Maryland
STATE DEPARTMENT OF EDUCATION

Maryland PreK- 12 Mathematics Policy

Mathematics Branch

Office of Teaching and Learning Instructional Programs & Services

Maryland State Department of Education

March 2025

MARYLAND STATE DEPARTMENT OF EDUCATION

Carey M. Wright, Ed.D.
State Superintendent of Schools

Tenette Smith, Ed.D.
Deputy State Superintendent
Office of Teaching and Learning

Wes Moore
Governor

MARYLAND STATE BOARD OF EDUCATION

Joshua L. Michael, Ph.D. (President)

Monica Goldson, Ed.D. (Vice President)

Chuen-Chin Bianca Chang, MSN, PNP, RN-BC

Alverne “Chet” Chesterfield

Kenny Clash

Clarence C. Crawford (President Emeritus)

Abhiram Gaddam (Student Member)

Nick Greer

Dr. Irma E. Johnson

Dr. Kim Lewis

Dr. Joan Mele-McCarthy, D.A., CCC-SLP

Rachel L. McCusker

Xiomara V. Medina, M.Ed.

Samir Paul, Esq.

Acknowledgements

A sincere appreciation is offered to the following individuals who contributed time and expertise to develop this policy. Their contribution will serve the Maryland State Department of Education and the state's local education agencies in their collaborative efforts to enhance mathematics instruction for students, promote access to resources, and ensure the successful implementation of the Mathematics Policy across Maryland. 2025 Version MSDE Contributors include:

OFFICE OF TEACHING AND LEARNING INSTRUCTIONAL PROGRAMS AND SERVICES

Lyndsey Brightful, Director of Mathematics

Elise Brown, Ph.D., Assistant State Superintendent Instructional Programs & Services

Stacie Marvin, NBCT, Coordinator of Mathematics

Jen Meehan, Coordinator of Mathematics

Robert Richardson, **Ed.D.,** Coordinator of Mathematics

Anthony Vargas, Director of Gifted & Talented and Advanced Programs

Table of Contents

Math Policy Engagement and Feedback Process

Timeline	Activity
January 28, 2025	• Version 1 of Maryland PreK-12 Math Policy presented to State Board of Education • State Board of Education shares initial reactions
January 28, 2025- ongoing	• MSDE Mathematics Branch individually responds to community stakeholder feedback shared with the agency by phone or email
February 4- 24, 2025	• Version 1 of Maryland PreK-12 Math Policy posted on MSDE Mathematics Branch website for public feedback.
February 13, 2025	• Version 1 of Maryland PreK-12 Math Policy presented to State Board of Education Policy Committee for information and detailed feedback
February 13 & 14, 2025	• MSDE hosts LEA Leadership Math Policy Feedback Sessions
February 25, 2025	• State Board hosts public hearing
Throughout March 2025	• MSDE shares resources to support the policy (as requested by LEA Leadership)
March 11, 2025	• Maryland Launch Years Task Force and Mathematics Standards & Framework Validation Committee joint meeting (focus on progression of PreK- Integrated Algebra 2 math standards)
March 13, 2025	• MSDE presents Summary of Public comment and Revised Maryland PreK-12 Math Policy • Version 2 of Maryland PreK-12 Math Policy presented to State Board of Education Policy Committee for adoption
March 14, 2025	• Pi Day LEA Leadership film screening/ Maryland Math Policy discussion • Pi Day Community film screening/ Maryland Math Policy discussion
March 20, 2025	• Math Policy Full Day Deep Dive at LEA Math Supervisor Collaborative
March 25, 2025	• Version 2.5 of Maryland PreK-12 Math Policy presented to State Board of Education for adoption • Policy unanimously adopted

I. Purpose

The PreK- 12 Maryland Mathematics Policy is designed to catalyze significant improvements to teaching, learning, and achievement in mathematics from early childhood through secondary grades across Maryland.

This policy aligns with and advances the foundational goals of The Blueprint for Maryland's Future by prioritizing equitable access to rigorous, relevant, high-quality mathematics education for all students in grades PreK through 12. This policy outlines recommendations for implementation of a coherent math program and support structure that guides students' mathematical development from early childhood through high school. Herein, we focus teaching and learning in mathematics to ensure that students can both conceptually understand and fluently apply math concepts, skills, and strategies in order to extend these experiences beyond the classroom and apply mathematical skills to their daily lives and future aspirations.

According to data from the 2024 administration of NAEP, 37% of 4th-grade students in Maryland scored at or above proficiency in math, in comparison to 39% of students nationally. Data from the 2024 NAEP administration showed that 25% of Maryland 8th graders scored at or above proficient in math, compared to 27% of students nationally. Historically, Maryland students have exceeded the national proficiency rate in grades 4 and 8, but in recent years, this trend has shifted. Additionally, in 2024, data from Maryland's state assessment, the Mathematics Maryland Comprehensive Assessment Program (MCAP), revealed that student outcomes improved from School Year 2022-2023 across all grade levels, but have not returned to pre-pandemic performance outcomes and remain below Maryland's expectations for student mathematical proficiency.

