

Baltimore County Public Schools

Office of Mathematics PreK-12

Course of Study

ACKNOWLEDGEMENTS

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FOREWORD

All children are learners, and the innate drive within them to learn must be constantly encouraged and nurtured, never stifled. To adequately fulfill the right of our students to quality education, the various courses of study in the school system must and will continue to manifest rigorous content and competencies that every student is expected to achieve. In recent years, education in Baltimore County has undergone a seismic shift in certain areas, such as increasing diversity, workforce demands, and emerging technology. The school system is committed to meet those changes as opportunities to further adhere to the highest standards and provide all students the best education possible.

Education is a multi-dimensional process, especially today. Still, the primary goal of education is the preparation of students to become self-sufficient individuals who, while pursuing their own objectives in life, will contribute to the betterment of society. This aim incorporates the ideal that education will enable people to attain personal fulfillment through learning and, at once, adopt responsibilities for others and their total environment. Essentially, education should assist individuals in enriching their lives to the best of their abilities, expanding their horizons and world visions, and fulfilling their roles as citizens. And paramount, education must prepare students to be active "learners" for the entirety of their lives.

Curriculum comprises the framework upon which instruction and learning are founded. Many often choose to view curriculum as the product of a bunch of "what's good for:" what's good for the individual, what's good for the community, what's good for business, what's good for the country, what's good for society and culture, and so on – sometimes forgetting what's good for students. And though input from all of the aforementioned sources is necessary in developing curriculum, educators must ever keep in mind that learning is not the sole possession of schools or the classroom. Accordingly, curriculum should increasingly attend, among other demands, students' need to increase creative and strategic thinking and learning skills. For with such skills, students will continue the learning process far beyond their classroom environment and into their future years.

Dr. Joe A. Hairston
Superintendent

INTRODUCTION

Mathematics PreK-12

Mission Statement

All Baltimore County students will learn rigorous mathematics in an active, engaging environment and will be taught by an effective, highly qualified teacher. Instruction will be appropriate for every student and will integrate cutting-edge technology into an application-based mathematical program building the foundation for interested students to step into the world of science, engineering, and applied and pure mathematics. Teachers in mathematics classrooms will create an instructional environment for students to gain an appreciation of mathematics and to understand how mathematics is a viable subject connected to all aspects of everyday life.

Vision for Mathematics PreK-12 Curricula

The integrity of the Baltimore County PreK–12 Mathematics program implementation is maintained in order to ensure that the written curriculum is the taught and the assessed curriculum.

- The curriculum objectives, indicators, core learning goals, and standards of all mathematics curricula are aligned with the National Council of Teachers of Mathematics standards, the College Board Standards where appropriate, and the Maryland State Department of Education Voluntary State Curriculum.
- The Baltimore County mathematics curricula will establish creative, differentiated instruction which will be meaningful, applicable, and achievable for all students.
- The Office of Mathematics PreK-12 will provide the necessary resources and staff development needed to ensure the effective implementation of the written curriculum.
- The Office of Mathematics PreK-12 will develop systemwide assessments in collaboration with the Department of Research, Accountability, and Assessment in order to provide a consistent framework of assessment across all schools and to provide teachers with data to target student achievement.
- The Office of Mathematics PreK-12 will provide professional development for all teachers of mathematics in order to ensure that classroom instruction is motivating, engaging, sequenced logically, and aligned with the curriculum, local assessments, and state assessments.

The Baltimore County mathematics program is designed to support the attainment of the standards in the Maryland Voluntary State Curriculum for Mathematics and the Performance Indicators as outlined in the BCPS *Blueprint for Progress* and in the *Master Plan for Baltimore County Public Schools*. In order to meet these state and county goals, we believe in the following instructional principles:

- Daily, rigorous, and effective mathematics instruction ensures that all students will meet the as identified in the Baltimore County Mathematics curriculum that is aligned to the Maryland Voluntary State Curriculum standards.
- The content of mathematics is taught using the processes of problem solving, reasoning, making connections, and communicating mathematically using multiple representations.

- Mathematics concepts and vocabulary are integrated into real life situations, other content areas, and with other mathematical topics. This increases students’ understanding and leads to effective learning of mathematics.
- Students need to develop an understanding of the mathematical concepts and skills that lead to accuracy and fluency when solving mathematics problems.
- The use of manipulatives helps students to develop a concrete understanding of the concepts and serves as a basis for proving the reasonableness of a solution.
- New knowledge and understanding is built on prior mathematical knowledge and real life experiences.
- Instruction is differentiated to assist all students in meeting grade level standards using the levels of abstraction, the students’ mathematics understanding, and the students’ learning preferences.
- Students need to be actively involved in the learning process by participating in hands-on activities, small group and partner work, discussions between teacher and student and student-to-student, and opportunities to reflect and communicate their understanding and knowledge using multiple representations.
- Students should be taught the appropriate use of the tools of technology for mathematics to assist in accurately solving mathematics problems.
- In order to assess how students are progressing toward meeting achievement expectations, their individual knowledge and understanding is continually assessed during all parts of the daily lesson.

Performance Goal 1 in the *Blueprint for Progress* clearly outlines the expectations for all Baltimore County Public School students: “By 2012, all students will reach high standards, as established by the Baltimore County Public Schools and State performance level standards, in reading/language arts, mathematics, science and social studies.” Under Dr. Hairston’s leadership, an expectation of rigorous coursework has been embraced. The Office of Mathematics PreK-12 is committed to this goal and to access for all students to a rigorous course of study. Baltimore County Public Schools continuously pushes students towards AP courses and college prep courses. All diploma bound students receive credits in Algebra I, Geometry, and Algebra 2 minimally – all courses needed for students to be successful on college entrance assessments and needed for success in college and the work world.

There are 42 curriculum guides for 66 mathematics courses currently being taught in Baltimore County Public Schools. Some of the curriculum guides were designed to include the curriculum for more than one course. For example, the curriculum guide for Algebra I also includes differentiated curriculum for GT Grade 7 Algebra I, Grade 8 Academic Algebra I, High School Academic Algebra I, and Algebra and Data Analysis Adapted – five courses with one curriculum guide. The curricula for Mathematics PreK-12 range from the prekindergarten mathematics program to the gifted and talented Grade 5 mathematics course at the elementary level, from Algebraic Foundations in Grade 6 to gifted and talented Grade 8 Algebra 2 at the middle school level, and from Algebra and Data Analysis Adapted to Linear Algebra, an online course, at the high school level. The curriculum guide for each course describes the instructional path needed to progress from the standards and objectives of the course towards the target assessments created as part of the curriculum guide. Each guide includes the portion of the scope and sequence for PreK-12 mathematics that includes the grade/course before, the course, and the

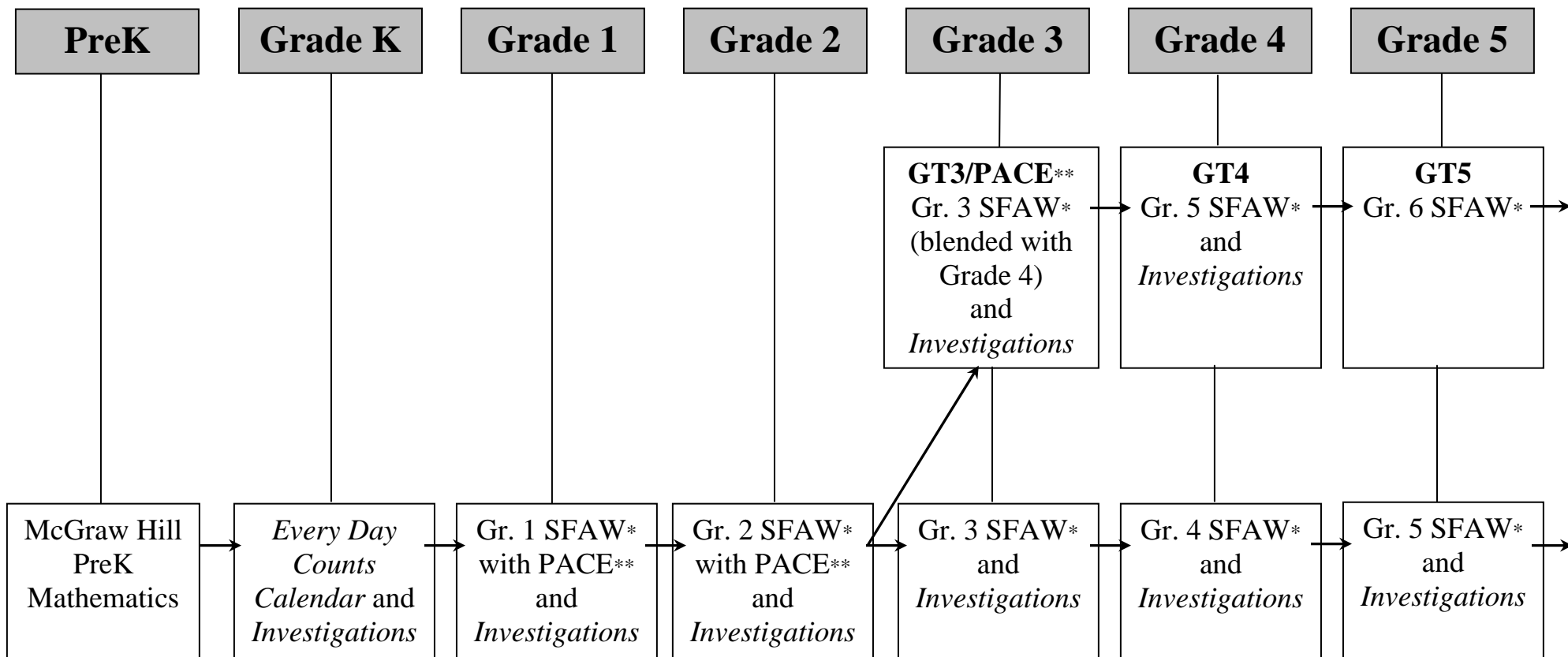
grade/course after in order for teachers to see the path of instruction and the importance of the current course objectives in the schema of mathematics. Articulated Instruction Modules (A.I.M.) provides the lens through which the curriculum can be viewed for alignment with the Voluntary State Curriculum and the state Core Learning Goals.

Curriculum guides vary depending on the content of the courses but each guide provides teachers with the necessary framework to plan and implement that particular mathematics program. Every curriculum guide is aligned to appropriate standards. For example, prekindergarten through Grade 8 curricula are aligned to the Voluntary State Curriculum; and, Algebra I courses and Geometry courses are aligned to the Core Learning Goals. Beyond algebra and geometry, the courses are aligned to the National Council of Teachers of Mathematics standards and the College Board Standards. Advanced placement courses for Calculus and Statistics are aligned to the College Board standards for that content. Each curriculum is designed to be an integral part of the PreK-12 mathematics program in meeting the county performance goals outlined in the *Blueprint for Progress* to help students meet state and county standards. Each is also designed to help students become confident mathematicians who understand mathematics, are effective problem solvers, can reason mathematically, and can communicate their understanding of mathematical concepts.

