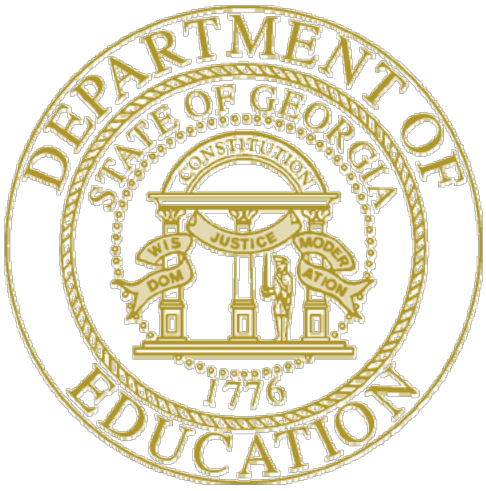

MATHEMATICS

Graduation Requirement Guidance

for Students Entering Ninth Grade in 2013-2014 and thereafter.

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Mathematics Graduation Requirement Guidance

for Students Entering Ninth Grade in 2013-2014 and thereafter

Executive Summary

Successful preparation for both postsecondary education and employment requires learning the same rigorous mathematics content and skills. No longer do students planning to enter the workplace after high school need a different and less rigorous mathematics curriculum than those planning to go to college. (Achieve, Inc., 2004)

In 2007, Georgia's State Board of Education adopted rigorous new graduation requirements effective with the ninth grade class of 2008. A hallmark of the rule was the elimination of tiered-diploma options where students followed either College Preparatory or Technology/Career coursework. All students are expected to complete a common set of mathematics requirements to earn a regular diploma. The rule specifies certain mathematics courses that all students must take – making rigorous content an expectation for all and not just for some of Georgia's students and ensuring that all students are given the opportunity to choose mathematics courses that could include Advanced Placement, International Baccalaureate, and dual enrollment courses. Additionally, the rule encourages active student involvement in selecting mathematics courses based on the students' areas of interest.

The Georgia State Board of Education's 2010 adoption of the Common Core State Standards in mathematics, English/ Language Arts, and literacy was a significant step toward ensuring that Georgia's K-12 students are prepared to enter the 21st century global workplace. As specified by the Council of Chief State School Officers and the National Governors Association, the Common Core State Standards are research- and evidence-based, aligned with college and work expectations, rigorous, and internationally benchmarked. The Standards are intended to be a living work; so as new and better evidence emerges, the Standards will be revised accordingly. As a natural outgrowth of meeting the charge to define college and career readiness, the Standards define what students should understand and be able to do in their study of mathematics. Georgia's mathematics standards are called College and Career Ready Georgia Performance Standards (CCGPS). CCGPS Mathematics was implemented in Georgia's K- 9 classrooms in the 2012-2013 school year so as to be fully implemented in K-12 classrooms by school year 2015-2016.

MATHEMATICS

The Standards for *Mathematical Practice* represent the habits and attitudes of mathematical thinkers and are integral to the super structure of CCGPS mathematics. The practice standards define the way knowledge comes together and gets used by students. The Standards *for Mathematical Practice* describe the expertise that mathematics educators at all levels should seek to develop in their students. The practices are as follows:

- Make sense of problems and persevere in solving them;
- Reason abstractly and quantitatively;
- Construct viable arguments and critique the reasoning of others;
- Model with mathematics;
- Use appropriate tools strategically;
- Attend to precision;
- Look for and make use of structure;
- Look for and express regularity in repeated reasoning.

The Standards *for Mathematical Content* offer a balanced combination of procedure and understanding.

A lack of understanding effectively prevents a student from engaging in the mathematical practices. Designers of curriculum, assessment, and professional development should all attend to the need to connect the mathematical practice to mathematical content in mathematics instruction.

Mathematics requirements associated with the 2007 graduation rule are currently aligned with the Georgia Performance Standards (GPS) and/or College and Career Ready Georgia Performance Standards (CCGPS) for mathematics. The Georgia Performance Standards and the College and Career Georgia Performance Standards for Mathematics are comparable in all domains. While there are differences in strand names and grade level expectations, the efficacy of the two sets of standards is evident. A wide range of mathematics courses provide opportunities for students to continue advanced coursework, to take advantage of academic support classes, and to choose special interest courses, depending on individual needs and aspirations. An increased number of students with disabilities now have the opportunity to earn a regular education diploma, thus enabling them to become employed or to go on to postsecondary education. The mathematics graduation requirements associated with the 2007 graduation rule, along with state curriculum standards and assessments, will ensure that more students finish school ready to thrive in our knowledge-based, high-skills economy.

Key Feature of the 2007 State Board of Education Rule 160-4-2-.48 Requirements

Four units of core credit in mathematics, including CCGPS Coordinate Algebra, GPS Mathematics I, GPS Algebra, or the equivalent; CCGPS Analytic Geometry, GPS Mathematics II, GPS Geometry, or the equivalent; and CCGPS Advanced Algebra, GPS Mathematics III, GPS Advanced Algebra, or the equivalent. Additional core courses needed to complete four credits in mathematics must be chosen from the list of GPS/ CCGPS /AP/IB/dual enrollment designated courses.