Acknowledging the current challenges with student achievement in mathematics across the state and recognizing struggle as a natural part of the math learning process (Sharma, 2024), this policy extends a deep commitment to instructional equity, access, and opportunity. The Maryland State Department of Education (MSDE) and the Maryland State Board of Education are committed to building comprehensive systems to ensure that all students receive responsive support when they need it. These systems must include meaningful daily, on-grade-level, standard aligned instruction and access to intervention and acceleration which will support student success from prekindergarten through secondary mathematics pathways for all students across Maryland.

Central to this policy is a redesign of the core secondary mathematics sequence to ensure that all students are mathematically college and career ready by the end of 10th grade and have multiple pathways and opportunities to explore rigorous mathematics content thereafter. This readiness equips all students to successfully pursue a diverse range of secondary mathematics pathways, tailored to their interests and future goals. Fundamentally, secondary mathematics success is built on a strong foundation of numeracy in the early and intermediate grades and the development of algebraic thinking and abstraction in the middle grades (SAP, 2021; Siegler et al., 2012).

In addition, the policy acknowledges the historical barriers to high-quality math experiences that exclusionary tracking creates, particularly for historically marginalized student groups (Francis & Darity, 2021; Irizarry, 2021; NCTM, 2018). It therefore is explicit about moving away from exclusionary tracking and creating structures that create authentic opportunities for all students to engage in advanced math throughout the PreK-12 progression. School schedules in every school across the state must be designed and implemented to reflect the belief that all students are capable of learning and doing mathematics.

Key policy recommendations also include the development and implementation of ongoing, job-embedded professional learning opportunities for all educators that promote effective teaching practices, implementation of standard-aligned instruction, and data-driven pedagogical approaches. Policy implementation will be monitored through the establishment of systemized, grade-level standards aligned assessments across Local Education Agencies (LEAs). These assessments will evaluate students' progress in defined areas of numeracy development and will enable consistent progress monitoring and support the strategic analysis of student-level data. LEAs will also review and respond to annual student data aligned to equitable access and student outcomes in advanced mathematics. To support implementation, MSDE and LEAs will collectively launch initiatives to involve and support families, communities, and local organizations in mathematics education through regular forums and workshops across the state.

The policy's key strategic recommendations were developed through collaboration with the PreK-12 and higher education math community, including the Charles A. Dana Center Launch Years Initiative. To align recommendations with local context, community feedback played an important role in shaping these policy recommendations.

II. Definitions

Throughout this policy, several key terms are used. The following section defines these terms as they are intended within the context of this policy's development.

A. **Acceleration** refers to providing students with access to mathematics content standards and instruction beyond their current grade level. It can occur at any grade and is based on demonstrated mastery of core content.

B. **Equitable Access** ensures that all students, particularly those from socio-economically disadvantaged and underserved groups, students with disabilities, and Multilingual Learners (ML), receive the support, resources, and opportunities they need to succeed in mathematics. Unlike *equal* opportunity, which treats all students the same, *equitable access* requires a deliberate and intentional approach that addresses historical and systemic barriers to participation in advanced mathematics (DiME, 2007; Leonard, 2009). *Equitable access focuses on ensuring that students who have been historically excluded are intentionally included in mathematics pathways and acceleration opportunities, with structures in place to support their success.*

C. **Equitable Teaching Practices** ensure that all students have meaningful engagement with standards aligned content. These practices are intentional and responsive and provide differentiated support and attention to uplift students who might otherwise become disengaged. By tailoring support to individual needs and focusing on building conceptual understanding rather than relying on rote procedures to support all students, equitable teaching helps remove barriers to learning, fosters a sense of belonging in mathematics, and cultivates the ability to apply mathematical ideas in new contexts (NCTM, 2018).

D. **Exclusionary Tracking** refers to the practice of placing students into rigid learning tracks, often arbitrary and based on assumptions about their abilities, which limits their future opportunities in mathematics (NCTM, 2018; Oakes, 2005; Oakes & Guiton, 1995).

E. **Flexible grouping** refers to student groups based on readiness and interest, with grouping decisions made frequently—by lesson, topic, unit, or even the modality of task engagement. Flexible groups can include homogeneous or heterogenous groupings for students developing skills on a targeted concept.