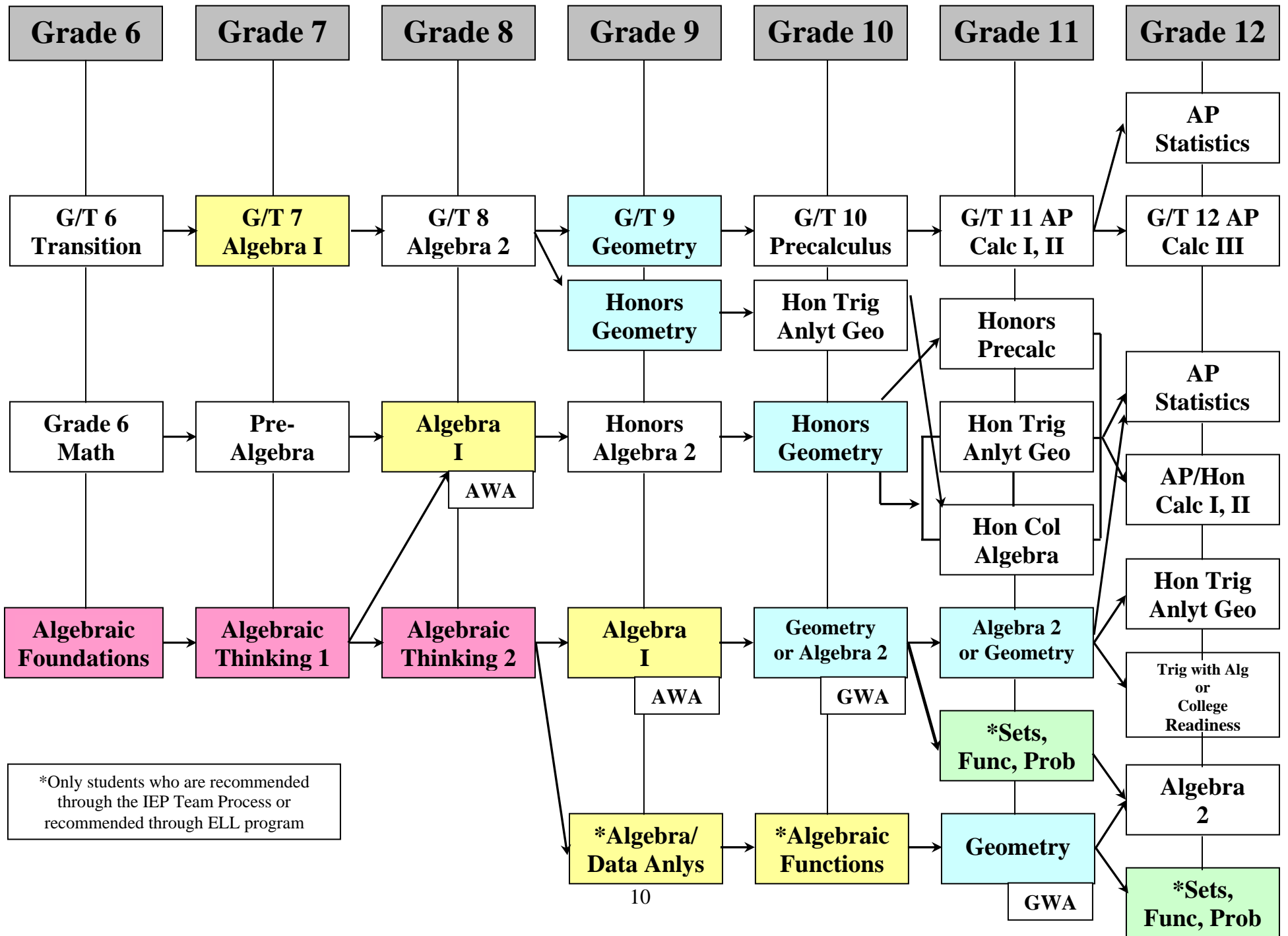
There are many challenges that present themselves when considering the mathematics program for students in preK-12. The bottom line is that Baltimore County Public Schools is committed to mathematics achievement for all students and will provide the necessary support for all students to have opportunities for success in mathematics. Baltimore County Public Schools also recognizes that a highly qualified mathematics teacher is a critical element in the mathematics achievement of students. To this end, a program of sustained, high quality professional development has been developed at all levels for teachers of mathematics. There are cohort programs with local universities to support BCPS teachers in acquiring highly qualified status at their teaching level or to advance their mathematics content.

The Office of Mathematics will continue to review current programs and develop new instructional programs to support all students as they access a high-quality, rigorous mathematics program that will lead them to success in future education and careers.

BCPS MATHEMATICS PROGRAM Grades PreK-5



BCPS MATHEMATICS PROGRAM Grades 6-12



COURSE OBJECTIVES

Elementary Mathematics

The goal of the elementary mathematics program is to teach students to become proficient in the content of elementary mathematics in the areas of number relationships and computation, geometry, measurement, statistics, probability, and algebra. The minimal expectations for each grade are established by the state of Maryland, as outlined in the Maryland Voluntary State Curriculum for Mathematics. These standards are assessed through the Maryland School Assessment program (MSA) in Grades 3, 4, and 5. Students explore these concepts through problem solving, reasoning, communicating ideas about math, and making connections within math and to other subject areas and to the real world.

In elementary mathematics, curriculum enrichment and acceleration are the means by which instructional experiences are differentiated to encourage the development of students' outstanding academic or creative potentials. The curriculum provides differentiation of content, processes, and/or products to accommodate student learning needs. The curriculum developed through the collaborative efforts of the Office of Mathematics PreK-12 and the Office of Gifted and Talented Education provides the differentiated learning experiences necessary to develop the potential of young students and to meet the needs of all gifted and talented mathematics students.

The formal identification process for gifted and talented instruction in mathematics begins at the end of second grade. Students are referred for gifted and talented education in mathematics at the conclusion of second grade, or at any time thereafter, as student identification and placement for gifted and talented education is ongoing.

Prior to this identification process, primary students who demonstrate proficiency in grade level expectations are given numerous opportunities to participate in activities which enrich and extend the grade level mathematics program. It is the philosophy of the Office of Mathematics PreK-12 and the Office of Gifted and Talented Education that students develop a strong number sense and a conceptual understanding of numbers prior to learning algorithms. It is essential for children to understand the flexibility of numbers and how to solve the same problem in more than one way using multiple strategies, rather than just rote computation. Teachers use grade level Primary Achievement and Curriculum Enrichment (PACE) Mathematics activities and resources with students who demonstrate the need for differentiated learning experiences. Student performance data is used to make referrals for gifted and talented education.

Prekindergarten Mathematics

Students in pre-kindergarten should know and be able to:

- Count orally to 10.
- Use one-to-one correspondence (touch an object and give that object a number name) to count up to five objects.
- Match objects that are the same size, shape, and color.
- Sort objects by one characteristic (color, size, shape, etc.).
- Use materials to make a simple pattern (such as red block, blue block, red block, blue block, red block, blue block.)
- Match triangles, circles, and squares.
- Begin to orally use mathematical vocabulary to describe and explain thinking.

Objectives:

- O-1. Students will identify, copy, and extend simple repeating patterns using no more than 2 different objects or actions in the core of the pattern.
- O-2. Students will sort objects by one attribute.
- O-3. Students will recognize and use the attributes of plane and solid geometric figures.
- O-4. Students will begin to recognize a transformation.
- O-5. Students will recognize and use measurement attributes.
- O-6. Students will explore and display data.
- O-7. Students will build sets 0 to 5.
- O-8. Students will match a numeral to a set 0 to 5.
- O-9. Students will represent and sequence numbers.

Kindergarten Mathematics

Students in kindergarten should know and be able to:

- Count orally to 31.
- Create a set containing 1-10 members.
- Match a numeral to a set.
- Recognize, duplicate, and extend simple patterns by using materials.
- Sort and regroup everyday objects according to attributes such as size, color, or shape.
- Identify the shapes triangle, circle, square, and rectangle by name.
- Use non-standard units (such as paper clips, blocks, etc.) to measure length, weight, and capacity.
- Use mathematical vocabulary to orally describe and explain thinking.
- Describe and explain mathematical thinking using pictures, words, and symbols.

Objectives:

- O-1. Students will identify, copy, describe, create, and extend non-numeric patterns.
- O-2. Students will recognize and describe plane geometric figures.
- O-3. Students will recognize, describe, and use the attributes of solid geometric figures.
- O-4. Students will demonstrate a transformation.
- O-5. Students will analyze geometric figures and pictures.
- O-6. Students will explore measurement units.
- O-7. Students will measure using non-standard units.
- O-8. Students will read and interpret data displays.
- O-9. Students will represent and sequence numbers.
- O-10. Students will build sets 0 to 10.
- O-11. Students will match a numeral to a set.
- O-12. Students will choose the coin (penny, nickel, dime) named from a given set of mixed coins and identify the value of the coin.
- O-13. Students will model and describe addition and subtraction.

Grade 1 Mathematics:

Students in grade one should know and be able to:

- Read, write, represent, and compare whole numbers through 100 using models, symbols, and words.
- Develop strategies for addition and subtraction basic facts.
- Solve addition and subtraction word problems using manipulatives and a variety of strategies.
- Identify, describe, extend, and create non-numeric patterns (using shapes, colors, sizes).
- Identify, name, and compare two-dimensional shapes (squares, triangles, rectangles, circles, etc.) by their attributes (number of sides and corners).
- Identify three-dimensional shapes
- Measure to the nearest inch.
- Organize and interpret data on a graph to answer questions or solve problems.
- Use mathematical vocabulary to describe and explain thinking.
- Describe and explain mathematical thinking using pictures, words, and symbols.

Objectives:

- O-1. Students will identify, describe, extend, and create numeric patterns.
- O-2. Students will identify, describe, create, and extend non-numeric patterns.
- O-3. Students will identify, write, and solve equations and inequalities.
- O-4. Students will recognize and apply the attributes of plane geometric figures.
- O-5. Students will recognize and use the attributes of solid geometric figures.
- O-6. Students will recognize a transformation.
- O-7. Students will analyze geometric figures and pictures.
- O-8. Students will read measurement units.
- O-9. Students will read and represent customary measurement units of time.
- O-10. Students will measure in customary units.
- O-11. Students will collect, organize, and display data.
- O-12. Students will analyze data displays.
- O-13. Students will count, read, write, and represent whole numbers to 100.
- O-14. Students will compose and decompose quantities up to 20.
- O-15. Students will compare and order whole numbers up to 99.
- O-16. Students will read, write, and represent fractions.
- O-17. Students will count and represent money amounts.
- O-18. Students will analyze number relations to add whole numbers.
- O-19. Students will analyze number relations to subtract whole numbers.

Grade 2 Mathematics:

Students in grade two should know and be able to:

- Read, write, represent, and compare whole numbers through 1,000 using models, symbols, and words.
- Use a variety of strategies to solve addition and subtraction basic facts.
- Solve addition and subtraction word problems using a variety of strategies.
- Solve two-digit addition and subtraction problems without and with regrouping ($24 + 13$ and $45 + 27$).
- Identify, describe, extend, and create non-numeric (repeating patterns) and numeric patterns (such as skip counting by 2's, 5's, 10's).
- Identify, describe, and compare two- and three-dimensional shapes by their attributes.
- Measure to the nearest inch and centimeter.
- Describe and interpret data on tables, pictographs, and bar graphs.
- Use mathematical vocabulary to describe and explain thinking.
- Describe and explain mathematical thinking using pictures, words, and symbols.