Section 1: Georgia HS Graduation Requirements

Four units of credit in mathematics shall be required of all students, to include:

- CCGPS Coordinate Algebra or its equivalent,
- CCGPS Analytic Geometry or its equivalent,
- CCGPS Advanced Algebra or its equivalent, and
- One Additional Unit to be selected from the list of CCGPS/AP/IB/dual enrollment designated courses.

NOTE: Accelerated CCGPS Coordinate Algebra/Analytic Geometry A and Accelerated CCGPs Analytic Geometry B/Advanced Algebra include the standards of CCGPS Coordinate Algebra, CCGPS Analytic Geometry, and CCGPS Advanced Algebra. At the present time, these are the only equivalent courses for CCGPS Coordinate Algebra, CCGPS Analytic Geometry, and CCGPS Advanced Algebra.

Students with disabilities who earn credit in CCGPS Coordinate Algebra or the equivalent, along with the associated support course, *and* CCGPS Analytic Geometry or the equivalent, along with the associated support course, may upon the determination through the Individualized Education Program Team meet the mathematics diploma requirements by completing CCGPS Advanced Algebra or the equivalent, for a total of 3 mathematics core credits. Successful completion of 3 core units of mathematics may not meet the mathematics admission requirements for entrance into a University System of Georgia institution or other post-secondary institution without additional course work.

Students with disabilities who were identified prior to enrollment in high school and have a disability affecting mathematics achievement may follow an alternative course sequence to meet the mathematics course requirements of the graduation rule 160-4-2-.48. The alternate course sequences include 1) students enrolling in a single advanced mathematics course and receiving instruction over two years or 2) receiving dispensation from completing CCGPS Advanced Algebra. These alternative course sequences would allow a student with disabilities earning core credit in CCGPS Coordinate Algebra and CCGPS Analytic Geometry with two other mathematics courses to satisfy the minimum mathematics requirements for high school graduation. For further detail, please see Guidelines for Georgia State Board of Education Rule 160-5-1-.15 AWARDING UNITS OF CREDIT AND ACCEPTANCE OF TRANSFER CREDIT AND/OR GRADES section 2(e) in Appendix A.

High school credit for mathematics courses taken in middle school should be awarded only for courses that included concepts and skills based on the CCGPS for grades 9-12 or those approved by the State Board of Education. All course requirements, including associated End of Course requirements, must be met prior to granting credit.

High School unit credit is not awarded for courses that address concepts and skills associated with grades K-8.

Mathematics Graduation Requirement Guidance

for Students Entering Ninth Grade in 2013-2014 and thereafter

Mathematics Graduation Requirements

Entered Ninth Grade in 2008-2009, 2009-2010, and 2010-2011	Entered Ninth Grade in 2011-2012	Entered Ninth Grade in 2012-2013 and Subsequent Years
Graduation Rule 160-4-2-.48		**Awarding Units of Credit Rule 160-5-1-.15**
○ 4 units of core credit in mathematics ○ 1 unit in GPS Mathematics I, GPS Algebra, or the equivalent ○ 1 unit in GPS Mathematics II, GPS Geometry, or the equivalent ○ Additional core mathematics credits must be chosen from the list of GPS/CCGPS/AP/IB/dual enrollment designated courses. ○ Districts have the flexibility of awarding either core or elective credit for support courses.	○ 4 units of core credit in mathematics ○ 1 unit in GPS Mathematics I or the equivalent ○ 1 unit in GPS Mathematics II or the equivalent ○ 1 unit in GPS Mathematics III or the equivalent ○ Support courses are designated as elective courses. ○ Additional core mathematics credits must be chosen from the list of GPS/CCGPS/AP/IB/dual enrollment designated courses. ○ Students with Disabilities who earn credit in GPS Mathematics I or the equivalent, along with the associated support course, *and* GPS Mathematics II or the equivalent, along with the associated support course, may upon determination through the Individualized Education Program Team meet the mathematics diploma requirements by completing GPS Mathematics III, or the equivalent, for a total of 3 mathematics core credits. ○ Students with disabilities, who were identified prior to enrollment in high school and have a disability affecting mathematics achievement, may follow an alternate course sequence to meet the mathematics course requirements of the graduation rule 160-4-2-.48. The alternate course sequences include 1) students enrolling in a single advanced mathematics course and receiving instruction over two years or 2) receiving dispensation from completing Mathematics III. These alternate course sequences would allow a student with disabilities earning core credit in Mathematics I and II with two other mathematics courses to satisfy the minimum mathematics requirements for high school graduation.	○ 4 units of core credit in mathematics ○ 1 unit in CCGPS Coordinate Algebra or the equivalent ○ 1 unit in CCGPS Analytic Geometry or the equivalent ○ 1 unit in CCGPS Advanced Algebra or the equivalent ○ Support courses are designated as elective courses. ○ Additional core mathematics credits must be chosen from the list of GPS/CCGPS/AP/IB/dual enrollment designated courses. ○ Students with Disabilities who earn credit in CCGPS Coordinate Algebra or the equivalent, along with the associated support course, *and* CCGPS Analytic Geometry or the equivalent, along with the associated support course, may upon determination through the Individualized Education Program Team meet the mathematics diploma requirements by completing CCGPS Advanced Algebra or the equivalent, for a total of 3 mathematics core credits. ○ Students with disabilities, who were identified prior to enrollment in high school and have a disability affecting mathematics achievement, may follow an alternate course sequence to meet the mathematics course requirements of the graduation rule 160-4-2-.48. The alternate course sequences include 1) students enrolling in a single advanced mathematics course and receiving instruction over two years or 2) receiving dispensation from completing CCGPS Advanced Algebra. These alternate course sequences would allow a student with disabilities earning core credit in CCGPS Coordinate Algebra and CCGPS Analytic Geometry with two other mathematics courses to satisfy the minimum mathematics requirements for high school graduation.