F. **Integrated Algebra** refers to the intentional integration of algebra, geometry, and statistics to showcase their interconnected nature for a cohesive and deeper understanding of mathematics. With this approach, students are provided opportunities to use different areas of math (algebra, geometry, statistics) as a lens through which they develop a more holistic understanding of concepts traditionally taught in isolation. For example, students can explore concepts like quadratic relationships not only through the lens of algebra but also by analyzing their graphical representations in geometry and modeling real-world data in statistics. *See Appendix A for an overview of Integrated Algebra 1 & 2 course content.*

G. **Secondary Mathematics Pathways** include mathematics courses that support students in building a unique, tailored path to mathematical college and career readiness. These pathways, starting no later than grade 11, are aligned with students' goals and interests and increase the relevance of secondary mathematics by acknowledging student autonomy in choosing their own mathematical path. Pathway options include Quantitative Reasoning, Data and Data Analytics, Algebraic Foundations of Calculus, and Statistics and Probability. *See Appendix C for an overview of Secondary Mathematics Pathways.*

III. Advancing Numeracy Through Consistent, Clear, and Effective Mathematics Instruction

A. This policy is grounded in the commitment to provide every student with meaningful math experiences that emphasize the development of numeracy.

B. The development of numeracy is supported by mathematics instruction that is both intentional and visible (Hattie et al., 2017) across Tiers I, II, and III. When implemented strategically and systematically, effective mathematics instruction guides students' development of conceptual understanding and procedural fluency, also ensuring that clearly defined processes and goals are transparently communicated. This visible mathematics instruction is grounded in the following principles (NMAP, 2008):

    1. Teachers set and communicate clear learning goals to ensure students understand the purpose and focus of their learning and what success looks like.

    2. Teachers provide clear models for strategically solving problems with a series of examples.

    3. Teachers actively make connections to prior mathematical knowledge, skills, or experiences to promote internalization of new concepts and support students' learning progression.

    4. Students are provided with extensive opportunities to practice new skills in a variety of contexts, with deliberate connections made to prior mathematical knowledge.

    5. Students are provided with opportunities to discuss their approaches with their peers and teachers.

    6. Teachers consistently provide timely and specific feedback to guide the mathematics learning progression.

C. Students demonstrate mathematical proficiency by jointly developing conceptual understanding of and procedural fluency with mathematical concepts, that then can be applied to various problem-solving contexts (NMAP, 2008).

    1. Concepts are to be introduced and developed through an appropriate balance of the concrete, semi-concrete or representational, and abstract approach.

    2. Instruction should lead students to develop flexible, accurate, and efficient application of mathematical strategies, including the informed use of standard algorithms.

    3. Students should develop automaticity, that is the ability to recall facts quickly, accurately, and with little effort, in order to lighten cognitive load and enable more complex problem solving.

D. The pathway to college and career numeracy develops within four interconnected content domains as students' progress from early elementary to secondary mathematics learning experiences. Each domain reflects a developmental progression from fundamental concepts in early grades to advanced skills in high school, and provides students with a multidimensional

understanding of numerical and algebraic relationships, spatial awareness and geometric modeling capabilities, proficient data literacy and critical statistical reasoning skills:

1. Number and Operational Sense - Early numeracy development begins with foundational skills in counting, place value, and basic operations which provide the foundation for proportional reasoning. As students' progress through their understanding of whole numbers, fractions, decimals, ratios, and percentages, they build fluency in interpreting and manipulating numerical information. This developmental trajectory enables students to recognize and make use of structure, attend to precision, and reason flexibly about numerical relationships, including proportionality.

2. Algebraic Reasoning - The progression of algebraic thinking starts with identifying and analyzing patterns to create mathematical models. Students advance from early pattern recognition to exploring functions (e.g., linear, exponential, and quadratic) and developing symbolic representations to model mathematical phenomena. As they deepen their algebraic thinking, they learn to algebraically express regularity in repeated reasoning, construct viable arguments, and critique the algebraic reasoning of others as they solve authentic problems in collaborative spaces.

3. Geometric Reasoning - Development in geometrical reasoning begins with recognizing shapes, symmetry, and measurement concepts. Over time, students expand their spatial awareness to include transformations, trigonometry, and spatial modeling. As they progress, students engage in conjecture, reasoning inductively and deductively, and verifying their conclusions. They learn to use multiple representations to analyze and reason about spatial phenomena and apply these skills to solve both abstract and practical problems.

4. Reasoning with Data and Statistics - The ability to reason with data and statistics develops as students move from organizing and interpreting information to engaging with variability, probability, and uncertainty. As they progress, they develop statistical models, analyze patterns, and question data sources critically. This growth includes using tools and technology to synthesize information and communicate findings effectively. By the time they reach advanced levels, students are prepared to apply data-driven decision making in complex, real-world contexts.

E. Adoption and effective implementation of High-Quality Instructional Materials (HQIM) supports access to daily effective mathematics instruction for all students.