Objectives:

- O-1. Students will identify, describe, extend, and create numeric patterns.
- O-2. Students will identify, describe, create, and extend non-numeric patterns.
- O-3. Students will write and identify expressions.
- O-4. Students will identify, write, and solve equations and inequalities.
- O-5. Students will recognize and apply the attributes of plane geometric figures.
- O-6. Students will analyze the attributes of solid geometric figures.
- O-7. Students will recognize transformations.
- O-8. Students will analyze geometric figures and pictures.
- O-9. Students will read measurement units.
- O-10. Students will read and represent customary measurement units of time.
- O-11. Students will measure in customary and metric units.
- O-12. Students will determine perimeter and area.
- O-13. Students will collect, organize, and display data.
- O-14. Students will analyze data.
- O-15. Students will read, write, represent, and describe whole numbers to 1,000.
- O-16. Students will compare and order whole numbers to 999.
- O-17. Students will read, write, and represent fractions.
- O-18. Students will count and represent money amounts.
- O-19. Students will analyze number relations to add whole numbers.
- O-20. Students will analyze number relations to subtract whole numbers.
- O-21. Students will solve problems based on a multiplication situation.
- O-22. Students will solve problems based on a division situation.

Grade 3 Mathematics:

Students in grade three should know and be able to:

- Read, write, represent, and order whole numbers to 10,000.
- Add and subtract whole numbers without and with regrouping.
- Use number sentences, pictures, or drawings to represent basic multiplication and division facts.
- Read, write, and represent fractions as part of a whole and as part of a group.
- Use a ruler to measure length of objects to the nearest half inch and nearest centimeter.
- Construct and interpret tables, pictographs, and bar graphs.
- Identify, represent, and describe one-, two-, and three-dimensional figures such as line segments, angles, triangles, quadrilaterals, pentagons, hexagons, octagons, cones, cylinders, cubes, and prisms.
- Use mathematical vocabulary to describe and explain thinking.
- Describe and explain mathematical thinking using pictures, words, and symbols.

Objectives:

- O-1. Students will identify, describe, extend, and create numeric patterns and functions.
- O-2. Students will identify, describe, extend, and create non-numeric growing patterns and repeating patterns.
- O-3. Students will write, identify, and solve expressions, equations, and inequalities.
- O-4. Students will locate points on a number line.
- O-5. Students will analyze the properties of plane geometric figures, and represent plane geometric figures.
- O-6. Students will analyze the properties of solid geometric figures.
- O-7. Students will analyze congruent figures.
- O-8. Students will analyze transformations in geometric figures and pictures.
- O-9. Students will analyze geometric figures and pictures using knowledge of symmetry.
- O-10. Students will read customary and metric units of length.
- O-11. Students will read customary units of time.
- O-12. Students will estimate and read customary units of weight.
- O-13. Students will read customary and metric measurement units of temperature.
- O-14. Students will measure in customary and metric units.
- O-15. Students will apply measurement concepts using perimeter and area.
- O-16. Students will determine equivalent measurements.
- O-17. Students will collect, organize, and display data.
- O-18. Students will analyze data displayed in graphs.
- O-19. Students will identify the probability of one simple event.
- O-20. Students will apply knowledge of whole numbers and place value using whole numbers up to 10,000.
- O-21. Students will apply knowledge of fractions.
- O-22. Students will represent, describe, and compute with decimals.
- O-23. Students will apply knowledge of money.
- O-24. Students will apply number relationships.
- O-25. Students will analyze number relations to add whole numbers.
- O-26. Students will analyze number relations to subtract whole numbers.
- O-27. Students will analyze number relations and compute using fractions with like denominators.

- O-28. Students will analyze number relations to represent multiplication basic facts.
- O-29. Students will analyze number relations to represent division basic facts.
- O-30. Students will analyze number relations to multiply and divide whole numbers.

Grade 3 GT Mathematics:

In grade three, identified gifted and talented students are provided with a blended curriculum, encompassing both grade three and grade four Maryland Voluntary State Curriculum (VSC) skills. Differentiation is provided through the GT/ PACE mathematics curriculum, which enriches and accelerates grade level content and skills. The blending of grade three and grade four skills enables gifted and talented students to transition successfully to an accelerated program in grade four. The grade three mathematics planning grids provide teachers with resources to both enrich and accelerate the instructional program. Additionally, the unit assessments are differentiated, with the GT/PACE assessments addressing both grade three and grade four content and skills.

The purpose of grade three GT/PACE is to provide students with appropriately challenging learning experiences in mathematics. As in all grades, student performance data is used to make recommendations for placement in gifted and talented education. Students may be identified for gifted and talented education placement in GT/PACE mathematics at the conclusion of grade two or they may be diagnostically placed for the first quarter of grade three. At the end of the first quarter, grade three diagnostic placements are evaluated. Students who are diagnostically placed and successfully complete the accelerated lesson components and GT/PACE assessments on a consistent basis should be formally identified for gifted and talented education in mathematics. Students may complete the enrichment lesson components without being formally identified.

Students in grade three gifted and talented should know and be able to:

- Identify, describe, extend, analyze, and create patterns.
- Add and subtract whole numbers and money amounts.
- Multiply and divide whole numbers.
- Read, write, and represent fractions and decimals using symbols, words, models, and pictures.
- Compare and order whole numbers, fractions, and decimals
- Add and subtract fractions and mixed numbers with like denominators, and express answers in simplest form.
- Organize, display, and interpret line plots and line graphs.
- Identify and classify angles and polygons, and analyze properties of three-dimensional figures.
- Identify the result of a transformation (translation-slide, rotation-turn, and reflection-flip).
- Solve for the unknown using algebraic thinking.
- Use a ruler to measure objects to the nearest $\frac{1}{4}$ inch or nearest millimeter.
- Use addition and multiplication strategies to determine area and perimeter.
- Use mathematical vocabulary, pictures, and symbols to describe and explain mathematical thinking used to solve problems.

Objectives:

- O-1. Students will identify, describe, extend, and create numeric patterns and functions.
- O-2. Students will identify, describe, extend, analyze, and create non-numeric growing patterns and repeating patterns.
- O-3. Students will write numeric and algebraic expressions and evaluate algebraic expressions.
- O-4. Students will identify, write, and solve inequalities and equations.

- O-5. Students will locate points on a number line and in a coordinate grid.
- O-6. Students will represent and analyze properties of plane geometric figures.
- O-7. Students will analyze the properties of solid geometric figures.
- O-8. Analyze the relationship between plane geometric figures and surfaces of solid geometric figures.
- O-9. Students will analyze congruent figures.
- O-10. Students will analyze transformations in geometric figures or pictures.
- O-11. Students will analyze geometric figures and pictures using knowledge of symmetry.
- O-12. Students will read customary and metric units of length.
- O-13. Students will apply measurement concepts of time.
- O-14. Students will read customary and metric measurement units of temperature.
- O-15. Students will read customary units of weight.
- O-16. Students will measure in customary and metric units.
- O-17. Students will apply measurement concepts using perimeter and area.
- O-18. Students will calculate equivalent measurements.
- O-19. Students will collect, organize, and display data.
- O-20. Students will analyze data displayed on graphs.
- O-21. Students will identify the probability of one simple event.
- O-22. Students will apply knowledge of whole numbers and place value using whole numbers to 1,000,000.
- O-23. Students will apply knowledge of fractions.
- O-24. Students will apply knowledge of decimals through hundredths, and compute using decimals.
- O-25. Students will apply knowledge of money.
- O-26. Students will apply number relationships.
- O-27. Students will analyze number relations to add whole numbers.
- O-28. Students will analyze number relations to subtract whole numbers.
- O-29. Students analyze number relations to add and subtract proper fractions and mixed numbers with like denominators.
- O-30. Students will analyze number relations to represent multiplication and division basic facts.
- O-31. Students will analyze number relations to multiply whole numbers.
- O-32. Students will analyze number relations to divide whole numbers.

Grade 4 Mathematics:

Students in grade four should know and be able to:

- Identify, describe, extend, analyze, and create patterns.
- Add and subtract whole numbers and money amounts.
- Multiply and divide whole numbers.
- Read, write, and represent fractions and decimals using symbols, words, models, and pictures.
- Compare and order whole numbers, fractions, and decimals
- Add and subtract fractions and mixed numbers with like denominators, and express answers in simplest form.
- Organize, display, and interpret line plots and line graphs.
- Identify and classify angles and polygons, and analyze properties of three-dimensional figures.
- Identify the result of a transformation (translation-slide, rotation-turn, and reflection-flip).
- Solve for the unknown using algebraic thinking.
- Use a ruler to measure objects to the nearest $\frac{1}{4}$ inch or nearest millimeter.
- Use addition and multiplication strategies to determine area and perimeter.
- Use mathematical vocabulary, pictures, and symbols to describe and explain mathematical thinking used to solve problems.

Objectives:

- O-1. Students will identify, describe, and extend numeric patterns and functions.
- O-2. Students will identify, describe, extend, and analyze non-numeric growing patterns and repeating patterns.
- O-3. Students will write, identify, and evaluate expressions.
- O-4. Students will identify, write, and solve equations and inequalities.
- O-5. Students will locate points on a number line and in the first quadrant of a coordinate grid.
- O-6. Students will represent and analyze properties of plane geometric figures.
- O-7. Students will analyze the properties of solid geometric figures.
- O-8. Students will analyze the relationship between plane geometric figures and the surfaces of solid geometric figures.
- O-9. Students will analyze transformations and describe geometric figures as congruent.
- O-10. Students will read customary and metric measurement units.
- O-11. Students will measure customary and metric units of length.
- O-12. Students will determine equivalent units of measurement.
- O-13. Students will determine capacity, weight, and mass.
- O-14. Students will apply measurement concepts of time.
- O-15. Students will apply measurement concepts using perimeter and area.
- O-16. Students will collect, organize, and display data.
- O-17. Students will analyze data.
- O-18. Students will describe a set of data.
- O-19. Students will identify possible outcomes and determine probability.
- O-20. Students will apply knowledge of whole numbers and place value to read, write, represent, and describe whole numbers to 1,000,000.
- O-21. Students will apply knowledge of fractions.
- O-22. Students will apply knowledge of mixed numbers.
- O-23. Students will apply knowledge of decimals through hundredths.

- O-24. Students will apply knowledge of money.
- O-25. Students will apply knowledge of number relationships.
- O-26. Students will add and subtract whole numbers, decimals through hundredths, and money amounts.
- O-27. Students will multiply whole numbers.
- O-28. Students will divide whole numbers.
- O-29. Students will add and subtract proper fractions and mixed numbers.

Grade 4 GT/Grade 5 Mathematics:

In grade four, students who are identified for gifted and talented mathematics education participate in an accelerated instructional program. The exception to the accelerated program is the use of grade level Engagements. Students participate in grade level Engagements, which are provided in each mathematics guide for all students and teachers. Teachers use these resources to reinforce skills and concepts aligned with the grade level VSC.

Identified gifted and talented students in grade four receive instruction in the grade five Maryland VSC mathematics skills through the BCPS Grade 5 mathematics program. Teachers utilize the grade five textbook and planning grids and administer the grade five assessments.

Students in grade four gifted and talented or grade five should know and be able to:

- Multiply and divide whole numbers and interpret remainders.
- Read, write, and represent simple fractions, decimals, and percents using symbols, words, and models.
- Compare and order fractions and decimals.
- Add and subtract fractions, mixed numbers, and decimals, and express answers in simplest form.
- Write the rule for a function table, complete a function table, and find the unknown in an equation.
- Determine start time, end time, and elapsed time.
- Measure length to one-eighth of inch with a ruler.
- Determine area and perimeter.
- Use a protractor to measure and draw acute, obtuse, and right angles.
- Analyze the properties of solid geometric figures such as prisms and pyramids.
- Organize, display, and interpret line graphs, stem-and-leaf plots, line plots, and double bar graphs.
- Determine the probability of a simple event as a fraction.
- Use mathematical vocabulary, pictures, and symbols to describe and explain mathematical thinking used to solve problems.

