Revised Alabama Course of Study Mathematics
Summary of Updates
November 2013

Cover  Redesigned colors to make Alabama more prominent

Inside Cover (2 pages)  added “State” to Alabama Department of Education in four places; changed name of superintendent from “Joseph B. Morton” to “Thomas R. Bice”

Page iv  changed “2010” to “2013” in State Superintendent of Education’s Message; revised paragraph 1 by adding “(CCSS)” and replacing “issues affecting our state” with “content specific to our state”; changed the names of the governor, superintendent, and State Board to reflect the current governor, superintendent, and State Board members

Pages v – vi  adjusted TOC as needed for new pagination caused by movement of content

Page vi  changed 1st paragraph from “2010” to “2013”; added “This same group of Alabama professionals returned in 2013 and revised the standards based on the first year of implementation. This process involved revising standards, moving specific standards to other grades and courses resulting in the 2013 Alabama Course of Study: Mathematics.” to the 2nd paragraph

Page viii  Revised section name from “Curriculum and Instruction” to “Standards/Courses of Study and Textbooks”

Page ix  added “2010 Alabama Course of Study: Mathematics was reviewed and updated in January 2013 and again in October 2013.”

Page 3  revised 2nd paragraph from “the eight Standards for Mathematical Practice adopted from the Common Core State Standards (CCSS)” to ”the eight CCSS Standards for Mathematical Practice”

Page 4  changed “2010” to “2013”

Page 10  revised example to match document numbering; revised 6th paragraph from “level, the national mathematics Common Core State Standards (CCSS) domain, and the CCSS number.” to “level and the CCSS mathematics domain and the standard number.”

Page 11  revised standard numbers in the examples to reflect the new numbers caused by the movement of standards
changed narrative to reflect new numbers of standards required for Algebra I A and B; added two sentences to 2nd paragraph of narrative:

“Content standards in Algebra IA should focus on rational numbers, arithmetic sequences, and linear functions. Standards 3, 4, 5, 6, 7, 7a, 7b, 8, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 28, 29, 30, 31, 31a, 32, 33, 34, 34a, 34b, 35, 36, 37a, 37b, 38, 40, 45, 45a, 45b, 45c, and 46 must be taught in the Algebra IA course. Content standards in Algebra IB should focus on irrational numbers, geometric sequences, and quadratic and exponential functions. Standards 1, 2, 3, 7, 7a, 7b, 8, 9, 9a, 9b, 9c, 9d, 10, 11, 12, 13, 16, 18, 18a, 18b, 21, 23, 27, 28, 29, 30, 31, 31a, 31b, 32, 32a, 32b, 33, 34, 34a, 34b, 35, 36, 37, 37a, 37c, 38, 39, 40, 41, 42, 43, 44, 45, 45a, 45b, and 47 must be taught in the Algebra IB course.”

added specific focus for standards 7 and 8 in cluster statement: “For standard 7” linear, exponential, quadratic; “for standard 8 linear, exponential, quadratic, rational”

added cluster statement and standard 11 from Algebra II and II/T:

“Rewrite rational expressions. (Linear and quadratic denominators.)
11. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. [A-APR7]”

added “and an awareness of” to cluster statement above standard 31
changed narrative to reflect new numbers of standard required for Geometry A and B

“Content standards 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 26, 30, 31, 32, 33, and 34 must be taught in the Geometry A course. Content standards 2, 12, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 35, 36, 37, 38, 39, 40, 41, 42, and 43 must be taught in the Geometry B course.”

Page 90 added examples to standard 15

“Example 1:

Given the two triangles above, show that they are similar.

\[
\frac{4}{8} = \frac{6}{12}
\]

They are similar by SSS. The scale factor is equivalent.

Example 2:

Show that the triangles are similar.

Two corresponding sides are proportional and the included angle is congruent.

(SAS similarity)"

Page 93 added example to standard 43

“Example:

What is the probability of tossing a penny and having it land in the non-shaded region? Geometric Probability is the Non-Shaded Area divided by the Total Area.

\[
\frac{(6^2) - \pi(3^2)}{6^2} = \frac{36 - 9\pi}{36} = \frac{4 - \pi}{4} \text{ or } 1 - \frac{\pi}{4}
\]
Algebra II

Page 96
added standard 3 from Precalculus
“3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. [N-CN3]”

Pages 96-97
added domain, cluster statement, and standard 7 (added clarification statement) through standard 11 from Precalculus

“Vector and Matrix Quantities
Perform operations on matrices and use matrices in applications.