Mathematics Graduation Requirement Guidance

for Students Entering Ninth Grade in 2013-2014 and thereafter

Section 2: Mathematics Course Sequence Information for Students Entering Ninth Grade in 2013-2014 and thereafter.

Flowchart for Students Entering Ninth Grade in 2013-2014 and thereafter					
GRADE	Option 1	Option 2	Option 3	Option 4	Option 5
			Advanced	Accelerated	Accelerated
6	Grade 6	Grade 6	Grade 6 Advanced	Grade 6-8 Advanced	Grade 6-8 Advanced
7	Grade 7	Grade 7	Grade 7 Advanced		
8	Grade 8	Grade 8	Grade 8 Advanced	CCGPS Coordinate Algebra	Accelerated CCGPS Accelerated Coordinate Algebra/Analytic Geometry A
9	CCGPS Coordinate Algebra	Accelerated CCGPS Coordinate Algebra/Analytic Geometry A	Accelerated CCGPS Coordinate Algebra/Analytic Geometry A	CCGPS Analytic Geometry	Accelerated CCGPS Analytic Geometry B/ Advanced Algebra
10	CCGPS Analytic Geometry	Accelerated CCGPS Analytic Geometry B/ Advanced Algebra	Accelerated CCGPS Analytic Geometry B/ Advanced Algebra	CCGPS Advanced Algebra	Accelerated CCGPS Pre-Calculus
11	CCGPS Advanced Algebra	Accelerated CCGPS Pre-Calculus	Accelerated CCGPS Pre-Calculus	Fourth Mathematics Course Options*; IB Courses**; Dual*** & Joint Enrollment Courses	Fourth Mathematics Course Options*; IB Courses**; Dual*** & Joint Enrollment Courses
12	Fourth Mathematics Course Options*; IB Courses**; Dual*** & Joint Enrollment Courses	Fourth Mathematics Course Options*; IB Courses**; Dual*** & Joint Enrollment Courses	Fourth Mathematics Course Options*; IB Courses**; Dual*** & Joint Enrollment Courses	Fourth Mathematics Course Options*; IB Courses**; Dual*** & Joint Enrollment Courses	Fourth Mathematics Course Options*; IB Courses**; Dual*** & Joint Enrollment Courses

* Fourth Mathematics Course Options are listed in Chart A on page 8.

**International Baccalaureate Course Sequences are provided in Chart B on page 9.

***Additions to the High School Roster of ACCEL-Aligned Courses are provided on page 10.

CHART A: CCGPS Fourth Mathematics Course Options for Students Entering Ninth Grade in 2013-2014 and thereafter

	4th Mathematics	Suggested Prerequisite Courses
27.09740	CCGPS Pre-Calculus	CCGPS: Coordinate Algebra + Analytic Geometry + Advanced Algebra OR CCGPS: Accelerated Coordinate Algebra/Analytic Geometry A + Accelerated Analytic Geometry B/Advanced Algebra
27.08500	Advanced Mathematical Decision Making (AMDM)	CCGPS: Coordinate Algebra + Analytic Geometry + Advanced Algebra OR CCGPS: Accelerated Coordinate Algebra/Analytic Geometry A + Accelerated Analytic Geometry B/Advanced Algebra
27.08800	Statistical Reasoning	CCGPS: Coordinate Algebra + Analytic Geometry + Advanced Algebra OR CCGPS: Accelerated Coordinate Algebra/Analytic Geometry A + Accelerated Analytic Geometry B/Advanced Algebra
27.08600	Mathematics of Industry and Government (MIG)	CCGPS: Coordinate Algebra + Analytic Geometry + Advanced Algebra OR CCGPS: Accelerated Coordinate Algebra/Analytic Geometry A + Accelerated Analytic Geometry B/Advanced Algebra
27.08700	Mathematics of Finance (MOF)	LEA Flexibility
27.07800	Calculus	CCGPS: Coordinate Algebra + Analytic Geometry + Advanced Algebra + Pre-Calculus
27.07400	AP Statistics	CCGPS: Coordinate Algebra + Analytic Geometry + Advanced Algebra OR CCGPS: Accelerated Coordinate Algebra/Analytic Geometry A + Accelerated Analytic Geometry B/Advanced Algebra
27.07200	AP Calculus AB	CCGPS: Coordinate Algebra + Analytic Geometry + Advanced Algebra + Pre-Calculus OR CCGPS: Accelerated Coordinate Algebra/Analytic Geometry A + Accelerated Analytic Geometry B/Advanced Algebra +Accelerated Pre-Calculus
27.07300	AP Calculus BC	CCGPS: Accelerated Coordinate Algebra/Analytic Geometry A + Accelerated Analytic Geometry B/Advanced Algebra +Accelerated Pre-Calculus
27.05200	History of Mathematics	AP Calculus AB or BC (may be taken concurrently with AP Calculus); 0.5 elective credit only
27.07700	Multivariable Calculus	AP Calculus BC
27.08000	Engineering Calculus	AP Calculus BC
27.07900	Advanced Mathematical Topics	AP Calculus AB or BC