Objectives:

- O-1. Students will describe and extend numeric patterns and analyze function tables.
- O-2. Students will write and evaluate expressions.
- O-3. Students will identify, write, and solve equations and inequalities.
- O-4. Students will locate points on a number line and in a coordinate grid.
- O-5. Students will analyze the properties of plane geometric figures.
- O-6. Students will analyze geometric relationships.
- O-7. Students will analyze the properties of solid geometric figures.
- O-8. Students will represent plane geometric figures.
- O-9. Students will analyze transformations.
- O-10. Students will select and read customary and metric measurement units, and measure using customary measurement units.
- O-11. Students will read and calculate units of time.
- O-12. Students will measure angles.
- O-13. Students will estimate and apply measurement formulas.
- O-14. Students will calculate equivalent measurements.

- O-15. Students will collect, organize, and display data.
- O-16. Students will analyze data from data displays.
- O-17. Students will describe data sets and data displays using measures of central tendency.
- O-18. Students will determine possible outcomes of independent events, and determine the probability of one simple event.
- O-19. Students will read, write, and represent whole numbers, fractions, mixed numbers, and decimals.
- O-20. Students will identify and determine equivalent forms of proper fractions as decimals, percents, and ratios.
- O-21. Students will compare and order fractions and/or mixed numbers.
- O-22. Students will compare and order decimals.
- O-23. Students will apply number relationships.
- O-24. Students will add and subtract proper fractions and mixed numbers.
- O-25. Students will add and subtract decimals through thousandths, including money amounts.
- O-26. Students will multiply whole numbers and decimals.
- O-27. Students will divide using whole numbers and decimals.
- O-28. Students will calculate the percent of a whole number.
- O-29. Students will analyze ratios.

Grade 5 GT Mathematics:

In grade five, students who are identified for gifted and talented mathematics education participate in an accelerated instructional program. The exception to the accelerated program is the use of grade level Engagements. Students participate in grade level Engagements, which are provided in each mathematics guide for all students and teachers. Teachers use these resources to reinforce skills and concepts aligned with the grade level VSC.

In grade five, identified gifted and talented students receive instruction in the grade six Maryland VSC mathematics skills through the BCPS Grade 5 GT mathematics program. Teachers utilize a grade six textbook, which is aligned with the Grade 5 GT planning grids and assessments.

Students in grade five should know and be able to:

- Add and subtract integers.
- Read, write, and represent whole numbers, integers, and rational numbers using symbols, words, and models.
- Add, subtract, multiply, and divide fractions, mixed numbers, and decimals.
- Write and evaluate expressions, and solve equations and inequalities.
- Select, measure, and read appropriate metric and customary units of measure, and calculate equivalent measurements.
- Determine area, perimeter, and volume of geometric figures.
- Analyze the properties of solid geometric figures such as prisms, pyramids, and cylinders.
- Determine ratios, proportions, and percents.
- Organize, display, and interpret data in various displays.
- Determine theoretical probability of a simple event.
- Use mathematical vocabulary, pictures, and symbols to describe and explain mathematical thinking used to solve problems.

Objectives:

- O-1. Students will analyze function tables.
- O-2. Students will write and evaluate expressions.
- O-3. Students will identify, write, and solve equations and inequalities.
- O-4. Students will locate points on a number line and in a coordinate plane.
- O-5. Students will analyze linear relationships.
- O-6. Students will analyze properties of plane geometric figures.
- O-7. Students will analyze geometric relationships.
- O-8. Students will represent plane geometric figures.
- O-9. Students will select, measure, and read appropriate metric and customary units of measure, and calculate equivalent measurements.
- O-10. Students will estimate and apply measurement formulas for plane geometric figures.
- O-11. Students will apply measurement formulas for 3-dimensional figures.
- O-12. Students will collect, organize, and display data.
- O-13. Students will analyze data from data displays.
- O-14. Students will determine theoretical probability of one simple event.
- O-15. Students will make predictions and express experimental probability.
- O-16. Students will read, write, and represent whole numbers, integers, and rational numbers.

- O-17. Students will identify and determine equivalent forms of fractions, decimals, percents, and ratios.
- O-18. Students will compare and order rational numbers (fractions, mixed numbers, decimals, and integers).
- O-19. Students will apply number relationships.
- O-20. Students will add and subtract fractions and mixed numbers, and express answers in simplest form.
- O-21. Students will add and subtract integers.
- O-22. Students will simplify numeric expressions using the properties of addition and multiplication.
- O-23. Students will multiply decimals.
- O-24. Students will divide decimals.
- O-25. Students will multiply and divide fractions and mixed numbers, and express answers in simplest form.
- O-26. Students will calculate with percents.
- O-27. Students will analyze ratios and proportions.

Middle School Mathematics

The mathematics courses in the middle grades transition the students from the foundational skills learned in the elementary grades through the preparation for Algebra I and beyond. The curricula at the middle school level ranges from Algebraic Foundations in Grade 6 to gifted and talented Grade 8 Algebra 2. The three Algebraic Thinking courses are on-grade level courses designed for students who struggle with mathematics and need an alternate method for learning mathematics. The three courses, Algebraic Foundations (grade 6), Algebraic Thinking Part 1 (grade 7), and Algebraic Thinking Part 2 (grade 8), prepare students for success in Algebra I at the ninth grade level.

The minimal expectations for each grade are established by the state of Maryland, as outlined in the Maryland Voluntary State Curriculum for Mathematics. These standards are assessed through the Maryland School Assessment program (MSA) in Grades 6, 7, and 8. Students in GT7 Algebra I and Grade 8 Algebra I are not only assessed on their grade level MSA but also on the Core Learning Goals through the High School Assessment (HSA) for Algebra/Data Analysis. Passing the HSA is a graduation requirement for all students.

Algebraic Foundation

Algebraic Foundation provides an alternate approach to grade 6 mathematics, building mathematical concepts and connections through a daily problem solving approach, use of manipulatives and graphic organizers, engaging activities, and spiraling review techniques.

Objectives

- O-1. Students will solve real-world problems by applying a variety of concepts, processes, and skills.
- O-2. Students will evaluate numerical expressions using the order of operations.
- O-3. Students will organize and display data in order to make decisions or predictions.
- O-4. Students will identify and determine equivalent forms of fractions in order to convert between fractions, decimals, and percents.
- O-5. Students will add, subtract, multiply, and divide fractions with answers expressed in simplest forms in order to simplify numerical expressions.
- O-6. Students will determine the probability of simple events comprised of equally likely outcomes.
- O-7. Students will demonstrate the meaning and effects of arithmetic operations with decimals.
- O-8. Students will locate points on a number line and in a coordinate plane.
- O-9. Students will identify, write, solve, and apply one-step equations.
- O-10. Students will use ratios, proportions, and percents to represent quantitative relationships.
- O-11. Students will select and use appropriate units/formulas from the customary to measure length, area, and volume.
- O-12. Students will demonstrate the meaning and effects of arithmetic operations with integers.
- O-13. Students will identify, write, solve, and apply two-step equations.
- O-14. Students will identify, write, solve, and apply inequalities.
- O-15. Students will analyze the properties of plane geometric figures.
- O-16. Students will analyze geometric relationships.
- O-17. Students will analyze a transformation on a coordinate plane.
- O-18. Students will analyze and interpret data in order to make decisions or predictions.

Mathematics 6

The Mathematics 6 course is designed to provide students with opportunities to think mathematically and to communicate their mathematical understanding. It emphasizes the conceptual development of mathematical processes that enable students to bridge from arithmetic to algebra, presenting a continuum of skills in the content area from fractions, decimals, and integers to geometry, probability, and algebraic thinking. As students complete the program, they should be able to apply a range of problem-solving strategies to a variety of real-world problems and become knowledgeable contributors to society.

Objectives:

- O-1. Students will identify, describe, extend, and create numeric patterns and functions.
- O-2. Students will write and evaluate expressions.
- O-3. Students will identify, write, and solve equations.
- O-4. Students will identify, write, and solve inequalities.
- O-5. Students will locate points on a number line and in a coordinate plane.
- O-6. Students will analyze linear relationships.
- O-7. Students will analyze the properties of plane geometric figures.
- O-8. Students will analyze geometric relationships.
- O-9. Students will represent plane geometric figures.
- O-10. Students will analyze congruent figures.
- O-11. Students will select and use appropriate tools and units.
- O-12. Students will use objects and reasoning to develop and use measurement formulas.
- O-13. Students will organize and display data.
- O-14. Students will analyze data.
- O-15. Students will describe a set of data.
- O-16. Students will identify a sample space.
- O-17. Students will determine the probability of one simple event comprised of equally likely outcomes.
- O-18. Students will apply knowledge of rational numbers and place value.
- O-19. Students will apply knowledge of exponents and place value.
- O-20. Students will apply number relationships.
- O-21. Students will analyze number relations and compute.
- O-22. Students will use estimation to determine the reasonableness of answers.
- O-23. Students will analyze and use ratios and proportions.

GT6 Transition Mathematics

This course is designed to prepare mathematically gifted and talented sixth grade students for the study of algebra and geometry, emphasizes pattern analysis and technologies that enable the development of skills in deductive and inductive reasoning, and features the application of mathematics to the real world. The challenging pace and the content respond to the needs of students who have demonstrated unusual promise in mathematics.

Objectives:

- O-1. Students will identify, describe, write, and evaluate expressions.
- O-2. Students will identify, write, solve, and apply equations and inequalities.
- O-3. Students will apply equations to abstract and real-world situations.
- O-4. Students will locate points on a number line and in a coordinate plane.
- O-5. Students will analyze the properties of plane geometric figures.
- O-6. Students will analyze geometric relationships.
- O-7. Students will represent plane geometric figures.
- O-8. Students will analyze transformations on a coordinate plane.
- O-9. Students will measure in customary and metric units.
- O-10. Students will estimate and apply measurement formulas.
- O-11. Students will analyze measurement relationships.
- O-12. Students will organize and display data.
- O-13. Students will analyze data.
- O-14. Students will determine the probability of one simple event comprised of equally likely outcomes.
- O-15. Students will analyze the results of a probability experiment.
- O-16. Students will apply knowledge of rational numbers and place value.
- O-17. Students will analyze number relations and compute.
- O-18. Students will use estimation to determine the reasonableness of answers.
- O-19. Students will analyze ratios, proportions, or percents.
- O-20. Students will recognize and apply number relationships.

Algebraic Thinking Part 1

Algebraic Thinking Part 1 provides an alternate approach to Prealgebra concepts, building mathematical concepts and connections through a daily problem solving approach, use of manipulatives and graphic organizers, engaging activities, and spiraling review techniques.