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]

8. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. [N-VM7]

9. (+) Add, subtract, and multiply matrices of appropriate dimensions. [N-VM8]

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]”

Page 98
added cluster statement and standard 25 from Algebra I (last sentence only)

“Solve equations and inequalities in one variable.

25. Recognize when the quadratic formula gives complex solutions, and write them as $a \pm bi$ for real numbers $a$ and $b$. [A-REI4b]”

Page 99
added cluster statement and standard 26 from Precalculus

“Solve systems of equations.

26. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension $3 \times 3$ or greater). [A-REI9]

added “(Emphasize understanding graphs and equations of circles and parabolas.)” to cluster statement above standard 28

Page 100
added standard 35 and 35a from Algebra I

“35. Find inverse functions. [F-BF4]

a. 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]

Example: $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1.”$
Algebra II (cont.)
Pages 101-102  added domain, cluster statement, and standard 39 from Algebra I and standards 40-46 from Geometry

“Conditional Probability and the Rules of Probability

Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)

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 $P(A \text{ and } B)/P(B)$, 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. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. [S-CP4]

Example: Collect data from a random sample of students in your school on their favorite subject among mathematics, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.

42. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. [S-CP5]

Example: Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

Use the rules of probability to compute probabilities of compound events in a uniform probability model.

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, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. [S-CP7]

45. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, 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]"
Algebra II with Trigonometry

Page 103  
added standard 3 from Precalculus  
“3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. [N-CN3]”

Pages 103-104  
added domain, cluster statement, and standard 7 (added clarification statement) through standard 11 from Precalculus

**Vector and Matrix Quantities**

Perform operations on matrices and use matrices in applications.
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]

8. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. [N-VM7]

9. (+) Add, subtract, and multiply matrices of appropriate dimensions. [N-VM8]

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]

Page 105  
added cluster statement and standard 25 from Algebra I (last sentence only)

**Solve equations and inequalities in one variable.**
25. Recognize when the quadratic formula gives complex solutions, and write them as \(a \pm bi\) for real numbers \(a\) and \(b\). [A-REI4b]

Page 106  
added cluster statement and standard 26 from Precalculus  
“Solve systems of equations.”
26. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 \(\times\) 3 or greater). [A-REI9]“

added “*(Emphasize understanding graphs and equations of circles and parabolas.)*” to cluster statement above standard 28

Page 107  
added standard 35 and 35a from Algebra I
35. Find inverse functions. [F-BF4]
   a. 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]
   Example: \(f(x) = 2x^3\) or \(f(x) = (x+1)/(x-1)\) for \(x \neq 1\).
Conditional Probability and the Rules of Probability

Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)

43. 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]

44. Understand the conditional probability of a given as \( P(A \text{ and } B)/P(B) \), and interpret independence of and as saying that the conditional probability of given is the same as the probability of , and the conditional probability of given is the same as the probability of . [S-CP3]

45. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. [S-CP4]

Example: Collect data from a random sample of students in your school on their favorite subject among mathematics, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.

46. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. [S-CP5]

Example: Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

Use the rules of probability to compute probabilities of compound events in a uniform probability model.

47. Find the conditional probability of given as the fraction of ’s outcomes that also belong to , and interpret the answer in terms of the model. [S-CP6]

48. Apply the Addition Rule, \( P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \), and interpret the answer in terms of the model. [S-CP7]

49. (+) Apply the general Multiplication Rule in a uniform probability model, \( P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B) \), and interpret the answer in terms of the model. [S-CP8]

50. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. [S-CP9]
added “conic sections” to first paragraph, last sentence of Precalculus narrative

added domain, cluster statement, and standard 12 (added clarification statement) from Algebra II and Algebra II/T

“Seeing Structure in Expressions

Write expressions in equivalent forms to solve problems.

12. 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.* (Extend to infinite geometric series.) [A-SSE4]

Example: Calculate mortgage payments.”

added domain, cluster statement, and standard 13 from Algebra II and Algebra II/T

“Arithmetic With Polynomials and Rational Expressions

Use polynomial identities to solve problems.

13. (+) Know and apply the Binomial Theorem for the expansion of \((x + y)^n\) in powers of \(x\) and \(y\) for a positive integer \(n\), where \(x\) and \(y\) are any numbers, with coefficients determined, for example, by Pascal’s Triangle. (The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.) [A-APR5]”

Page 117

added cluster statement and standards 16-17 from Algebra II and Algebra II/T

“Interpret functions that arise in applications in terms of the context. (Emphasize selection of appropriate models. “Understand limits of functions.”)

16. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. (Key features include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. “Determine odd, even, neither.”) * [F-IF4]

17. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.* [F-IF6]”

added (Focus on using key features to guide selection of appropriate type of model function “with emphasis on piecewise, step, and absolute value. Also emphasize inverse and transformations of polynomials, rational, radical, absolute value, and logarithmic functions.”) to cluster statement above standard 18; deleted “logarithmic” from cluster clarification

added standards 18, 18a, and 18d from Algebra I, Algebra II, and Algebra II/T and, 18b from Algebra II and Algebra II/T

“18. 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]

a. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. [F-IF7b]"
b. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. [F-IF7c]
d. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. [F-IF7e]

Page 119

33. Prove the Pythagorean identity \( \sin^2(\theta) + \cos^2(\theta) = 1 \), and use it to find \( \sin(\theta) \), \( \cos(\theta) \), or \( \tan(\theta) \) given \( \sin(\theta) \), \( \cos(\theta) \), or \( \tan(\theta) \) and the quadrant of the angle. [F-TF8]

Page 120

“Similarity, Right Triangles, and Trigonometry

Apply trigonometry to general triangles.

35. (+) Derive the formula \( A = \frac{1}{2}ab \sin(C) \) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. (Apply formulas previously derived in Geometry.) [G-SRT9]

“Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on a single count or measurement variable.

39. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. “(Focus on increasing rigor using standard deviation.)” [S-ID2]

40. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). “(Identify uniform, skewed, and normal distributions in a set of data. Determine the quartiles and interquartile range for a set of data.)” [S-ID3]

41. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. [S-ID4]

Page 121

“Interpret linear models.

42. Compute (using technology) and interpret the correlation coefficient of a linear fit. [S-ID8]

43. Distinguish between correlation and causation. [S-ID9]”
Precalculus (cont.)
Page 121 (cont) added domain, cluster statement, and standards 44-45 from Algebra II and Algebra II/T “Making Inferences and Justifying Conclusions
Understand and evaluate random processes underlying statistical experiments.
44. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. [S-IC1]

45. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. [S-IC2]
   Example: A model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?”

added cluster statement and standards 46-49 from Algebra II and Algebra II/T “Make inferences and justify conclusions from sample surveys, experiments, and observational studies.
46. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. [S-IC3]

47. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. [S-IC4]

48. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. [S-IC5]

49. Evaluate reports based on data. [S-IC6]”

Page 126 Revised the title from “Common Addition and Subtraction Situations” to “Addition and Subtraction Situations”

Page 127 Revised the title from “Common Multiplication and Division Situations” to “Multiplication and Division Situations”

Page 131 changed “page 131” to “page 134” in footer to reflect new enumeration
## ALABAMA HIGH SCHOOL GRADUATION REQUIREMENTS

*(Alabama Administrative Code 290-3-1-02(8) and (8)(a))*

Effective for students in the ninth grade in the 2013-2014 school year, all students shall earn the required credits for the Alabama High School Diploma. A local board of education may establish requirements for receipt of diplomas and endorsements, but any diploma or endorsement shall include the requirements of the Alabama High School Diploma. The Alabama courses of study shall be followed in determining minimum required content in each discipline.

### COURSE REQUIREMENTS

<table>
<thead>
<tr>
<th>English Language Arts</th>
<th>Four credits to include:</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 9</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>English 10</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>English 11</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>English 12</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Equivalent options may include: Advanced Placement/International Baccalaureate/postsecondary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| English Language Arts Total Credits | 4 |

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>Three credits to include:</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra I or its equivalent</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Geometry or its equivalent</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Algebra II w/Trigonometry or Algebra II, or its equivalent</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

| Mathematics Total Credits | 4 |

<table>
<thead>
<tr>
<th>Science</th>
<th>Two credits to include:</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>A physical science (Chemistry, Physics, Physical Science)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

| Science Total Credits | 4 |

<table>
<thead>
<tr>
<th>Social Studies*</th>
<th>Four credits to include:</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>World History</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>United States History I</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>United States History II</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>United States Government</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Economics</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Equivalent options may include: Advanced Placement/International Baccalaureate/postsecondary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Social Studies Total Credits | 4 |

<table>
<thead>
<tr>
<th>Physical Education</th>
<th>Lifelong Individualized Fitness Education (LIFE)</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Education</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Career Preparedness</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Career and Technical Education and/or Foreign Language and/or Arts Education</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>Local boards shall offer foreign languages, arts education, physical education, wellness education, career and technical education, and driver education as electives.</td>
<td>2.5</td>
</tr>
</tbody>
</table>

| Total Credits | 24 |

*All four credits shall comply with the current Alabama Course of Study: Social Studies*