F. Students' attitudes toward math, tied to their math identity, need consistent support throughout their learning journey. To build positive math identities, instruction should include opportunities for mathematical modeling and reasoning, exploring connections between ideas, and strengthening reasoning skills through productive struggle and collaboration. Additionally, students should have experiences that help them see themselves as capable mathematicians, develop a sense of belonging in the mathematics classroom, and recognize the relevance of mathematics in their lives and communities (Aguirre, et al., 2013).

IV. Policy Standards

A. ACCESS AND EQUITABLE MATHEMATICS OPPORTUNITIES

1. By School Year (SY) 2026-2027, LEAs must implement a Multi-Tiered System of Supports (MTSS) for mathematics instruction to provide responsive, differentiated support that meets the needs of all students, including those requiring intervention, enrichment, or acceleration.

    a. MTSS ensures real-time, evidence-based support aligned with grade-level standards, structured across three tiers:

        i. **Tier I:** High-quality, differentiated instruction in the classroom by licensed math teachers using grade-level, standards aligned curricular resources. Tier I instruction is designed for all students and incorporates Universal Design for Learning (UDL) principles to provide scaffolding for students who need additional support, enrichment for advanced learners, and an inclusive learning environment that fosters confidence and reduces math anxiety.

        ii. **Tier II:** Small-group instruction for students needing additional support or enrichment beyond Tier I. This instruction reinforces core content, builds prerequisite skills necessary for grade-level success, and/or provides opportunities for deeper engagement with mathematical concepts for students who would benefit from content extension.

        iii. **Tier III:** Intensive, individualized support for students with significant learning needs or those requiring an accelerated progression. This includes tailored interventions, foundational skill development, and mentoring for emotional growth and confidence.

    b. School-based structures and schedules for MTSS must be designed to facilitate the consistent implementation of Tier II and Tier III instruction during the school day without disrupting Tier I instructional blocks. Additional opportunities for Tier II and Tier III instruction can be provided after school or during the summer.

    c. MTSS is a framework for providing tiered support, not a system for categorizing students into fixed tiers. Schools must regularly review student progress and ensure that movement between levels of support occurs dynamically. Support should be adjusted at the content module level (e.g., unit, topic, or instructional cycle), but at a minimum, student progress must be reviewed, and support must be refined after each end-of-unit summative assessment.

    d. LEAs must develop and implement protocols for identifying and supporting students who have not reached proficiency in number and operation, algebraic thinking, geometrical reasoning, and reasoning with data and statistics as identified in MSDE's Numeracy Development Framework.

        i. School and district leaders should prioritize MTSS in mathematics to enhance student proficiency by the end of elementary school. Further details will be in MSDE's MTSS Framework and MTSS Math Guidance.

ii. LEAs should leverage mathematics interventionists to provide targeted, research-based support for students requiring additional assistance beyond core instruction (Jimerson et al., 2016; Roach & Elliott, 2008). These interventionists should support Tier II and Tier III instruction by reinforcing foundational and prerequisite skills, deepening conceptual understanding, and providing data-driven interventions.

2. Beginning in SY 2026-2027, LEAs shall develop a process to identify and support students who exhibit difficulties with learning mathematics, including students with disabilities. To support their numeracy development, identified students shall receive supplemental instruction (Gersten et al., 2009) aligned to their identified needs through MTSS which include:

    a. Explicit and systematic instruction that prioritizes the use of mathematical language, manipulatives, visual representations (including number lines), word problem structures, and dedicated time for developing fact fluency;

    b. A proactive, school-wide framework for supporting and increasing academic, behavioral, and social emotional outcomes for all students

    c. Program-specific monitoring tools that LEAs should use to collect and analyze intervention data to make instructional decisions; and

    d. All mathematics learning goals in student Individualized Education Programs should be reviewed annually to ensure alignment with core grade level content and student numeracy development;

    e. Math-specific language goals that are clearly defined to support Multilingual Learners in developing the academic vocabulary, reasoning skills, and communication strategies necessary for full engagement with mathematics (Aguirre et al., 2012; Moschkovich, 2015; Zwiers et al., 2017). These goals should be intentionally integrated into instruction, with ongoing scaffolds and progress monitoring.

3. By SY 2027- 2028, all LEAs must develop and implement an accelerated mathematics course progression that is an evidence-based, continuous process that provides students with multiple opportunities to advance in mathematics based on readiness and interest. Acceleration decisions should:

    a. Be data-driven, flexible, and equitable,

    b. Use a multi-tiered approach that includes in-class opportunities, and

    c. Support individual student needs.