Objectives:

- O-1. Students will conduct experiments and simulations to determine the probability of dependent and independent events.
- O-2. Students will use percents to represent and solve problems in authentic settings.
- O-3. Students will use tables, graphs, stem-and-leaf plots, box-and-whisker plots, and scatter plots to display and interpret data and make predictions.
- O-4. Students will use proportions to represent and solve problems in authentic settings.
- O-5. Students will identify and describe relationships between angles formed when parallel lines are cut by a transversal.
- O-6. Students will use integers to represent real-world situations and to solve problems.
- O-7. Students will perform operations (addition and subtraction) on rational numbers.
- O-8. Students will perform operations (multiplication and division) on rational numbers.
- O-9. Students will use measures of central tendency and spread to interpret and compare data.
- O-10. Students will identify, describe, and plot the results of multiple transformations on a coordinate plane.
- O-11. Students will use square roots to represent rational and irrational numbers and to solve problems involving right triangles.
- O-12. Students will write and evaluate algebraic expressions.
- O-13. Students will write, solve, and apply algebraic equations and inequalities.
- O-14. Students will locate points on a number line and in a coordinate plane.
- O-15. Students will use formulas to find area, circumference, and surface area of geometric figures.
- O-16. Students will use formulas to find the volume of geometric figures.

Prealgebra 7

The expectations for students in middle school mathematics move from arithmetic to abstract concepts and algebraic models in the Prealgebra 7 program. The course of study has been designed to stimulate students to investigate the real number system and to use algebra and geometry to solve problems. These increased expectations respond to state and system goals which require that all students demonstrate proficiency in algebra and geometry and are prepared for success in Algebra I.

Objectives:

- O-1. Students will identify, describe, extend, and create linear patterns and functions.
- O-2. Students will write and evaluate expressions.
- O-3. Students will identify, write, solve, and apply equations.
- O-4. Students will identify, write, solve, and apply inequalities.
- O-5. Students will locate points on a number line and in a coordinate plane.
- O-6. Students will analyze linear relationships.
- O-7. Students will analyze the properties of plane geometric figures.
- O-8. Students will analyze geometric relationships.
- O-9. Students will represent plane geometric figures.
- O-10. Students will apply the properties of congruent polygons.
- O-11. Students will analyze a transformation on a coordinate plane.
- O-12. Students will estimate and apply measurement formulas.
- O-13. Students will analyze measurement relationships.
- O-14. Students will organize and display data.
- O-15. Students will analyze data.
- O-16. Students will describe a set of data.
- O-17. Students will identify a sample space.
- O-18. Students will determine the probability of an event comprised of no more than 2 independent events.
- O-19. Students will analyze the results of a survey or simulation.
- O-20. Students will apply knowledge of rational numbers and place value.
- O-21. Students will analyze number relations and compute.
- O-22. Students will use estimation to determine the reasonableness of answers.
- O-23. Students will analyze ratios, proportions, or percents.

GT7 Algebra I

Algebra I is a graduation requirement for Baltimore County students that not only meets the MSDE graduation requirement for a course in algebra but also prepares students for both Geometry and Algebra II. Identified gifted and talented students are prepared to take this course by grade 7. This course provides the foundation for a program in higher mathematics. The course includes simulations, data analysis, linear functions and graphs, systems of linear equations, irrational numbers, operations with polynomials, and the exploration of non-linear equations. Algebra I requires the use of a graphing calculator which is provided to the students on a daily basis during class time. The HSA Algebra/Data Analysis is administered at the end of the course. Students who pass this course at the middle school level will receive a mathematics credit towards high school graduation requirements.

Objectives:

- O-1. Students will solve and describe if and where two straight lines intersect using numbers, symbols, and/or graphs.
- O-2. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-3. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and, or graphs.
- O-4. Students will describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.
- O-5. Students will represent linear inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-6. Students will apply formulas and/or use matrices (arrays of numbers) to solve problems.
- O-7. Students will make informed decisions and predictions based upon the results of simulations and data from research.
- O-8. Students will interpret data and/or make predictions by finding and using a line of best fit.
- O-9. Students will use the measures of central tendency and/or variability to make informed conclusions.
- O-10. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-11. Students will create and interpret linear graphs.
- O-12. Students will write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-13. Students will solve linear inequalities and describe the solutions using numbers, symbols and/or graphs.
- O-14. Students will describe how the graphical model of a non-linear function represents a given problem and will estimate the solution.
- O-15. Students will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expressions.
- O-16. Students will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.
- O-17. Students will calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.
- O-18. Students will compare and contrast the properties of numbers and number systems, including rational and real numbers.

Algebraic Thinking Part 2

Algebraic Thinking Part 2 provides an alternate approach to Prealgebra concepts, extending the students learning into Algebra I concepts, building mathematical concepts and connections through a daily problem solving approach, use of manipulatives and graphic organizers, engaging activities, and spiraling review techniques.

Objectives:

- O-1. Students will use tables, graphs, and special plots to display and interpret data and make predictions.
- O-2. Students will identify, describe, and plot the results of multiple transformations on a coordinate plane.
- O-3. Students will apply the properties of similarity for geometric figures in order to measure indirectly.
- O-4. Students will use measures of central tendency and spread to interpret and compare data.
- O-5. Students will analyze number relationships and compute.
- O-6. Students will write, simplify, and evaluate expressions.
- O-7. Students will identify, write, solve, and apply equations and inequalities.
- O-8. Students will analyze linear relationships in order to solve real-world problems.
- O-9. Students will solve systems of linear equations.
- O-10. Students will solve and graph linear equations and inequalities.
- O-11. Students will apply given formulas to a problem-solving situation.
- O-12. Students will conduct experiments and simulations to determine the probability of dependent and independent events.
- O-13. Students will use percents to represent and solve problems in authentic settings.
- O-14. Students will use proportions to represent and solve problems in authentic settings.
- O-15. Students will use square roots to represent rational and irrational numbers and to solve problems involving right triangles.

Grade 8 Algebra I

Algebra I is a graduation requirement for Baltimore County students that not only meets the MSDE graduation requirement for a course in algebra but also prepares students for both Geometry and Algebra II. Students who have successfully passed Prealgebra 7 or are otherwise identified are eligible to take Algebra I in the eighth grade. This course provides the foundation for a program in higher mathematics and includes simulations, data analysis, linear functions and graphs, systems of linear equations, irrational numbers, operations with polynomials, and the exploration of non-linear equations. Algebra I requires the use of a graphing calculator that is provided to the students on a daily basis during class time. The HSA Algebra/Data Analysis is administered at the end of the course. Students who pass this course at the middle school level will receive a mathematics credit towards high school graduation requirements.

Objectives:

- O-1. Students will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.
- O-2. Students will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expressions.
- O-3. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-4. Students will describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.
- O-5. Students will represent linear inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-6. Students will apply formulas and/or use matrices (arrays of numbers) to solve problems.
- O-7. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-8. Students will create and interpret linear graphs.
- O-9. Students will solve linear inequalities and describe the solutions using numbers, symbols and/or graphs.
- O-10. Students will describe how the graphical model of a non-linear function represents a given problem and will estimate the solution.
- O-11. Students will interpret data and/or make predictions by finding and using a line of best fit.
- O-12. Students will use the measures of central tendency and/or variability to make informed conclusions.
- O-13. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and, or graphs.
- O-14. Students will solve and describe if and where two straight lines intersect using numbers, symbols, and/or graphs.
- O-15. Students will write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-16. Students will make informed decisions and predictions based upon the results of simulations and data from research.
- O-17. Students will calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.
- O-18. Students will compare and contrast the properties of numbers and number systems, including rational and real numbers.

Algebra II GT8

This course is designed for students who have accelerated their mathematics program and have successfully completed Algebra I by the end of the seventh grade. This course extends algebraic processes and models to matrices, systems of inequalities, linear programming, absolute value functions, quadratic relations and functions, complex numbers, rational equations, exponential functions, and logarithms. Algebra II requires of a graphing calculator that is provided to the students on a daily basis during class time. Students who pass this course at the middle school level will receive a mathematics credit towards high school graduation requirements.

Objectives:

- O-1. Students will generalize patterns using explicitly defined and recursively defined functions.
- O-2. Students will analyze functions on one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
- O-3. Students will perform transformations such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more complicated symbolic expressions.
- O-4. Students will recognize and write equivalent forms of expressions, equations, inequalities, and relations involving rational exponents, absolute values, radicals, and logarithms.
- O-5. Students will recognize and write equivalent forms of expressions, equations, inequalities, and relations involving polynomials.
- O-6. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and/or graphs.
- O-7. Students will write equivalent forms of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-8. Students will solve systems of equations and describe the solutions using numbers, symbols, and or graphs.
- O-9. Students will solve inequalities and systems of inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-10. Students will use a variety of symbolic representations for functions and relations.
- O-11. Students will approximate and interpret rates of change from graphical and numerical data.
- O-12. Students will apply appropriate techniques, tools, and formulas to determine measurements.
- O-13. Students will interpret data and/or make predictions by finding and using the line or curve of best fit.
- O-14. Students will compare and contrast the properties of numbers and number systems and identify and compute with complex numbers.
- O-15. Students will develop fluency in operations with real numbers, vectors, matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases.
- O-16. Students will recognize and identify relations and functions and select, convert flexibly among, and use various representations for them.

High School Mathematics

Students are required to earn three credits in mathematics as part of the high school graduation requirements in Maryland. Algebra I, Algebra II, and Geometry meet the University of Maryland System entrance requirements and prepare students for the High School Assessment in mathematics. Gifted and talented and honors sections of courses are advanced courses for the Maryland High School Certificate of Merit. In these classes, the instructional level and materials are modified according to the needs of the students. Course selections will vary according to the academic level and occupational goals of students. All students are prepared for college through rigorous coursework at the high school level. Course sequences for high school courses are shown below.

Programs	Grade 9	Grade 10	Grade 11	Grade 12
Standard Program	Algebra I	Geometry or Algebra II	Algebra II or Geometry	Trigonometry with Algebra or other Mathematics courses including Advanced Placement Statistics
Standard Program Adapted*	Algebra/Data Analysis Adapted	Algebraic Functions Adapted	Geometry	Sets, Functions, and Probability or Algebra II
Honors Program	Honors Algebra II	Honors Geometry	Honors Trigonometry with Analytic Geometry and/or Honors College Algebra or Honors Precalculus	Honors Trigonometry with Analytic Geometry or Honors College Algebra or Honors Calculus or Advanced Placement Calculus AB and/or Advanced Placement Statistics
GT Program	GT 9 Geometry	GT 10 Precalculus or Trigonometry with Analytic Geometry and College Algebra	Advanced Placement Calculus AB and/or Advanced Placement Statistics	Advanced Placement Calculus BC and/or Advanced Placement Statistics

Online courses are available for students who have completed all other mathematics courses. These courses include Multivariable Differential Calculus, Linear Algebra, and Differential Equations.

Algebra/Data Analysis Adapted

This course focuses solely on the HSA Algebra/Data Analysis Core Learning Goals. Algebra/Data Analysis will include and enhance the development of algebraic relationships and skills through hands-on learning experiences with the integration of manipulatives and technology to ensure that students learn all the concepts and skills required for the successful completion of algebra and the High School Assessment. Algebra and Data Analysis Adapted requires the use of a graphing calculator that is provided to the students on a daily basis during class time. This is a course for which the HSA Algebra/Data Analysis is administered at the end of the course. This course is intended for Grade 9 students recommended through the IEP team process and recommended ELL students attending the BCPS Centers for ELL with appropriate parental approval and final approval from the Office of World Languages.

