-6 extends past the scope of Alg2, except for *knowing how to apply* the Fundamental Theorem of Algebra.

Standards	Text	Days

5) Extend polynomial identities to the complex numbers.
 	
**6) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. [N-CN9]
  Students are expected to know that the number of zeros is the same as the power of the polynomial, to know that complex zeros come in pairs, and to recognize graphs that could have complex zeros.
 	
12a. Interpret parts of an expression such as terms, factors, and coefficients. [A-SSE1a]
 	
16) Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x - a is p(a), so p(a) = 0 if and only if (x - a) is a factor of p(x). [A-APR2]
 	
**17) Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. [A-APR3]
  Students are expected to recognize zeros of graphs, and to use zeros of a polynomial of a graph.
 	
18) Prove polynomial identities and use them to describe numerical relationships. [A-APR4]
 	
19) Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or for the more complicated examples, a computer algebra system. [A-APR6]
 	
27) Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* [A-REI11]
 	
**30b. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. [F-IF7c]
  Students are expected to factor third-degree polynomials when a GCF would yield a quadratic with real roots.
 	
33) Write a function that describes a relationship between two quantities.* [F-BF1]
	Chapter 5 sections 1-5, and part of 6	15 days

THIRD NINE WEEKS, chapters 6, 7, 8, and 9

Chapter 6: Radical Functions and Rational Exponents

Vocabulary: root, rational, (binomial) radical expression, radical function

Note: Composition is in Section 6-6, but is not an Algebra2 standard.

Standards	Text	Days

13) Use the structure of an expression to identify ways to rewrite it. [A-SSE2]
 	
20) Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. [A-CED1]
 	
23) Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. [A-CED4]
 	
**24) Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. [A-REI2]
   Students are expected to solve radical equations that do not require squaring more than once.
 	
30a. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. [F-IF7b]
 	
33) Write a function that describes a relationship between two quantities.* [F-BF1]
 	
**33a. Combine standard function types using arithmetic operations. [F-BF1b]
   Students are expected to add, subtract, multiply, and divide functions, and evaluate combined functions at a value of x. (not composition)
 	
35) Find inverse functions. [F-BF4]
 	
35a. Solve an equation of the form f(x) = c for a simple function f that has an inverse, and write an expression for the inverse. [F-BF4a]
	Chapter 6 sections 1-8	10 days

Chapter 7: Exponential and Logarithmic Functions

Vocabulary: exponential decay and growth, logarithm, logarithmic

Standards	Text	Days
20) Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. [A-CED1] 27) Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* [A-REI11] 30c) Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. [F-IF7e] 32) Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). [F-IF9] 33) Write a function that describes a relationship between two quantities.* [F-BF1] 35) Find inverse functions. [F-BF4] **36) For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers, and the base b is 2, 10, or e; evaluate the logarithm using technology. [F-LE4] *Students are expected to translate exponential form to logarithm form, and back. Students are expected to solve <u>simple</u> logarithmic and exponential equations.*	**Chapter 7 sections 1-6**	**10 days**

Chapter 8: Rational Functions

Vocabulary: rational expression, equation, function.

Note: 8-3 (graphing rational functions) is a Precalculus standard and will not be tested. Also, 8-5 is an Algebra1 standard and will not be explicitly tested, but will be needed for 8-6.

Standards	Text	Days
3) Write a function that describes a relationship between two quantities.* [F-BF1] 12a) Interpret parts of an expression such as terms, factors, and coefficients. [A-SSE1a] 23) Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. [A-CED4] Section 8-5 (Algebra Standard) Add, Subtract Multiply and Divide Rational expressions [A-APR7] **24) Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. [A-REI2] *Students are expected to solve rational equations of the type* $\frac{X+2}{X-2} = \frac{5}{X+2}$ 27) Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* [A-REI11] 34) Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. [F-BF3] 35a. Solve an equation of the form f(x) = c for a simple function f that has an inverse, and write an expression for the inverse. [F-BF4a]	Chapter 8 sections 1-6 except 3	10 days

Chapter 9: Sequences and Series

Vocabulary: Finite, Geometric, Series, Summation Notation, Sigma

Note: The standards only call for assessing Finite Geometric Series – deriving and using the formula. This could be developed in a number of ways, including - but not limited to - sections 9-1 through 9-4.