4. By SY 2027- 2028, all students entering grades 3-7 should be evaluated for math acceleration readiness at least once a school year based on multiple data points such as formative and summative assessment progress, teacher observations, parent observations, and student reflection. Each LEA shall develop a system for identification.

    a. Beginning in grade 3, every school must offer an accelerated mathematics course progression that allows access to Integrated Algebra 1 by grade 8 for students who

demonstrate readiness. Progressions must ensure students receive instruction or demonstrate mastery in all core content for each grade level.

b. All students enrolled in accelerated pathways are expected to demonstrate mastery in accelerated course content. LEAs and schools are responsible for providing timely and robust supports for students who struggle in accelerated courses.

c. LEAs must implement automatic mathematics course acceleration progressions for all students who achieve the highest level of proficiency level on state assessments in grades 3-6.

    i. In grades 3-4, additional data points should be reviewed to determine readiness for acceleration for students who achieve proficiency on the state assessment.

    ii. In grade 5, all students who achieve proficiency should be placed on a progression aligned to enrollment in Integrated Algebra 1 by grade 8.

d. Acceleration course progressions should provide students with access to Integrated Algebra before high school.

e. Full expectations for acceleration practices can be found in MSDE's Mathematics Acceleration Guidance released by Summer 2025.

5. Beginning SY 2027-2028, LEAs shall adhere to a minimum daily requirement of 60 cumulative instructional minutes or the equivalent of 300 weekly minutes for all math courses in kindergarten through grade 8. Exemplar schedule models aligned to MTSS will be provided in guidance.

6. Beginning in SY 2025-2026, LEAs shall review all scheduling policies and practices to reduce or eliminate exclusionary tracking in mathematics education and ensure students are purposefully grouped in classrooms where all students have access to effective mathematics instruction and robust support within a formal MTSS structure.

7. By SY 2026-2027, school schedules should be aligned to the MTSS expectations and the expectations below:

    a. In early grades PreK-1, schools must maintain heterogenous mathematics classrooms. Flexible grouping should be utilized to support and enrich student learning.

    b. In elementary grades 2-5, schools should purposefully and regularly regroup students for math instruction based on LEA developed MTSS math structures, including accelerated math classes.

    c. In middle grades 6-8, schools must provide math intervention during the school day for students who demonstrate the need for additional support. In alignment with MTSS, intervention scheduling should be in addition to Tier 1 instruction, flexible, and allow students to transition in and out of support courses throughout the school year.

    d. In high school (grades 9-12), schools must provide access to a variety of secondary mathematics pathways that align with different career and academic interests.

e. Students who demonstrate challenges with mathematics content should always remain enrolled in mathematics courses aligned to grade-level standards in addition to appropriate co-requisite support courses when warranted (Alexander et al., 2003; Fong et al., 2014; Logue et al., 2019).

8. In collaboration with MSDE, LEAs should incorporate support for numeracy development into their community engagement initiatives.

    a. Beginning in SY 2025-2026, MSDE will develop grade level family guides to support families with understanding and supporting core math concepts for each grade level.

    b. Beginning in SY 2025-2026, LEAs should hold regular forums throughout the school year to support families with understanding core content in each grade level and how they can best support students.

    c. LEAs should develop and implement a mechanism to discuss changes to mathematics instruction, structures, and systems with families and community stakeholders.

9. LEAs will be required to submit annual reports to MSDE detailing student outcomes, aligned to the strategies implemented to provide equitable access. MSDE will develop and communicate a template for reporting by Summer 2027.

B. COLLEGE AND CAREER READINESS MATH STANDARD PROGRESSION

1. LEAs shall prepare for full implementation of the revised mathematics standards and course progression for grades PreK-12 by SY 2028-2029.

    a. Beginning in SY 2026-2027, LEAs shall implement curriculum and instruction aligned to prekindergarten through grade 8 Maryland College and Career Readiness (MCCR) mathematics standards.

    b. All schools must shift from the current Algebra I – Geometry – Algebra II (AGA) secondary mathematics course progression to an Integrated Algebra course progression that launches students into their chosen mathematics pathway.

        i. Beginning in SY 2027-2028, LEAs shall implement curriculum and instruction aligned to PreK-Integrated Algebra 1 math standards for all students enrolled in Algebra for the first time.

        ii. Beginning in SY 2028-2029, LEAs shall implement curriculum and instruction aligned to PreK-Integrated Algebra 2 math standards for all students who completed Integrated Algebra 1 the prior school year.

    c. Beyond SY 2028-2029, all students should follow the PreK-12 course sequence culminating in secondary math pathways.

    d. Revised math standards will include an emphasis on the development of fluency with number operations and algebraic procedures, contextual application, and connections to financial literacy.

    e. MSDE shall develop repositories where the mathematics education community can access instructional resources to support implementing revised math standards, including the integrated course sequence, financial literacy applications, and differentiated resources to support students with disabilities.