Mathematics Graduation Requirement Guidance

for Students Entering Ninth Grade in 2013-2014 and thereafter

CHART B: International Baccalaureate Mathematics-CCGPS Mathematics Course Sequences for Students Entering Ninth Grade in 2013-2014 and thereafter– Page 1

Grade	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
					MS Acceleration	MS Acceleration
6	Grade 6	Grade 6	Grade 6	Grade6	Grades 6-8	Grades 6-8
7	Grade 7	Grade 7	Grade7	Grade 7		
8	Grade 8	Grade 8	Grade 8	Grade 8	CCGPS Coordinate Algebra	Accelerated CCGPS Coordinate Algebra/Analytic Geometry A
9	CCGPS Coordinate Algebra	CCGPS Coordinate Algebra	Accelerated CCGPS Coordinate Algebra/Analytic Geometry A	Accelerated CCGPS Coordinate Algebra/Analytic Geometry A	CCGPS Analytic Geometry	Accelerated CCGPS Geometry B/ Advanced Algebra
10	CCGPS Analytic Geometry	CCGPS Analytic Geometry	Accelerated CCGPS Geometry B/ Advanced Algebra	Accelerated CCGPS Geometry B/ Advanced Algebra	CCGPS Advanced Algebra	Accelerated CCGPS Pre-Calculus or IB Mathematics Studies*
11	CCGPS Advanced Algebra	CCGPS Advanced Algebra: Block / CCGPS Pre-Calculus or IB Mathematical Studies – Year 1*: Block	Accelerated CCGPS Pre-Calculus or IB Mathematical Studies – Year 1*	Accelerated CCGPS Pre-Calculus or IB Mathematics – Year 1*	IB Mathematical Studies – Year 1*	IB Mathematics – Year 1* or AP Calculus AB
12	IB Mathematical Studies – Year 1	IB Mathematics – Year 1 or IB Mathematical Studies – Year 2	IB Mathematics – Year 1 or IB Mathematical Studies – Year 2	IB Mathematics – Year 2 or AP Calculus AB/BC, AP Statistics	IB Mathematics – Year 1 or IB Mathematical Studies – Year 2	IB Mathematics – Year 2 or AP Calculus AB/BC, AP Statistics

**After students meet the diploma requirements for IB Standard Level, additional choices for the fourth year could include Advanced Mathematical Decision Making, Mathematics of Industry and Government, Mathematics of Finance, Statistical Reasoning, AP Statistics, and AP Calculus AB/BC.*

ACCEL Program: High School Course Roster Additions

The courses and course codes below are *inactive* and will not appear on the IDA-3 roster of state-funded courses

The courses and course codes below are to be used ONLY to report dual enrollment credit for a college course which ACCEL has aligned to the *inactive* course.

27.07910	College Statistics A
27.07920	College Statistics B
27.08010	College Calculus A
27.08020	College Calculus B

Section 3: High School Mathematics Course Descriptions

Georgia Mathematics

The Georgia Mathematics Curriculum focuses on actively engaging students in the development of mathematical understanding by encouraging the use of manipulative and a variety of representations (e.g., concrete, symbolic, verbal, graphical), by supporting independent and cooperative work to solve problems, by emphasizing estimation and fluent computation, and by offering opportunities to conduct investigations and to report findings. The CCGPS mathematics courses expect students to apply mathematical concepts and skills in the context of authentic problems and understand concepts, rather than to merely follow a sequence of procedures. In Georgia mathematics classrooms, students will develop the habits of mathematical thinkers, will learn to think critically in a mathematical way with an understanding that there are different means to a solution, and will be given opportunities to explain their thinking and to critique the thinking of others. The three facets of rigor, which are conceptual understanding, fluency, and application, will be pursued with equal intensity. The CCGPS mathematical practice standards define the reasoned, logical connections that make mathematics manageable and are integral to the structure of the mathematics. The practice standards underpin the coherence and focus inherent to the content of the curriculum.

In CCGPS mathematics, content is divided into clusters of standards and addressed in unit size pieces. The grade level clusters are not emphasized equally, but none can be neglected or ignored without negative consequences to the learning progression. After all, grade level content is not a new event, but rather an extension of previous learning and a prelude to future learning. The high school CCGPS courses add a modeling category and demonstrate a decided connection of Euclidean geometry to transformational geometry.

