

Cullman High School Grades 9-12



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Superintendent of Education

Student Learning Objectives 2005 – 2006

Math

GRADES Nine - Twelve

Minimum Required Content for MATH

ALGEBRA I

The Cullman City School System continually strives to promote a high quality education for all of our students. The school system encourages each teacher to incorporate a wide variety of teaching strategies in an effort to ensure the academic success of each student. The Cullman City School System values high academic standards and promotes excellence through a challenging curriculum. Teachers receive on-going training in a continuous effort to improve reading instruction for all students. This booklet identifies the minimum student learning objectives by subject as identified by the Alabama Course of Study. Each year students in tenth grade are assessed through the administration of the Alabama High School Graduation Exam (AHSGE) and the Alabama Direct Assessment of Writing (ADAW). In addition, classroom teachers continually monitor student progress to determine gains in student achievement in all academic areas. Teachers in the Cullman City School system design instruction based on the standards outlined in the Alabama Course of Study (ACOS), the Alabama High School Graduation Exam (AHSGE), and the ARMT. The following information is provided in an effort to assist you in monitoring the educational progress of your child. Please feel free to contact your child's teacher if you have further questions concerning these standards. Also, you may view additional curriculum information on the web at www.cullmancats.net or www.alsde.edu.

Students will:

1. Simplify numerical expressions using properties of real numbers and order of operations, including those involving square roots, radical form, or decimal approximations.
2. Analyze linear functions from their equations, slopes, and intercepts.
3. Determine characteristics of a relation, including its domain, range, and whether it is a function, when given graphs, tables of values, mappings, or sets of ordered pairs.
4. Represent graphically common relations, including $x = \text{constant}$, $y = \text{constant}$,
5. Perform operations of addition, subtraction, and multiplication on polynomial expressions.
6. Factor binomials, trinomials, and other polynomials using GCF, difference of squares, perfect square trinomials, and grouping.
7. Solve multistep equations and inequalities including linear, radical, absolute value, and literal equations.
8. Solve systems of linear equations and inequalities in two variables graphically or algebraically.
9. Solve quadratic equations using the zero product property.
10. Calculate length, midpoint, and slope of a line segment when given coordinates of its endpoints on the Cartesian plane.
11. Solve problems algebraically that involve area and perimeter of a polygon, area and circumference of a circle, and volume and surface area of right circular cylinders or right rectangular prisms.
12. Compare various methods of data reporting, including scatterplots, stem-and-leaf plots, histograms, box-and-whisker plots, and line graphs, to make inferences or predictions.
13. Identify characteristics of a data set, including measurement or categorical and univariate or bivariate.
14. Use a scatterplot and its line of best fit or a specific line graph to determine the relationship existing between two sets of data, including positive, negative, or no relationship.
15. Estimate probabilities given data in lists or graphs.

GEOMETRY

Students will:

1. Determine the equation of a line parallel or perpendicular to a second line through a given point.
2. Justify theorems related to pairs of angles, including angles formed by parallel and perpendicular lines, vertical angles, adjacent angles, complementary angles, and supplementary angles.
3. Verify the relationships among different classes of polygons by using their properties.
4. Determine the measure of interior and exterior angles associated with polygons.
5. Solve real-life and mathematical problems using properties and theorems related to circles, quadrilaterals, and other geometric shapes.
6. Apply the Pythagorean Theorem to solve application problems, expressing answers in simplified radical form or as decimal approximations, using Pythagorean triples when applicable.
7. Use the ratios of the sides of special right triangles to find lengths of missing sides.

8. Deduce relationships between two triangles, including proving congruence or similarity of the triangles from given information, using the relationships to solve problems and to establish other relationships.
9. Use inductive reasoning to make conjectures and deductive reasoning to justify conclusions.
10. Find the missing measures of sides and angles in right triangles by applying the right triangle definitions of sine, cosine, and tangent.
11. Determine the areas and perimeters of regular polygons, including inscribed or circumscribed polygons, given the coordinates of vertices or other characteristics.
12. Apply distance, midpoint, and slope formulas to solve problems and to confirm properties of polygons.
13. Identify the coordinates of the vertices of the image of a given polygon that is translated, rotated, reflected, or dilated.
14. Classify polyhedrons according to their properties, including the number of faces.
15. Calculate measures of arcs and sectors of a circle from given information.
16. Calculate surface areas and volumes of solid figures, including spheres, cones, and pyramids.
17. Analyze sets of data from geometric contexts to determine what, if any, relationships exist.
18. Construct with precision a circle graph to represent data from given tables or classroom experiments.

ALGEBRAIC CONNECTIONS

Students will:

1. Use algebraic and geometric techniques to make financial and economic decisions.
2. Solve problems using direct, inverse, and joint variation.
3. Use formulas or equations of functions to calculate outcomes of exponential growth or decay.
4. Determine maximum and minimum values of a function using linear programming procedures.
5. Approximate rates of change of nonlinear relationships from graphical and numerical data.
6. Use the extreme value of a given quadratic function to solve applied problems.
7. Make predictions based upon tables or graphs from societal contexts.
8. Determine missing information in an application-based situation by using the properties of right triangles.
9. Analyze the aesthetics of real-life situations using line symmetry, rotational symmetry, or the golden ratio.
10. Use arc length and sector area to solve applied problems.
11. Critique the appropriateness of measurements in terms of precision, accuracy, and approximate error.
12. Use ratios of perimeters, areas, and volumes of similar figures to solve applied problems.
13. Model a set of data by estimating the equation of a curve of best fit from tables of values or scatterplots.
14. Estimate probabilities given a frequency distribution.