Objectives:

- O-1. Students will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.
- O-2. Students will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expressions.
- O-3. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-4. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and, or graphs.
- O-5. Students will solve and describe if and where two straight lines intersect using numbers, symbols, and/or graphs.
- O-6. Students will describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.
- O-7. Students will represent linear inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-8. Students will solve linear inequalities and describe the solutions using numbers, symbols and/or graphs.
- O-9. Students will write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-10. Students will apply formulas and/or use matrices (arrays of numbers) to solve real-world problems.
- O-11. Students will create and interpret linear graphs.
- O-12. Students will make informed decisions and predictions based upon the results of simulations and data from research.
- O-13. Students will interpret data and/or make predictions by finding and using a line of best fit.
- O-14. Students will use the measures of central tendency and/or variability to make informed conclusions.
- O-15. Students will calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.
- O-16. Students will compare and contrast the properties of numbers and number systems, including rational and real numbers.

Algebraic Functions Adapted

Algebraic Functions Adapted provides a more in-depth study of concepts introduced in Algebra/Data Analysis Adapted and extends beyond the HSA Algebra/Data Analysis Core Learning Goals to complete an Algebra I program in preparation for Geometry and Algebra II. Algebraic Functions Adapted requires the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.
- O-2. Students will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expressions.
- O-3. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-4. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and, or graphs.
- O-5. Students will solve and describe if and where two straight lines intersect using numbers, symbols, and/or graphs.
- O-6. Students will describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.
- O-7. Students will represent linear inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-8. Students will apply formulas and/or use matrices (arrays of numbers) to solve real-world problems.
- O-9. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-10. Students will create and interpret linear graphs.
- O-11. Students will write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-12. Students will solve linear inequalities and describe the solutions using numbers, symbols and/or graphs.
- O-13. Students will make informed decisions and predictions based upon the results of simulations and data from research.
- O-14. Students will interpret data and/or make predictions by finding and using a line of best fit.
- O-15. Students will use the measures of central tendency and/or variability to make informed conclusions.
- O-16. Students will calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.
- O-17. Students will compare and contrast the properties of numbers and number systems, including rational and real numbers.
- O-18. Students will create and interpret quadratic functions using graphs, tables, and equations in order to solve real-world problems.
- O-19. Students will create and interpret exponential functions using graphs, tables, and equations in order to solve real-world problems.

Algebra I

Algebra I is a graduation requirement for Baltimore County students that not only meets the MSDE graduation requirement for a course in algebra but also prepares students for both Geometry and Algebra II. This course provides the foundation for a program in higher mathematics. The course includes simulations, data analysis, linear functions and graphs, systems of linear equations, irrational numbers, operations with polynomials, and the exploration of non-linear equations. Algebra I requires of a graphing calculator that is provided to the students on a daily basis during class time. This is a course for which the HSA Algebra/Data Analysis is administered at the end of the course.

Objectives:

- O-1. Students will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expressions.
- O-2. Students will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.
- O-3. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-4. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and, or graphs.
- O-5. Students will solve and describe if and where two straight lines intersect using numbers, symbols, and/or graphs.
- O-6. Students will describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.
- O-7. Students will represent linear inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-8. Students will apply formulas and/or use matrices (arrays of numbers) to solve real-world problems.
- O-9. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-10. Students will create and interpret linear graphs.
- O-11. Students will write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-12. Students will solve linear inequalities and describe the solutions using numbers, symbols and/or graphs.
- O-13. Students will describe how the graphical model of a non-linear function represents a given problem and will estimate the solution.
- O-14. Students will make informed decisions and predictions based upon the results of simulations and data from research.
- O-15. Students will interpret data and/or make predictions by finding and using a line of best fit.
- O-16. Students will use the measures of central tendency and/or variability to make informed conclusions.
- O-17. Students will calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.
- O-18. Students will compare and contrast the properties of numbers and number systems, including rational and real numbers.

Mathematics Modeling: Applications to Algebra

This elective half-credit course will include and enhance the development of algebraic relationships and skills through hands-on learning experiences with the integration of manipulatives and technology to ensure that students have learned all the concepts and skills required for successful the completion of Algebra, the HSA Algebra/Data Analysis, and are prepared for Algebra II. The course will include enhanced review coverage of algebra concepts and include some Algebra II concepts that apply to real world situations. Students who have passed Algebra I but not passed the HSA Algebra/Data Analysis will be provided with additional instruction in order to ensure mastery of needed content.

Objectives:

- O-1. Students will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.
- O-2. Students will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expressions.
- O-3. Students will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.
- O-4. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and, or graphs.
- O-5. Students will solve and describe if and where two straight lines intersect using numbers, symbols, and/or graphs.
- O-6. Students will describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.
- O-7. Students will represent linear inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-8. Students will solve linear inequalities and describe the solutions using numbers, symbols and/or graphs.
- O-9. Students will write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-10. Students will create and interpret linear graphs.
- O-11. Students will make informed decisions and predictions based upon the results of simulations and data from research.
- O-12. Students will interpret data and/or make predictions by finding and using a line of best fit.
- O-13. Students will use the measures of central tendency and/or variability to make informed conclusions.
- O-14. Students will calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.
- O-15. Students will compare and contrast the properties of numbers and number systems, including rational and real numbers.
- O-16. Students will create and interpret quadratic functions using graphs, tables, and equations in order to solve real-world problems.
- O-17. Students will solve quadratic equations by using graphing, completing the square, factoring, and the quadratic formula.

Algebra II

Algebra II is a graduation requirement for students in Baltimore County Public Schools. This course extends algebraic processes and models to matrices, systems of inequalities, linear programming, absolute value functions, quadratic relations and functions, complex numbers, rational equations, exponential functions, and logarithms. Algebra II requires of a graphing calculator that is provided to the students on a daily basis during class time. There is also an Honors Algebra II course available for ninth grade students who have earned a credit in Algebra I by the end of grade 8.

Objectives:

- O-1. Students will generalize patterns using explicitly defined and recursively defined functions.
- O-2. Students will analyze functions on one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
- O-3. Students will perform transformations such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more complicated symbolic expressions.
- O-4. Students will recognize and write equivalent forms of expressions, equations, inequalities, and relations involving rational exponents, absolute values, radicals, and logarithms.
- O-5. Students will recognize and write equivalent forms of expressions, equations, inequalities, and relations involving polynomials.
- O-6. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and/or graphs.
- O-7. Students will write equivalent forms of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-8. Students will solve systems of equations and describe the solutions using numbers, symbols, and or graphs.
- O-9. Students will solve inequalities and systems of inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-10. Students will use a variety of symbolic representations for functions and relations.
- O-11. Students will approximate and interpret rates of change from graphical and numerical data.
- O-12. Students will apply appropriate techniques, tools, and formulas to determine measurements.
- O-13. Students will interpret data and/or make predictions by finding and using the line or curve of best fit.
- O-14. Students will compare and contrast the properties of numbers and number systems and identify and compute with complex numbers.
- O-15. Students will develop fluency in operations with real numbers, vectors, matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases.
- O-16. Students will recognize and identify relations and functions and select, convert flexibly among, and use various representations for them.

Geometry

Geometry is a graduation requirement for Baltimore County students and meets the MSDE graduation requirement for one course in geometry. Successful completion of Algebra I is recommended in order for the student to apply these skills to geometric concepts. This course develops the important ideas of Euclidean geometry and the analytic-synthetic method of proof and lays a foundation for subsequent courses in mathematics and science. High school geometry is primarily deductive and employs methods of logical reasoning. Geometry from an algebraic perspective is emphasized throughout. Honors Geometry and GT9/IB Geometry is available for identified students.

Objectives:

- O-1. Students will recognize and use basic terms, notations of geometry, and postulates to solve real-world problems.
- O-2. Students will analyze the properties of angles formed by parallel lines cut by a transversal.
- O-3. Students will identify and/or verify properties of geometric figures using the coordinate plane and concepts from algebra.
- O-4. Students will move figures, create designs, and/or demonstrate geometric properties using transformations.
- O-5. Students will construct and/or draw and/or validate properties of geometric figures using appropriate tools and technology.
- O-6. Students will identify and/or verify congruent and similar figures and/or apply equality or proportionality of their corresponding parts.
- O-7. Students will solve problems using two-dimensional figures and/or right triangle trigonometry.
- O-8. Students will use inductive or deductive reasoning.
- O-9. Students will measure angles of polygons and circles indirectly by using algebraic and/or geometric properties.
- O-10. Students will measure angles and side lengths indirectly by using properties of similarity.
- O-11. Students will estimate, calculate, and/or compare perimeter, circumference, and area of two-dimensional figures and their parts.
- O-12. Students will estimate, calculate, and/or compare surface area of three-dimensional solids and their parts.
- O-13. Students will estimate, calculate, and/or compare volume of three-dimensional solids and their parts.
- O-14. Students will make informed decisions and predictions based upon the results of simulations and data from research.

Sets, Functions, and Probability

This course involves the study of concepts beyond the Algebra and Geometry courses and assumes that students have taken prerequisite courses. The course presents topics that lead to a future complete study in Algebra II and will develop new concepts necessary for success on the SAT. This course is intended for students recommended through the IEP team process and recommended ELL students attending the BCPS Centers for ELL with appropriate parental approval and final approval from the Office of World Languages. Successful completion of Algebra I and Geometry is recommended.

Objectives:

- O-1. Students will compare a variety of number systems developed by ancient civilizations to provide cultural connections to the modern day number systems and special types of numbers.
- O-2. Students will solve problems by performing basic arithmetic operations with whole numbers, decimals, and fractions using number systems developed by ancient civilizations.
- O-3. Students will develop logical thinking and problem solving skill by applying basic facets of logical reasoning.
- O-4. Students will organize information and solve real-world problems by creating graphical representations of sets.
- O-5. Students will define and apply counting techniques to solve real world problems.
- O-6. Students will calculate probabilities for simple compound events in order to make predictions and solve real-world problems.
- O-7. Students will organize, analyze, and interpret statistical data by selecting and constructing graphical displays.
- O-8. Students will analyze, interpret, and predict events by using measures of central tendency.
- O-9. Students will organize information and make predictions by analyzing measures of dispersion and the normal distribution curve.
- O-10. Students will create and interpret linear functions using graphs, tables, and equations.
- O-11. Students will create and interpret quadratic functions using graphs, tables, and equations in order to solve real-world problems.
- O-12. Students will create and interpret exponential functions using graphs, tables, and equations in order to solve real-world problems.
- O-13. Students will create and interpret visual representations of algebraic functions and find the line of best fit using the tools of technology.
- O-14. Students will create geometric art by applying various geometric design methods.
- O-15. Students will solve for missing angle and side measures of right triangles using trigonometric ratios.
- O-16. Students will solve problems involving right and oblique triangles by applying trigonometric formulas.
- O-17. Students will solve real-world problems by selecting appropriate models from finance.

College Readiness Mathematics

This senior level elective mathematics course uses applications to enhance understanding of advanced algebraic topics like linear models and systems, quadratic and rational functions, exponential and logarithmic functions, and conic sections. Developed in collaboration with a local community college, the goal is to prepare students to transition from high school to college level mathematics seamlessly. Students who maintain at least a C average per quarter and achieve a 70% on the final exam will qualify for entry into a credit bearing course at the Community College of Baltimore County (CCBC). Successful completion of Algebra I, Algebra II, and Geometry is a prerequisite for this course. College Readiness Mathematics requires the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will distinguish between relations and functions and select, convert flexibly among, and use various representations for them.
- O-2. Students will perform transformations such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more complicated symbolic expressions.
- O-3. Students will determine equivalent forms of expressions, equations, inequalities, and relations.
- O-4. Students will write equivalent forms of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-5. Students will solve systems of equations and inequalities and describe the solutions using numbers, symbols, and or graphs.
- O-6. Students will use a variety of symbolic representations including recursive and parametric equations for functions and relations.
- O-7. Students will approximate and interpret rates of change from graphical and numerical data.
- O-8. Students will draw reasonable conclusions about a situation being modeled.
- O-9. Students will compare and contrast the properties of numbers and number systems, including the rational and real numbers, and recognize complex numbers as solutions to quadratic equations that do not have real solutions.
- O-10. Students will generalize patterns using explicitly defined and recursively defined functions.
- O-11. Students will determine equivalent forms of expressions, equations, inequalities, and relations.
- O-12. Students will apply appropriate techniques, tools, and formulas to determine measurements.