2. Beginning in SY 2027-2028, all courses beyond Integrated Algebra 1 and 2 must be aligned to secondary math pathway standards. Schools and districts must provide access to a variety of secondary mathematics pathways that align with different career and academic interests.

    a. In alignment with the Launch Years Task Force recommendations, secondary math pathways include Quantitative Reasoning, Data and Data Analytics, Algebraic Foundations of Calculus, and Statistics and Probability as outlined in Appendix C. School leaders must ensure that these pathways are flexible and allow for movement between them based on student progress or evolving interests.

        i. Quantitative Reasoning pathway develops real-world mathematical skills in problem-solving, modeling, financial literacy, and data-driven decision-making.

        ii. Data and Data Analytics are increasingly essential, and this pathway builds foundational skills in data analysis, programming, and mathematical reasoning. It leverages technology to explore real-world datasets and prepare students for a data-driven future.

iii. Algebraic Foundations of Calculus pathway is designed for students pursuing STEM fields. It provides a deep exploration of functions and change in preparation for Calculus.

iv. Statistics and Probability builds students' understanding of data, uncertainty, and statistical inference. It focuses on using quantitative research on real-world phenomena to enhance understanding of relationships in the world around us.

b. District leaders are encouraged to develop innovative models for course offerings including but not limited to dual enrollment and centralized courses in cases where there are limited course offerings.

3. COMAR 13A.03.02.03- High school mathematics graduation requirements beginning with any student who enrolls in Algebra for the first time in school year 2027-2028 shall be updated to reflect:

   a. four credits and four years of mathematics in high school,

   b. two of the four credits with instruction in Integrated Algebra 1 and Integrated Algebra 2 aligned with the statewide assessment for Algebra, and

   c. two credits aligned to courses in secondary mathematics pathways in which Integrated Algebra is a prerequisite.

4. LEAs are responsible for ongoing engagement with parents and students to communicate the expectations and content of revised math standards and course progression. MSDE will provide resources to support communication.

C. SYSTEM OF SUPPORT FOR EDUCATORS

1. Beginning in Spring 2025, LEA system and instructional leaders shall engage in professional learning and information sessions to understand the upcoming changes and start aligning their planning with the revised math standards and prioritized instructional strategies being developed by MSDE.

2. By Fall 2025, LEAs shall identify a team to participate in the initial professional learning and serve as LEA liaisons to support shifts in math standards, Integrated Algebra courses, and secondary math pathways.

    a. MSDE will lead initial professional learning, transitioning to a collaborative model with LEA liaisons to build LEA capacity for ongoing professional learning.

    b. LEA Liaison teams will be responsible for ongoing collaboration and feedback with MSDE.

    c. By Spring 2026, LEAs should be prepared to lead professional learning related to revised math standards and instructional shifts.

3. By Spring 2027, MSDE will develop a Maryland Effective Mathematics Educator course. This course will be available to all math educators, special educators, ML educators, coaches, interventionists, and administrators as a component of their Individualized Professional Development Plan (IPDP) towards licensure renewal. LEAs shall collaborate with MSDE to communicate the availability of this course to all educators and provide ongoing opportunities for educator course participation.

4. Beginning Spring 2025, MSDE shall initiate a statewide effort to engage families, community members, and local organizations in supporting mathematics education.

    a. Beginning in SY 2025-2026, LEAs shall implement their community engagement initiatives developed in collaboration with MSDE, focusing on sustaining long-term partnerships.

    b. LEAs should collaborate with MSDE to provide training and resources to support school - based educators to effectively engage with families and the community about best practices for supporting students in their mathematics learning experience.

5. LEAs should establish and sustain mathematics instructional coaching structures to provide ongoing, school-based support for teachers aligned to best practices for math instruction.

    a. Instructional coaches provide essential, job-embedded support to ensure effective implementation of instructional shifts by modeling best practices and offering real-time feedback (Desimone & Pak, 2016; Domina et al., 2015; Kraft et al., 2018; Stein & Meikle, 2017).

    b. MSDE will provide guidance and ongoing professional learning to enhance coaching effectiveness and statewide alignment.

D. ASSESSMENT AND ACCOUNTABILITY

1. By Summer 2025, MSDE will develop a Numeracy Development Framework. This will include a grade-by-grade description of the progression toward mathematical college and career readiness, aligned with the identified components of numeracy in Section III. This progression will outline the essential mathematical skills and understandings at each grade level to guide progress monitoring and inform the development of targeted support structures.

2. Beginning in SY 2026-2027, LEAs must identify and implement common unit or modular based assessments aligned to grade-level standards across all schools from grades K- 8.

    a. LEAs should also develop systems to monitor and report progress on these assessments across the district by student group and action plan to improve student outcomes for all students.

    b. LEA assessment systems should include support for teachers to interpret and respond to student performance.

3. Beginning in Fall 2027, MSDE will provide an annual statewide assessment data analysis report to LEAs. LEAs will be expected to review this data and their own collected course access data and develop an annual report that outlines strengths, areas of improvement, and planned actions to address any disparities. The first report will be submitted in January 2028.