CCGPS High School Mathematics

CCGPS Coordinate Algebra

This is the first in a sequence of three high school courses designed to ensure career and college readiness. The course represents a discrete study of algebra with correlated statistics applications and a bridge to the second course through coordinate geometric topics.
The course requires that students:

- Reason quantitatively and use units to solve problems
- Interpret the structure of expressions
- Create linear and exponential equations that describe numbers or relationships
- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable and systems of linear equations
- Represent and solve equations and inequalities graphically
- Understand the concept of a function and use function notation
- Interpret functions that arise in applications in terms of the context
- Analyze linear and exponential functions using different representations
- Build a function that models a relationship between two quantities and new functions from existing functions
- Construct and compare linear and exponential models and solve problems
- Interpret expressions for functions in terms of the situation they model
- Experiment with transformations in the plane

- Use coordinates to prove simple geometric theorems algebraically
- Summarize, represent, and interpret data on a single count or measurement variable and on two categorical and quantitative variables
- Interpret linear models

CCGPS Analytic Geometry

This is the second course in a sequence of three high school courses designed to ensure career and college readiness. The course embodies a discrete study of geometry analyzed by means of algebraic operations with correlated probability/statistics applications and a bridge to the third course through algebraic topics. The course requires that students:

- Extend the properties of exponents to rational exponents
- Use properties of rational and irrational numbers; perform arithmetic operations with complex numbers
- Use complex numbers in polynomial identities and equations
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Make geometric constructions
- Understand similarity in terms of similarity transformations and prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
- Understand and apply theorems about circles; find arc lengths and areas of sectors of circles
- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically
- Explain volume formulas and use them to solve problems
- Interpret the structure of expressions; write expressions in equivalent forms to solve problems
- Perform arithmetic operations on polynomials
- Create equations that describe numbers or relationships
- Solve equations and inequalities in one variable and systems of equations
- Interpret functions that arise in applications in terms of the context
- Analyze functions using different representations
- Build a function that models a relationship between two quantities; build new functions from existing functions
- Construct and compare linear, quadratic, and exponential models and solve problems
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Understand independence and conditional probability and use them to interpret data
- Use the rules of probability to compute probabilities of compound events in a uniform probability model

CCGPS Advanced Algebra

This is the culminating course in a sequence of three high school courses designed to ensure career and college readiness. It is designed to prepare students for fourth course options relevant to their career pursuits. The course requires that students:

- Use complex numbers in polynomial identities and equations.
- Interpret the structure of expressions; write expressions in equivalent forms to solve problems
- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions
- Create equations that describe numbers or relationships
- Understand solving equations as a process of reasoning and explain the reasoning
- Solve systems of equations; represent and solve equations and inequalities graphically
- Interpret functions that arise in applications in terms of the context; analyze functions using different representations
- Build a function that models a relationship between two quantities; build new functions from existing functions
- Construct and compare linear, quadratic, and exponential models and solve problems
- Extend the domain of trigonometric functions using the unit circle
- Model periodic phenomena with trigonometric functions
- Prove and apply trigonometric identities
- Visualize relationships between two-dimensional and three-dimensional objects;
- Apply geometric concepts in modeling situations
- Summarize, represent, and interpret data on a single count or measurement variable
- Understand and evaluate random processes underlying statistical experiments
- Make inferences and justify conclusions from sample surveys, experiments, and observational studies

CCGPS Pre-Calculus

This is a fourth mathematics course designed to prepare students for calculus and other college level mathematics courses. The course requires that students:

- Perform arithmetic operations with complex numbers
- Represent complex numbers and their operations on the complex plane
- Represent and model with vector quantities
- Perform operations on vectors
- Perform operations on matrices and use matrices in applications
- Solve systems of equations
- Build new functions from existing functions
- Extend the domain of trigonometric functions using the unit circle
- Model periodic phenomena with trigonometric functions
- Prove and apply trigonometric identities
- Apply trigonometry to general triangles
- Translate between the geometric description and the equation for a conic section
- Use the rules of probability to compute probabilities of compound events in a uniform probability model
- Calculate expected values and use them to solve problems
- Use probability to evaluate outcomes of decisions

Accelerated CCGPS Coordinate Algebra/Analytic Geometry A

This is the first in a sequence of mathematics courses designed to ensure that students are prepared to take higher-level mathematics courses during their high school career, including Advanced Placement Calculus AB, Advanced Placement Calculus BC, and Advanced Placement Statistics. The course requires that students:

- Reason quantitatively and use units to solve problems
- Interpret the structure of expressions
- Create linear and exponential equations that describe numbers or relationships
- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable and systems of linear equations
- Represent and solve equations and inequalities graphically
- Understand the concept of a function and use function notation
- Interpret functions that arise in applications in terms of the context
- Analyze functions using different representations
- Build a function that models a relationship between two quantities and new functions from existing functions
- Construct and compare linear and exponential models and solve problems
- Interpret expressions for functions in terms of the situation they model
- Experiment with transformations in the plane
- Use coordinates to prove simple geometric theorems algebraically
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Make geometric constructions
- Understand similarity in terms of similarity transformations and prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
- Understand and apply theorems about circles; find arc lengths and areas of sectors of circles
- Explain volume formulas and use them to solve problems
- Summarize, represent, and interpret data on a single count or measurement variable and on two categorical and quantitative variables
- Interpret linear models

Accelerated CCGPS Analytic Geometry B/Advanced Algebra

This is the second in a sequence of mathematics courses designed to ensure that students are prepared to take higher-level mathematics courses during their high school career, including Advanced Placement Calculus AB, Advanced Placement Calculus BC, and Advanced Placement Statistics. The course requires that students:

- Extend the properties of exponents to rational exponents
- Use properties of rational and irrational numbers; perform arithmetic operations with complex numbers
- Perform arithmetic operations on polynomials
- Use complex numbers in polynomial identities and equations
- Interpret the structure of expressions; write expressions in equivalent forms to solve problems
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions
- Create equations that describe numbers or relationships
- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Solve systems of equations; represent and solve equations and inequalities graphically
- Interpret functions that arise in applications in terms of the context; analyze functions using different representations