Trigonometry with Algebra

Trigonometry with Algebra reviews and extends the concepts from Algebra II to support the study of trigonometric concepts. Students will use graphing utilities to examine functions and their inverses, trigonometric functions and their graphs, polar coordinates, identities, formulas and equations, and the solving of right triangles. The course also features preparation for the mathematics portion of the SAT. Trigonometry with Algebra requires the use of a graphing calculator which is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will generalize patterns using explicitly defined and recursively defined functions.
- O-2. Students will distinguish relations and functions and will select, convert flexibly among, and use various representations for each.
- O-3. Students will analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
- O-4. Students will determine the equivalent forms of expressions, equations, inequalities, and relations.
- O-5. Students will write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency-mentally or with paper and pencil in simple cases and using technology in all cases.
- O-6. Students will use a variety of symbolic representations including recursive and parametric equations for functions and relations.
- O-7. Students will analyze trigonometric relationships to determine lengths and angle measures.
- O-8. Students will use Cartesian coordinates and other coordinate systems (polar) to analyze geometric situations.
- O-9. Students will compare and contrast the properties of numbers and number systems, including the rational and real numbers, and will recognize complex numbers as solutions to quadratic equations that do not have real solutions.
- O-10. Students will develop fluency in operations with real numbers, vectors, and matrices, using mental computation or paper-and-pencil calculations for simple cases and technology for more-complicated cases.

College Algebra

Designed as a college freshman level course for highly able mathematics students, this course focuses on function theory and topics from linear algebra. Students who take College Algebra and Trigonometry with Analytic Geometry are prepared for success in AP Calculus or college calculus courses. College Algebra requires the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will generalize patterns using explicitly defined and recursively defined functions.
- O-2. Students will identify, select, convert flexibly among, and use various representations for relations and functions.
- O-3. Students will analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
- O-4. Students will perform transformations such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more complicated symbolic expressions.
- O-5. Students will write, simplify, and evaluate equivalent forms of expressions, equations, inequalities, and relations.
- O-6. Students write, simplify, and evaluate equivalent forms of expressions, equations, inequalities, and relations involving polynomials.
- O-7. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and/or graphs.
- O-8. Students will write equivalent forms of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-9. Students will solve systems of equations and describe the solutions using numbers, symbols, and or graphs.
- O-10. Students will solve inequalities and systems of inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-11. Students will use a variety of symbolic representations including recursive and parametric equations for functions and relations.
- O-12. Students will approximate and interpret rates of change from graphical and numerical data.
- O-13. Students will draw reasonable conclusions about a situation being modeled.
- O-14. Students will use inductive or deductive reasoning to verify mathematical properties.
- O-15. Students will represent translations, reflections, rotations, and dilations of objects in the plane by using sketches, coordinates, vectors, function notation, and matrices.
- O-16. Students will interpret data and/or make predictions by finding the line or curve of best fit.
- O-17. Students will apply the properties of probability and the fundamental counting principal to solve problems.

Trigonometry with Analytic Geometry

Trigonometry with Analytic Geometry serves as a foundation for students who will be taking calculus. It focuses on right triangle trigonometry, circular functions, graphs of trigonometric functions, inverse trigonometric functions, trigonometric identities, coordinate geometry, oblique triangles, vectors, conic sections, parametric equations, and polar coordinates. This course requires the use of a graphing calculator which is provided to the students on a daily basis during class time.

- O-1. Students will generalize patterns using explicitly defined and recursively defined functions.
- O-2. Students will write equivalent forms of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-3. Students will use a variety of symbolic representations including recursive and parametric equations for functions and relations.
- O-4. Students will interpret data and/or make predictions by finding the line or curve of best fit.
- O-5. Students will determine lengths and angle measures using trigonometric relationships.
- O-6. Students will use Cartesian coordinates and other coordinate systems, such as polar and spherical, to analyze geometric situations.
- O-7. Students will prove, verify, and solve various measurable attributes of objects and unit analysis to check measurement computations.
- O-8. Students will develop fluency in operations with real numbers, vectors, and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more-complicated cases.

Precalculus

This course, designed as a college level mathematics course, combines selected topics from function theory, linear algebra, trigonometry, and analytic geometry in preparation for Calculus I and II. Trigonometric functions are treated as a special type of function along with polynomial, rational, exponential, and logarithmic functions. Precalculus courses require the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will identify, select, convert flexibly among, and use various representations for relations and functions.
- O-2. Students will analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
- O-3. Students will perform transformations such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more complicated symbolic expressions.
- O-4. Students will write, simplify, and evaluate equivalent forms of expressions, equations, inequalities, and relations.
- O-5. Students write, simplify, and evaluate equivalent forms of expressions, equations, inequalities, and relations involving polynomials.
- O-6. Students will determine the equation for a line and/or describe the solutions using numbers, symbols, and/or graphs.
- O-7. Students will write equivalent forms of equations and solve them with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-8. Students will solve systems of equations and describe the solutions using numbers, symbols, and or graphs.
- O-9. Students will solve inequalities and systems of inequalities and describe the solutions using numbers, symbols, and/or graphs.
- O-10. Students will approximate and interpret rates of change from graphical and numerical data.
- O-11. Students will draw reasonable conclusions about a situation being modeled.
- O-12. Students will use inductive or deductive reasoning to verify mathematical properties.
- O-13. Students will interpret data and/or make predictions by finding the line or curve of best fit.
- O-14. Students will generalize patterns using explicitly defined and recursively defined functions.
- O-15. Students will write equivalent forms of equations related to trigonometry and conic sections and solve the equations with fluency, mentally, or with paper and pencil in simple cases and using technology in all cases.
- O-16. Students will use a variety of symbolic representations including recursive and parametric equations for functions and relations.
- O-17. Students will develop fluency in operations with real numbers, vectors, and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more-complicated cases.
- O-18. Students will determine lengths and angle measures using trigonometric relationships.
- O-19. Students will use Cartesian coordinates and other coordinate systems, such as polar and spherical, to analyze geometric situations.
- O-20. Students will prove, verify, and solve various measurable attributes of objects and unit analysis to check measurement computations.

Calculus I, II GT/AP [AP Calculus AB]

Calculus I, II (GT/AP) is designed for students who desire advanced standing in college. It deals with the theory and techniques of differential and integral calculus with applications. Students are provided a structured preparation for the Advanced Placement Calculus AB exam. Students in the GT program must take this course in Grade 11 in order to enroll in GT Mathematics 12: AP Calculus BC. Calculus I, II requires the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will evaluate limits by examining graphs, using tables of values and applying algebraic techniques.
- O-2. Students will apply one-sided limits in relation to asymptotes and holes.
- O-3. Students will use limits to determine the continuity of a function at a point.
- O-4. Students will distinguish between and compute the average and instantaneous rates of change of functions.
- O-5. Students will apply the definition of the derivative to develop differentiation formulas for basic functions.
- O-6. Students will apply the sum, product, quotient and chain rules to differentiate combinations of functions.
- O-7. Students will interpret the derivative as the slope of a tangent line and as the instantaneous rate of change in various applied contexts.
- O-8. Students will use implicit differentiation to find the derivatives of relations and to investigate comparative rates of change in physical situations.
- O-9. Students will apply the first and second derivatives to analyze the behavior of functions.
- O-10. Students will utilize the first and second derivatives to analyze the graphic behavior of functions.
- O-11. Students will apply extrema found by differentiation.
- O-12. Students will prove and apply Rolle's Theorem and the Mean Value Theorem.
- O-13. Students will establish techniques to determine antiderivatives.
- O-14. Students will estimate the area under a bounded curve using a finite number of subdivisions.
- O-15. Students will apply concepts of integration to develop and analyze models of exponential growth and decay and analyze models involving position, velocity and acceleration.
- O-16. Students will use slope fields to analyze differential equations.
- O-17. Students will use the First Fundamental Theorem of Calculus to evaluate the derivative of a function expressed as an integral.
- O-18. Students will use the Second Fundamental Theorem of Calculus to analyze problems analytically and geometrically.
- O-19. Students will construct and evaluate integral expressions to represent the area between two curves and volume.
- O-20. Students will construct and evaluate integral expressions to represent arc length and surface area.
- O-21. Students will evaluate integrals using advanced techniques.
- O-22. Students will evaluate improper integrals.

Calculus III, GT/AP [AP Calculus BC]

This course is designed to provide students in the gifted and talented mathematics program with a sound background in multivariable calculus. Topics include vector-valued functions, partial derivatives, directional derivatives, multiple integrals, vector fields, line and surface integrals, and Green's and Stokes' Theorems. Students are provided a structured preparation for the Advanced Placement Calculus BC exam. Calculus III requires the use of a graphing calculator that is provided to the students on a daily basis during class time..

Objectives:

- O-1. Students will evaluate integrals using advanced techniques. (BC)
- O-2. Students will evaluate improper integrals. (BC)
- O-3. Students will analyze characteristics of a sequence. (BC)
- O-4. Students will interpret and apply infinite series of constants. (BC)
- O-5. Students will apply convergence tests to infinite series of more complicated terms. (BC)
- O-6. Students will approximate elementary functions by creating Taylor Polynomials.
- O-7. Students will represent functions by power series. (BC)
- O-8. Students will find Taylor or Maclaurin Series to represent functions. (BC)
- O-9. Students will interpret and apply parametric forms of curves. (BC)
- O-10. Students will analyze plane curves in parametric form by applying calculus techniques.
- O-11. Students will analyze the behavior of curves in the plane defined by polar equations. (BC)
- O-12. Students will model and solve applied problems using differential equations.
- O-13. Students will demonstrate an understanding of the concept of a vector and its properties in the plane.
- O-14. Students will generalize the basic concepts, definitions, and vector operations for vectors in the plane to vectors in 3-d space.
- O-15. Students will use the definition of the cross product and triple scalar product to determine the area of a parallelogram and the volume of a parallelepiped.
- O-16. Students will apply the parametric equations for a line and the standard equation of a plane to find intersections.
- O-17. Students will calculate distances between points, lines and planes.
- O-18. Students will analyze curves given in vector form, and extend differentiation and integration to vector-valued functions.
- O-19. Students will examine the relationship between a position vector, tangent vector and acceleration vector for a given value of the parameter t .
- O-20. Students will employ the concepts of differential calculus for a single variable function to functions of two variables.
- O-21. Students will solve optimization problems by interpreting extrema of functions of two variables.
- O-22. Students will demonstrate an understanding of iterated and double integrals in rectangular and polar coordinates.
- O-23. Students will solve application problems by creating an appropriate triple integral.