10. Key data points for analysis will include:

    a. Proficiency levels by cohort in grades 3-8

    b. Proficiency levels for accelerated students

    c. Progress for students performing at Level 1

    d. Integrated Algebra 1 and 2 participation and proficiency by grade level

    e. Percent of students enrolled in courses in each Secondary Math Pathway

4. Beginning in SY 2026-2027, LEAs are required to develop a systematic approach to family communication across the LEA to ensure the progression of student numeracy development is consistently communicated across schools and classrooms.

    a. Families of students in kindergarten through Integrated Algebra must be notified at least twice a year (December and June) if their child is not progressing in alignment with grade-level standards based on their progress on standard aligned assessments.

    b. LEAs must develop a clear communication plan that outlines how families are notified about their child's progress and interventions in place in alignment with the LEA's MTSS math structure.

5. Beginning with the graduating class of 2030-2031 (students in grade 9 or below in school year 2027-2028), the Math Mastery option of the College and Career Readiness standard shall be updated to reflect the revised MCCR math standards and course progression.

6. Beginning in SY 2027-2028, earning a final course grade of A, B, or C in a secondary mathematics pathways course in which Integrated Algebra is a prerequisite will be included in the Math Mastery option of the CCR standard.

7. Beginning in SY 2028-2029, LEAs shall administer the Integrated Algebra statewide assessment to all students enrolled in Integrated Algebra 2 in the Winter testing window. In the final quarter and summer of each school year, LEAs shall provide responsive interventions and retesting opportunities to support students in reaching proficiency.

V. Timeline Overview

Timeline	Policy Implementation
Spring 2025	• MSDE Mathematics Policy Adoption • Initial Community & Educator Engagement Sessions
Summer- Fall 2025	• Adoption of revised mathematics standards for PreK- Integrated Algebra 2 • Mathematics Policy Guidance Documents released (MTSS Math, Acceleration, Integrated Algebra course frameworks) • MSDE Numeracy Development Framework released • Joint collaborative/planning with LEA Math Supervisors & Advanced Academic Supervisors
Beginning in School Year 2025-2026	• MSDE will develop grade level family guides. • LEAs should hold regular forums to support families and engage community stakeholders in mathematics. • Ongoing professional learning with LEA Liaisons • LEA led professional learning beginning by Spring 2026 • Integrated Algebra 1 course resources released by Spring 2026 • Secondary math pathways standards developed
Beginning in School Year 2026- 2027	• Implementation of revised standards for PreK-8 • LEAs implement common standard aligned assessments across all schools • Equitable scheduling practices implemented in all schools • Ongoing professional learning • LEAs develop a process to identify and support students who exhibit difficulties with learning mathematics • LEAs implement a Multi-Tiered System of Supports (MTSS) for mathematics instruction • MSDE Maryland Effective Mathematics Educator course released • Required parent notification regarding student grade level standard proficiency progress • Secondary math pathways standards adopted • Integrated Algebra 2 course resources released by Spring 2027
Beginning in School Year 2027-2028	• Implementation of revised standards and course for Integrated Algebra 1 • Grade 3 – 7 acceleration progression implemented in all schools • LEAs adhere to minimum daily /weekly instructional minutes in math. • LEA annual data reflection and action reports • Secondary math pathways standards implemented
Beginning in School Year 2028-2029	• Implementation of revised standards and course for Integrated Algebra 2 • Integrated Algebra State Assessment

VI. Responsibilities

Local Education Agencies (LEAs), The Maryland State Department of Education (MSDE), and the Maryland State Board of Education will collaboratively work to ensure that all students across Maryland have equitable access to high-quality mathematics instruction to prepare them for their college and career aspirations. This collaboration requires a shared system of responsibilities:

LOCAL EDUCATION AGENCY RESPONSIBILITIES

1. Collaborate with MSDE to implement policies that promote equitable access to high-quality mathematics instruction and MTSS math structures as outlined in MSDE guidance.
2. Adopt and implement instruction aligned to the revised MCCR math standards and course progression.
3. Develop and implement grade level aligned standard assessment systems to identify students for intervention and acceleration and ensure family communication.
4. Provide ongoing, job-embedded, professional learning for all educators to ensure consistency in implementation of equitable math instruction aligned to grade level standards and numeracy development progression.
5. Regularly monitor and report the effectiveness of implementation of courses aligned to MCCR mathematics standards, including the new integrated algebra courses, and secondary mathematics pathways.
6. Provide opportunities for continuous engagement with all stakeholders regarding the district's math programming and student progress.