Standards	Text	Days
**14) Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. [A-SSE4] *Students are expected to evaluate Geometric Series written in Summation Notation.*	Chapter 9 section 5	30 days

FOURTH NINE WEEKS chapters 10, 11, and 12

Vocabulary: Conic sections, parabola, hyperbola, ellipse, circle.

Chapter 10: Conics

Note: It is not recommended to use the textbook for conics. Emphasis should be placed on recognizing characteristics of functions/relations that determine shape of the graph, and on transformation rules.*

Standards	Text	Days
28) Create graphs of conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations. (Alabama) *Students are expected to recognize the characteristics of the standard forms of the conic sections. Please see Teacher's Edition page 667 (Chapter Test) questions 1-4, 13-19, 28-29 as examples.* 28a. Formulate equations of conic sections from their determining characteristics. (Alabama)	**Chapter 10***	**5 days**

Chapter 11: Probability and Statistics

Vocabulary: permutations, combinations, theoretical, experimental, simulation, conditional probability

Standards	Text	Days
37) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). [S-MD6] **38) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). [S-MD7] 39) Describe events as subsets of a sample space (the set of outcomes), using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). [S-CP1] **40) Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. [S-CP3] 41) Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. 42) Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. [S-CP5] 43) Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. [S-CP6] 44) Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model. [S-CP7] 45) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. [S-CP8] 46) Use permutations and combinations to compute probabilities of compound events and solve problems. [S-CP9]	Chapter 11 sections 1-6	15 days

Chapter 12: Matrices

Vocabulary: matrix/matrices, scalar, determinant, inverse of a matrix

Note: start with section 3-6. Curiously, creating the matrices (3-6) is a Precalculus standard, but solving (12-4) is Algebra 2.

Standards	Text	Days

7)   Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. (Use technology to approximate roots) [N-VM6] (Alabama)
 	
**8)   Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. [N-VM7]
    Students are expected to multiply matrices by a scalr.
 	
**9)   Add, subtract, and multiply matrices of appropriate dimensions. [N-VM8]
    Students are expected to add and subtract matrices of appropriate dimensions (and determine if the dimensions are appropriate).
 	
10)   Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. [N-VM9]
 	
11)   Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. [N-VM10]
 	
26)   Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimensions 3 x 3 or greater). [A-REI9]
	Chapter 12 sections 1-4	**10 days**

Listed below are the technology standards for grades nine through twelve. You are to make every effort to incorporate the applicable standards into your daily classroom lessons. These standards should be noted in your lesson plans.

Alabama Technology Standards Ninth – Twelfth Grade

Operations and Concepts

Students will:

2. Diagnose hardware and software problems.
    Examples: viruses, error messages
    Applying strategies to correct malfunctioning hardware and software
    Performing routine hardware maintenance
    Describing the importance of antivirus and security software

3. Demonstrate advanced technology skills, including compressing, converting, importing, exporting, and backing up files.
    Transferring data among applications
    Demonstrating digital file transfer
    Examples: attaching, uploading, downloading

4. Utilize advanced features of word processing software, including outlining, tracking changes, hyperlinking, and mail merging.

5. Utilize advanced features of spreadsheet software, including creating charts and graphs, sorting and filtering data, creating formulas, and applying functions.

6. Utilize advanced features of multimedia software, including image, video, and audio editing.

Digital Citizenship

9. Practice ethical and legal use of technology systems and digital content.
    Explaining consequences of illegal and unethical use of technology systems and digital content
    Examples: cyberbullying, plagiarism
    Interpreting copyright laws and policies with regard to ownership and use of digital content

Citing sources of digital content using a style manual
Examples: Modern Language Association (MLA), American Psychological Association (APA)

Research and Information Fluency

11. Critique digital content for validity, accuracy, bias, currency, and relevance.

Communication and Collaboration

12. Use digital tools to publish curriculum-related content.
    Examples: Web page authoring software, coding software, wikis, blogs, podcasts

13. Demonstrate collaborative skills using curriculum-related content in digital environments.
Examples: completing assignments online; interacting with experts and peers in a structured, online learning environment

Critical Thinking, Problem Solving, and Decision Making

14. Use digital tools to defend solutions to authentic problems.
    Example: disaggregating data electronically

Creativity and Innovation

15. Create a product that integrates information from multiple software applications.
    Example: pasting spreadsheet-generated charts into a presentation