Calculus (Honors)

This course is designed for seniors who desire an introduction to calculus in anticipation of taking calculus as college freshmen. The course presents the theory and techniques of differential and integral calculus with applications but does not maintain the pace or level of rigor appropriate for students planning to take the AP tests. This course requires the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will evaluate limits by examining graphs, using tables of values and applying algebraic techniques.
- O-2. Students will apply one-sided limits in relation to asymptotes and holes.
- O-3. Students will use limits to determine the continuity of a function at a point.
- O-4. Students will apply the definition of the derivative to develop differentiation formulas for basic functions.
- O-5. Students will apply the sum, product, quotient and chain rules to differentiate combinations of functions.
- O-6. Students will interpret the derivative as the slope of a tangent line and as the instantaneous rate of change in various applied contexts.
- O-7. Students will use implicit differentiation to find the derivatives of relations and to investigate comparative rates of change in physical situations.
- O-8. Students will apply the first and second derivatives to analyze the behavior of functions.
- O-9. Students will utilize the first and second derivatives to analyze the graphic behavior of functions.
- O-10. Students will apply extrema found by differentiation.
- O-11. Students will prove and apply Rolle's Theorem and the Mean Value Theorem.
- O-12. Students will establish techniques to determine antiderivatives.
- O-13. Students will estimate the area under a bounded curve using a finite number of subdivisions.
- O-14. Students will apply concepts of integration to develop and analyze models of exponential growth and decay and analyze models involving position, velocity and acceleration.
- O-15. Students will use slope fields to analyze differential equations.
- O-16. Students will use the First Fundamental Theorem of Calculus to evaluate the derivative of a function expressed as an integral.
- O-17. Students will distinguish between and compute the average and instantaneous rates of change of functions.
- O-18. Students will use the Second Fundamental Theorem of Calculus to analyze problems analytically and geometrically.
- O-19. Students will construct and evaluate integral expressions to represent the area between two curves and volume.
- O-20. Students will construct and evaluate integral expressions to represent arc length and surface area.

Statistics

This half-credit course is designed to acquaint students with the basic techniques of descriptive and inferential statistics. Calculator-assisted applications of statistical topics to business, biology, engineering, industry, and the social sciences will be featured. This course requires the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will interpret graphical displays of distributions of univariate data (dotplots, stemplots, histograms, cumulative frequency plots)
- O-2. Students will summarize distributions of univariate data.
- O-3. Students will compare distributions of univariate data (dotplots, back-to-back stemplots, and parallel boxplots).
- O-4. Students will analyze bivariate data.
- O-5. Students will apply the characteristics of random variables with normal distribution.
- O-6. Students will apply methods of data collection.
- O-7. Students will compare independent random variables.
- O-8. Students will apply probability as frequency.

Statistics: GT/AP

This calculator-assisted course features the study of techniques in descriptive and inferential statistics and includes frequency and probability distributions, Central Limit Theorem, hypothesis testing and confidence intervals, correlation and regression for bivariate data, analysis of variance, and nonparametric statistics. Students successfully completing this course will be prepared for the AP test in statistics. This course requires the use of a graphing calculator that is provided to the students on a daily basis during class time.

Objectives:

- O-1. Students will interpret graphical displays of distributions of univariate data (dotplots, stemplots, histograms, cumulative frequency plots)
- O-2. Students will summarize distributions of univariate data.
- O-3. Students will compare distributions of univariate data (dotplots, back-to-back stemplots, and parallel boxplots).
- O-4. Students will analyze bivariate data.
- O-5. Students will interpret categorical data in frequency tables.
- O-6. Students will apply methods of data collection.
- O-7. Students will plan and conduct surveys.
- O-8. Students will plan and conduct experiments.
- O-9. Students will apply probability as relative frequency.
- O-10. Students will apply the characteristics of random variables with normal distribution.
- O-11. Students will analyze sampling distributions.
- O-12. Students will compute and interpret confidence intervals.
- O-13. Students will construct, analyze, and interpret results for tests of significance.
- O-14. Students will determine the appropriate model for special cases of normally distributed data.

Math Studies (IB/GT)

Math Studies is a course offered as part of the International Baccalaureate Program at identified schools and is designed to prepare students for the IB Math Studies exam. Topics studied include numbers and algebra, geometry and trigonometry, sets and logic, probability, statistics, functions, and financial math.

Objectives:

- O-1. Students will use properties of numbers and algebra.
- O-2. Students will use sequences and series.
- O-3. Students will apply properties of sets and logic.
- O-4. Students will apply properties of probability.
- O-5. Students will analyze linear functions.
- O-6. Students will analyze quadratic and exponential functions.
- O-7. Students will use properties of geometry.
- O-8. Students will use properties of trigonometry.
- O-9. Students will use basic statistical concepts to organize and analyzed data.
- O-10. Students will use statistical tests to analyze data and make predictions.
- O-11. Students will apply basic concepts of differential calculus.
- O-12. Students will use finance formulas and concepts.

Modeling/Simulations (Magnet)

Modeling/Simulations is a course offered as a magnet mathematics course and is designed to introduce students to a view of mathematics entirely different from the traditional algebra, geometry, trigonometry, and finite mathematics curriculum. The course is a collection of mathematical topics ranging from fractals to network problems to simulations.

Objectives:

- O-1. Students will analyze the mathematical concepts and physical laws that connect growth and symmetry.
- O-2. Students will analyze the basic concepts of Fractal Geometry.
- O-3. Students will categorize the various types of Euler Circuits.
- O-4. Students will categorize the various types of Euler Circuits.
- O-5. Students will analyze the key characteristics of the Traveling Salesman Problem: Hamilton Circuits.
- O-6. Students will analyze and apply networks to solve problems.
- O-7. Students will analyze the Mathematics of Voting.
- O-8. Students will analyze the properties of Weighted Voting Systems.
- O-9. Students will analyze and apply properties of Fair-Division.

Finite Mathematics (Magnet)

Finite Mathematics, offered as a mathematics magnet course, brings together several mathematical topics, including basic probability theory, an introduction to linear programming, some theory of matrices and determinants, and the underpinnings of calculus.

Objectives:

- O-1. Students will model real-world problems using matrix operations.
- O-2. Students will solve systems of linear equations by applying matrix techniques.
- O-3. Students will solve linear programming problems from business and industry by employing geometric techniques.
- O-4. Students will solve linear programs using matrix techniques and the simplex method.
- O-5. Students will apply counting techniques to problem-solving situations.
- O-6. Students will distinguish between permutations and combinations in order to solve problems.
- O-7. Students will analyze univariate data utilizing graphical techniques, measures of central tendencies, and dispersion.
- O-8. Students will solve real-world problems using Markov Chains.

Differential Equations

This online course is designed to provide students in the gifted and talented mathematics program with an extension from the concept of differential equations introduced in Calculus I, II and Calculus III. The course presents basic techniques and methods for solving ordinary differential equations, covering many if not all of the topics found in most first-quarter college courses in differential equations.

Objectives:

- O-1. Students will solve first order linear differential equations and initial value problems using integrating factors.
- O-2. Students will analyze first order ordinary differential equations (ODEs) involving continuous compounding, and population dynamics using the logistic equation.
- O-3. Students will analyze difference equations and their solutions, focusing on first order linear difference equations.
- O-4. Students will solve second order ODEs and initial value problems and discuss solutions to second order homogeneous constant coefficient equations.
- O-5. Students will solve second order linear non-homogeneous equations
- O-6. Students will solve higher order constant coefficient homogeneous equations.
- O-7. Students will solve differential equations and initial value problems using power series.
- O-8. Students will review improper integration and apply Laplace transform.
- O-9. Students will analyze systems of equations and the basic existence and uniqueness result for the corresponding initial value problems.

Linear Algebra

This online course is designed to provide students in the gifted and talented mathematics program with a sound background in linear algebra. Topics include matrices, linear equations, vector spaces, bases and coordinates, linear transformations, eigenvectors and eigenvalues, and diagonalization.

Objectives:

- O-1. Students will define characteristics and properties of matrices.
- O-2. Students will define and apply basic matrix operations: addition, scalar multiplication and matrix multiplication.
- O-3. Students will apply properties of transpose and symmetry.
- O-4. Students will apply definitions and properties of partitions and special forms of matrices.
- O-5. Students will illustrate and solve linear systems of equations by applying properties of matrices.
- O-6. Students will apply Gaussian Elimination.
- O-7. Students will define and use the inverse of a matrix.
- O-8. Students will define and use properties of elementary matrices.
- O-9. Students will define and apply properties and theorems of LU Decompositions of matrices.
- O-10. Students will define and use notations and basic properties of vector spaces.
- O-11. Students will define and use properties of subspaces.
- O-12. Students will define and identify linear independence.
- O-13. Students will define and use properties of basis and dimension.
- O-14. Students will define and apply properties of row space.
- O-15. Students will define and use properties of column space and rank of a matrix.
- O-16. Students will apply properties of linear transformations to matrices.
- O-17. Students will use matrix representations and change of basis.
- O-18. Students will define and use properties of kernel and image.
- O-19. Students will use properties of determinants.
- O-20. Students will define and use properties of eigenvectors and eigenvalues.
- O-21. Students will define and use properties of Diagonalization.

Multivariable Differential Calculus

This course is designed to provide students in the gifted and talented mathematics program with a sound background in multivariable differential calculus. Topics include vector-valued functions, partial derivatives, directional derivatives, multiple integrals, vector fields, line and surface integrals, and Green's and Stokes' Theorems.

- O-1. Students will use properties of three-dimensional Cartesian (or rectangular) coordinate system.
- O-2. Students will apply definitions and properties of vectors.
- O-3. Students will apply definitions and properties of norms, unit vectors, and decomposition.
- O-4. Students will demonstrate vector addition and resultant forces.
- O-5. Students will use definitions and properties of the dot product.
- O-6. Students will illustrate orthogonal projections.
- O-7. Students will use definitions and properties of cross products.
- O-8. Students will illustrate the geometry of cross products.
- O-9. Students will define and apply the scalar triple product.
- O-10. Students will represent parametric and vector equations of lines.
- O-11. Students will analyze problems involving vector and parametric equations of lines in 3-space.
- O-12. Students will define and use properties of equations of planes.
- O-13. Students will define and use properties of angles and distances in planes.
- O-14. Students will define and use the trace of a surface in a plane.
- O-15. Students will graph quadric surfaces.
- O-16. Students will define and use properties of cylindrical coordinates.
- O-17. Students will define and use properties of spherical coordinates.
- O-18. Students will apply properties of vector-valued functions.
- O-19. Students will demonstrate the geometry of derivatives.
- O-20. Students will define and use properties of parametrizations of curves.
- O-21. Students will apply properties of unit tangents, normals, and binormals.
- O-22. Students will apply properties of curvature.
- O-23. Students will apply definitions of vector calculus and motion along a curve.
- O-24. Students will use properties and notation of multivariable functions.
- O-25. Students will define and apply properties of sets in 2-space and 3-space.
- O-26. Students will use properties of limits.
- O-27. Students will use properties of continuity.
- O-28. Students will define and use properties of partial and higher-order partial derivatives.
- O-29. Students will define and use properties of differentiability.
- O-30. Students will apply properties of the chain rule.
- O-31. Students will define and apply properties of tangent planes.
- O-32. Students will apply properties of directional derivatives.
- O-33. Students will analyze properties of the gradient.
- O-34. Students will apply properties of differentiation to functions of n variables.
- O-35. Students will analyze and apply properties of extrema of functions of two variables.
- O-36. Students will use the Second Partial Test.
- O-37. Students will define and apply properties of Lagrange Multipliers in two and three dimensions.