- Build a function that models a relationship between two quantities; build new functions from existing functions
- Construct and compare linear, quadratic, and exponential models and solve problems
- Extend the domain of trigonometric functions using the unit circle
- Model periodic phenomena with trigonometric functions
- Prove and apply trigonometric identities
- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically
- Visualize relationships between two-dimensional and three-dimensional objects;
- Apply geometric concepts in modeling situations
- Summarize, represent, and interpret data on a single count or measurement variable
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Understand and evaluate random processes underlying statistical experiments
- Make inferences and justify conclusions from sample surveys, experiments, and observational studies

Accelerated CCGPS Pre-Calculus

This is the third in a sequence of mathematics courses designed to ensure that students are prepared to take higher-level mathematics courses during their high school career, including Advanced Placement Calculus AB, Advanced Placement Calculus BC, and Advanced Placement Statistics. The course requires that students:

- Perform arithmetic operations with complex numbers.
- Represent complex numbers and their operations on the complex plane.
- Represent and model with vector quantities
- Perform operations on vectors.
- Perform operations on matrices and use matrices in applications
- Solve systems of equations
- Build new functions from existing functions
- Extend the domain of trigonometric functions using the unit circle
- Model periodic phenomena with trigonometric functions
- Prove and apply trigonometric identities
- Apply trigonometry to general triangles
- Translate between the geometric description and the equation for a conic section
- Use the rules of probability to compute probabilities of compound events in a uniform probability model
- Calculate expected values and use them to solve problems
- Use probability to evaluate outcomes of decisions

Section 4: Student Placement

I. Student Placement from Grade 8 CCGPS Mathematics to CCGPS Coordinate Algebra or Accelerated CCGPS Coordinate Algebra/Analytic Geometry A

Students who have successfully completed CCGPS mathematics in grades 6 – 8 have mastered the content necessary to be successful in CCGPS Coordinate Algebra or Accelerated CCGPS Coordinate Algebra/Analytic Geometry. Determination of course placement should depend on the student's interest in mathematics and/or related fields of study and on the student's achievement in mathematics. As the pace and rigor of accelerated mathematics courses is significantly more challenging than that of the regular mathematics sequence, students placed in an accelerated mathematics course should have strong mathematical skills and an interest in pursuing Advanced Placement or other higher-level mathematics courses while still in high school.

Students who will require additional support for success in CCGPS Coordinate Algebra are best served through placement in CCGPS Coordinate Algebra Support concurrent with enrollment in CCGPS Coordinate Algebra. Students should be enrolled in mathematics support courses based on local system criteria for identifying students who are at risk for failing mathematics. Students who are *placed* in high school and have not passed the grade 8 math CRCT should certainly be afforded the benefit of a support course. Other criteria might include teacher recommendation based on student performance in the previous or current mathematics course, prior retention, a failing grade in a mathematics course, and/or low scores on the mathematics component of the CRCT or other instruments used by the system to predict success.

Schools should consider equity and access for all when assigning students to accelerated mathematics courses. The CCGPS curricula provide the opportunity for students with an interest and desire to study mathematics to challenge themselves by taking more rigorous courses. Given the alignment of the standards, students who have difficulty in the accelerated mathematics sequences will be able to transition easily to the regular mathematics sequence.

The local school or system will determine the criteria for placing students in appropriate mathematics courses.

II. Student Placement for Students Transferring into Georgia Schools from Out-of-State Schools

Existing mathematics credits granted by out-of-state schools must be transferred as mathematics credit. Because the *content* of courses with similar names can vary significantly, it is crucial that the transcripts of students entering Georgia high schools from other states or countries with existing credit in high school mathematics courses be examined and that the students' mathematics proficiency be assessed. In every case, students' transcripts should be carefully evaluated and compared to Georgia course content; placement assessments are appropriate as needed. Students' interest and levels of achievement (grades) should also be considered when making a placement decision.

Students needing extensive remediation on middle grades topics should be placed in CCGPS Coordinate Algebra, along with CCGPS Coordinate Algebra Support.

- Placement in CCGPS mathematics courses is dependent upon assessment of student knowledge from the transfer school.
- Students should be evaluated by a mathematics instructor with a thorough understanding of the content.
- Because students who transfer from outside Georgia may lack content knowledge from some strands (Algebra, Geometry, and Data Analysis) it is important to identify both strengths and weaknesses for each strand.
- After using the identified strengths to place the student in the appropriate course, identified weaknesses should be used to prescribe supplementary lessons that address pre-requisite content knowledge. These lessons can be delivered through the mathematics Support courses or through independent work.
- Students who complete the mathematics sequences only through CCGPS Advanced Algebra may have limited post- secondary options. Parents should be thoroughly advised of the consequences of their student graduating with only CCGPS Coordinate Algebra through CCGPS Advanced Algebra credit.
- During the advisement session, fourth year mathematics options should be discussed and clarified, and opportunities through summer courses, virtual courses, and other available resources explained.