ALGEBRA II

Students will:

1. Determine the relationships among the subsets of complex numbers.
2. Simplify expressions involving complex numbers, using order of operations and including conjugate and absolute value.
3. Analyze families of functions, including shifts, reflections, and dilations of $y = \frac{k}{x}$ (inverse variation), $y = kx$ (direct variation/linear), $y = x^2$ (quadratic), $y = a^x$ (exponential), and $y = \log_a x$ (logarithmic).
4. Determine approximate real zeros of functions graphically and numerically and exact real zeros of polynomial functions.
5. Identify the characteristics of quadratic functions from their roots, graphs, or equations.
6. Perform operations on functions, including addition, subtraction, multiplication, division, and composition.
7. Solve equations, inequalities, and applied problems involving absolute values, radicals, and quadratics over the complex numbers, as well as exponential and logarithmic functions.
8. Solve systems of linear equations or inequalities in two variables using algebraic techniques, including those involving matrices.
9. Solve coordinate geometry problems using algebraic techniques.
10. Use different forms of representation to compare characteristics of data gathered from two populations.
11. Determine an equation of linear regression from a set of data.
12. Calculate probabilities of events using the laws of probability.

ALGEBRA II WITH TRIGONOMETRY

Students will:

1. Determine the relationships of subsets of complex numbers.

2. Simplify expressions involving complex numbers, using order of operations and including conjugate and absolute value.
3. Analyze families of functions, including shifts, reflections, and dilations of $y = \frac{k}{x}$ (inverse variation), $y = kx$ (direct variation/linear), $y = [x]$ (greatest integer), $y = x^2$ (quadratic), $y = a^x$ (exponential), and $y = \log_a x$ (logarithmic).
4. Determine approximate real zeros of functions graphically and numerically and exact real zeros of polynomial functions.
5. Identify the characteristics of quadratic functions from their roots, graphs, or equations.
6. Perform operations on functions, including addition, subtraction, multiplication, division, and composition.
7. Solve equations, inequalities, and applied problems involving absolute values, radicals, and quadratics over the complex numbers, as well as simple trigonometric, exponential, and logarithmic functions.
8. Solve systems of linear equations or inequalities in two or three variables using algebraic techniques.
9. Graph trigonometric functions of the form $y = a \sin(bx)$, $y = a \cos(bx)$, and $y = a \tan(bx)$.
10. Solve general triangles, mathematical problems, and real-world applications using the Law of Sines and the Law of Cosines.
11. Define the six trigonometric functions using ratios of the sides of a right triangle, coordinates on the unit circle, and the reciprocal of other functions.
12. Verify simple trigonometric identities using Pythagorean and/or reciprocal identities.
13. Use different forms of representation to compare characteristics of data gathered from two populations.
14. Determine an equation of linear regression from a set of data.
15. Calculate probabilities of events using the laws of probability.

ALGEBRA III WITH STATISTICS

Students will:

1. Utilize matrices to solve problems manually or with technological tools.
2. Solve problems involving maximum or minimum values of functions by using linear programming procedures.
3. Graph conic sections, centered at and rotated about the origin, given the equations.
4. Graph polynomial functions.
5. Solve systems of linear and quadratic equations and inequalities.
6. Approximate solutions of trigonometric and exponential equations from tables and graphs.
7. Expand powers of binomials using the Binomial Theorem.
8. Plot points in a polar coordinate system given their coordinates in polar form, a table of values, or an equation.
9. Compare summary statistics for sets of data represented in a graph, a stem-and-leaf chart, a box-and-whisker graph, a histogram, a linear or quadratic equation of best fit of a scatterplot, and a frequency distribution.
10. Calculate descriptive statistics of univariate data, including measures of central tendency, measures of dispersion, and measures of position.
11. Interpret relationships of bivariate data using linear or quadratic regression and linear correlation.
12. Test a hypothesis for a study that involves one or two populations, generating the appropriate descriptive statistics.
13. Calculate probabilities of mutually exclusive, independent, and dependent events using permutations, combinations, and laws of probability.
14. Determine the probability of an event using a frequency distribution curve.
15. Analyze the data from a student-designed study to create a distribution curve and to determine the resulting confidence interval.
16. Analyze differences among experimental, simulation, and theoretical probability techniques.

PRECALCULUS

Students will:

1. Perform the vector operations of addition, scalar multiplication, and absolute value.
2. Define e using the limit forms of $\sum_{n=0}^{\infty} \frac{1}{n!}$, $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$, and $\lim_{n \rightarrow 0} \left(1 + n\right)^{\frac{1}{n}}$.
3. Graph conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations.

4. Analyze the graphs of rational, logarithmic, exponential, trigonometric, and piecewise-defined functions by determining the domain and range; identifying any vertical, horizontal, or oblique asymptotes; and classifying the function as increasing or decreasing, continuous or discontinuous, and noting the type of discontinuity if one exists.
5. Analyze the effects of parameter changes on the graphs of trigonometric, logarithmic, and exponential functions.
6. Apply the laws of logarithms to simplify expressions and to solve equations using common logarithms, natural logarithms, and logarithms with other bases.
7. Solve trigonometric equations and inequalities using sum, difference, and half- and double-angle identities.
8. Use parametric equations to represent real-life and mathematical situations.
9. Solve applied problems involving sequences with recurrence relations.
10. Find limits of functions at specific values and at infinity numerically, algebraically, and graphically.
11. Convert coordinates, equations, and complex numbers in Cartesian form to polar form and from polar form to Cartesian form.
12. Determine the equation of a curve of best fit from a set of data by using exponential, quadratic, or logarithmic functions.