Transfer Credit

Pursuant to State Board of Education Rule 160-5-1-.15 section (2)(a)," Local boards of education shall accept student course credit earned in an accredited school." In paragraph (2)(a)1, "A local board of education shall not substitute courses and exempt students from the required secondary minimum core curriculum…unless the student transferred from an accredited secondary school…".

Military Transfer Law

In 2009, O.C.G.A. § 20-2-2130 through 20-2-2170 which pertain to the transfer and placement of children of military families in Georgia public schools were added to Georgia State Law. Among other provisions, the law requires that the local school system shall initially honor placement of the student in educational courses based on the student's enrollment in the sending state school or educational assessments conducted at the school in the sending state, if the courses are offered. Course placement includes but is not limited to honors, international baccalaureate, advanced placement, vocational, technical, and career pathways courses. Continuing the student's academic program from the previous school and promoting placement in academically and career challenging courses should be paramount when considering placement. Additionally, local school systems shall have flexibility in waiving course or program prerequisites or other preconditions for placement in courses and programs offered by the local school system.

Course Numbers

Students who move into Georgia shall receive transfer credit for courses taken. Please use the following course numbers to award transfer credit for courses not closely aligned to CCGPS courses: (We will not add the following numbers to State Board of Education Rule 160-4-2-.20 [IDA(3)] since they cannot be used as active classes in the school day, but only for the recording of transfer credit.)

27.03400 Transfer Algebra I (1st year if taught over 2 years)
27.03500 Transfer Algebra I (2nd year if taught over 2 years or if taught in 1 year)
27.03600 Transfer Geometry
27.03700 Transfer Algebra II

III. Student Placement for Students Transferring out of Georgia Schools

Content descriptions (provided on pages 11-15) for all completed CCGPS mathematics courses need to accompany transcripts of students transferring out of Georgia schools.

Section 5: Mathematics Support Course Guidance

Purpose: The purpose of the mathematics support courses is to address the needs of students who have traditionally struggled in mathematics by providing the additional time and attention they need in order to successfully complete their core academic mathematics course without failing.

Mathematics support courses should be taught concurrently with a student's core academic mathematics course. Additional elective credit can be given for mathematics support courses if students retake core academic mathematics courses in which they were not initially successful and choose to retake the associated support course.

How should students be selected to be enrolled in a mathematics support course?

Students should be enrolled in mathematics support courses based on local system criteria for identifying students who are at risk for failing mathematics. Students who are *placed* in high school and have not passed the grade 8 math CRCT should certainly be afforded the benefit of a support course. Other criteria might include teacher recommendation based on student performance in the previous or current mathematics course, prior retention, a failing grade in a mathematics course, and/or low scores on the mathematics component of the CRCT, mathematics EOCT, or other instruments used by the system to predict success.

Who should teach this course?

The course should be taught by a certified mathematics teacher, preferably one with experience in differentiating instruction to meet the needs of struggling students. If English Learners are being served in a mathematics support course, it is recommended that the teacher also hold the ESOL endorsement. The mathematics support teacher should work closely with the teacher(s) teaching the associated core mathematics course to align content, instruction, and assessments.

How important is collaboration among teachers to the success of students enrolled in mathematics support courses?

Teachers of the mathematics support courses and the academic core mathematics courses, including collaborative English Learner (EL) and special education teachers, share the responsibility for students' mathematical achievement. In fact, all teachers who instruct students who are enrolled in mathematics support courses should consistently and frequently engage in communication which focuses on:

- individual student progress, including grades, strengths and weaknesses based on standards, mathematical disposition, and work habits;
- curriculum expectations, including specific standards to be addressed based on a timeline, prerequisite skills, vocabulary, and potential misconceptions;
- instructional strategies, including specific strategies for teaching math concepts that are being used in both classrooms to provide consistency and understanding for teachers and students; and
- differentiation of instruction, including tasks based on the ACCESS for ELs Composite Proficiency Levels of ELs and the WIDA standards for English Learners; and

- assessments, including content and formats that are being used to evaluate students for specific standards.

What are the critical components of a mathematics support course?

- All students in a particular mathematics support course should be enrolled in the same core academic mathematics course. (i.e. students enrolled in CCGPS Coordinate Algebra Support will all be enrolled in CCGPS Coordinate Algebra as well).
- The mathematics support course should focus on mastery of the standards being taught in the associated core academic mathematics course, and not on general content from elementary or middle school.
- Grading practices should emphasize mastery of standards through the frequent use of aligned quizzes and tests, both formative and summative.
- Continual progress monitoring should be used to assess and diagnose each student's strengths and weaknesses, based on the standards of the associated core academic mathematics course, and to provide appropriate interventions.
- Opportunities should be provided for students to review content with a focus on standards not previously mastered.
- Opportunities should be provided for students to preview the mathematical concepts associated with the core academic mathematics course. In the support course, attention needs to be given to prerequisite skills and concepts and to the vocabulary of the current course.
- The academic language of mathematics should be explicitly taught as concepts are introduced and reinforced.
- Proven strategies for success in mathematics should be utilized on a daily basis. Students should be engaged in doing mathematics, explaining their thinking, and justifying their work. Multiple representations of concepts (tables, charts, graphs, verbal descriptions) should be used as often as possible.
- There should be strong emphasis on building a positive disposition toward learning mathematics.
- Although there is no class size requirement for the mathematics support courses, a reduced class size is recommended.

How will students be evaluated in mathematics support courses?

The goal of a mathematics support course is to assist students in the successful completion of the associated core academic mathematics course. Assignments, quizzes and tests should be aligned to the standards being taught in the core academic course. Individuals should be given multiple opportunities to show mastery of the content, including opportunities to demonstrate mastery of material first addressed in the associated core academic mathematics course. Mathematics support provides the time some students need for additional practice or re-testing. The value of formative assessment and feedback cannot be overstated. Continuous progress monitoring with both feedback and commentary is essential in this course. Students should not feel pressure to "make grades" in this class as much as they should be motivated and encouraged to master standards. Documented continuous communication with students on an individual basis is the most appropriate way to maintain records of progress. Remedial Education Program (REP) assessment processes may be appropriate models.

How much credit is awarded for one mathematics support course?

One unit of elective credit is earned for the successful completion of this course.

How is this course different from the Remedial Education Program (REP)?

The focus of the mathematics support course is to provide very specific support for the high school core academic mathematics course in which a student is currently enrolled. The Remedial Education Program is an instructional program designed for students in grades 6-12 who have identified deficiencies in reading, writing, and math. However, REP funding can be used for the mathematics support class, if REP guidelines for eligibility, scheduling, and class size are followed.

If a school is on a 4x4 block schedule, does this mean that students must have mathematics for two blocks during the school day?

It is important that the mathematics support course be taught concurrently with the associated core academic mathematics course. However, scheduling options that keep struggling students engaged in mathematics throughout the school year are generally preferable to two blocks each day for a semester. A hybrid scheduling model might address these issues, allowing for continuous yearlong support without requiring that two of the student's four semester blocks be devoted to mathematics.

Section 6: Resources Available to Middle School and High School Counselors

- Sandi Woodall, Mathematics Program Coordinator
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- Brooke Kline, Mathematics Lead Program Specialist
bkline@doe.k12.ga.us; 404.657.9064

- Dr. James Pratt, Mathematics Program Specialist
jpratt@doe.k12.ga.us; 404.651.7272

- GaDOE Mathematics Program Webpage at:
http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Curriculum-and-Instruction/Pages/Mathematics.aspx

- GaDOE georgiastandards.org CCGPS Mathematics Website at:
https://www.georgiastandards.org/Common-Core/Pages/Math.aspx

Appendix A

Guidelines for Georgia State Board of Education Rule 160-5-1-.15 AWARDING UNITS OF CREDIT AND ACCEPTANCE OF TRANSFER CREDIT AND/OR GRADES.

2(e): Awarding Units of Credit for Mathematics Courses for Students Receiving Special Education Services Under the Individuals with Disabilities Education Act (IDEA).

1. Local boards of education shall award units of credit for mathematics courses that will satisfy the mathematics course requirements in State Board of Education Rule 160-4-2-.48 to a student receiving special education services under IDEA if the student meets all of the following:

i. Prior to the student entering the ninth grade, the student's Individualized Education Program (IEP) Team identified that the student had a disability that affected mathematics achievement;
ii. The student successfully earns course credit in CCGPS Coordinate Algebra and CCGPS Analytic Geometry; and
iii. The student successfully earns course credit for at least two other state-approved mathematics courses, which may include, but not be limited to, mathematics Support courses.

2. The IEP Team for students who receive Mathematics course in this manner shall document that:

i. The student's disability has precluded the student from achieving grade-level proficiency, as demonstrated by the student's pattern of performance on the state-mandated test in the area of Mathematics;
ii. The student's progress to date in response to appropriate instruction, including special education and related services designed to address the student's individual needs, is such that, even if significant growth occurs, the IEP team is reasonably certain that the student will not successfully master the standards in CCGPS Advanced Algebra as traditionally delivered in a single year course. The IEP team should first consider enrolling these students in a single advanced mathematics course with instruction delivered over two years prior to other considerations. The determination of the student's progress has been based on multiple measurements that are valid for the content area of mathematics and that have been collected over a period of time; and
iii. The student has access to instruction in the state-adopted curriculum and will be required to successfully complete CCGPS Coordinate Algebra and CCGPS Analytic Geometry in addition to participating and earning credit in two additional state-approved mathematics courses. As stated above, the IEP team should first consider enrolling these students in a single advanced mathematics course with instruction delivered over two years prior to other considerations. The student's IEP includes goals that are related to mathematics, support access to the content standards, and are designed to promote the student's progress in the content area state-adopted curriculum.

3. Local boards of education shall inform parents and students that students who do not complete CCGPS Advanced Algebra may not meet the mathematics admission requirements for entry into a University System of Georgia institution or other post-secondary institution without additional coursework.

4. **High School Mathematics Decision Rubric**: Local school districts shall use the High School Mathematics Decision Rubric included in Appendix 3.1 of the Guidelines for Georgia State Board of Education Rule 160-5-1-.15, AWARDING UNITS OF CREDIT AND ACCEPTANCE OF TRANSFER CREDIT AND/OR GRADES, to determine which students are eligible for flexibility regarding mathematics requirements for high school graduation as described in the section above. The decision rubric shall be included in the student's IEP.

The High School Mathematics Decision Rubric can be found here:
http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Curriculum-and-Instruction/Documents/SWD%20High%20School%20Mathematics%20Decision%20Rubric%202-15-13.pdf