MARYLAND STATE DEPARTMENT OF EDUCATION RESPONSIBILITIES:

1. Provide guidance and resources to support implementation of courses aligned to MCCR mathematics standards, including the new integrated algebra courses and secondary mathematics pathways.
2. Develop guidelines, protocols, and resources to support LEAs in implementing inclusive practices including Numeracy Development Framework, MTSS guidelines, templates for monitoring and reporting, and annual LEA data reports.
3. Provide ongoing professional learning opportunities and resources to educators, system and instructional leaders, counselors, and support staff to support equitable access and opportunities in mathematics education statewide.
4. Monitor the implementation of math policy initiatives and adjust as needed.
5. Provide opportunities for continuous engagement with all stakeholders regarding statewide math programming and student progress.

MARYLAND STATE BOARD OF EDUCATION RESPONSIBILITIES

1. Review and approve the Mathematics Policy developed by MSDE.
2. Review the implementation of this policy in alignment with improving student achievement in mathematics for all Maryland students by analyzing LEA and MSDE annual reports. All reported student data will be disaggregated by student groups.

References

Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics: Rethinking equity-based practices*. National Council of Teachers of Mathematics.

Aguirre, J. M., Zavala, M. D. R., & Katanyoutanant, T. (2012). Developing Robust Forms of Pre-Service Teachers' Pedagogical Content Knowledge through Culturally Responsive Mathematics Teaching Analysis. *Mathematics Teacher Education and Development*, *14*(2), 113-136. https://eric.ed.gov/?id=EJ1018658

Akar, G. K., Zembat, İ. Ö., Arslan, S., & Thompson, P. W. (Eds.). (2023). *Quantitative Reasoning in Mathematics and Science Education* (Vol. 21). Springer Nature.

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (2003). *On the success of failure: A reassessment of the effects of retention in the primary grades* (2nd ed.). Cambridge University Press.

American Institutes for Research (AIR). (2023). *Maryland College and Career Readiness Empirical Study: Final Report*. American Institutes for Research. Retrieved from https://www.air.org/project/maryland-college-and-career-readiness-empirical-study

American Mathematical Association of Two-Year Colleges (AMATYC). (2014). *Position on the appropriate use of intermediate algebra as a prerequisite course*. https://amatyc.org/page/PositionInterAlg

Black, S. E., Muller, C., Spitz-Oener, A., He, Z., Hung, K., & Warren, J. R. (2021). The importance of STEM: High school knowledge, skills and occupations in an era of growing inequality. *Research Policy, 50*(7), 104249. https://doi.org/10.1016/j.respol.2021.104249

Boaler, J. (2019, October). Opinion: Modern high school math should be about data science – not Algebra 2. *Los Angeles Times*. www.latimes.com/opinion/story/2019-10-23/math-high-school-algebra-data-statistics .

Charles A. Dana Center. (2020). Launch Years: A new vision for the transition from high school to postsecondary mathematics. *Austin, TX: Charles A. Dana Center at the University of Texas at Austin.* https://utdanacenter.org/launchyears .

Charles A. Dana Center. (2024). *Mathematics Pathways: Ensuring all students benefit from relevant, rigorous mathematics pathways*. University of Texas at Austin.

Chen, X., National Center for Education Statistics (ED), & RTI International. (2013). STEM Attrition: College Students' Paths into and out of STEM Fields. Statistical Analysis Report. NCES 2014-001. *National Center for Education Statistics*.

Conference Board of Mathematical Sciences (CBMS). (2016). Active learning in post-secondary mathematics education. https://cbmsweb.org/2016/07/active-learning-in-post-secondary-mathematics-education/

Daro, P., & Asturias, H. (2019). Branching out: Designing high school math pathways for equity. *Berkeley, CA: Just Equations.* https://justequations.org/resource/branching-out-designing-high-school-math-pathways-for-equity

DiSessa, A. A. (2018). Computational literacy and "the big picture" concerning computers in mathematics education. *Mathematical thinking and learning*, *20*(1), 3-31. https://doi.org/10.1080/10986065.2018.1403544

Desimone, L. M., & Pak, K. (2016). Instructional coaching as high-quality professional development. *Theory into Practice, 56*(1), 3-12. https://doi.org/10.1080/00405841.2016.1241947

Domina, T., Lewis, R., Agarwal, P., & Hanselman, P. (2015). Professional sense-makers: Instructional specialists in contemporary schooling. *Educational Researcher, 44*(6), 359-364. https://doi.org/10.3102/0013189x15601644

Douglas, D., Logue, A. W., & Watanabe-Rose, M. (2023). The long-term impacts of corequisite mathematics remediation with statistics: Degree completion and wage outcomes. *Educational Researcher, 52*(1), 7–15. https://doi.org/10.3102/0013189x221138848

Erickson, T. (2019). Awash with Data: An introduction to Data Science and data moves with CODAP. https://codap.xyz/awash/

Francis, D. V., & Darity, W. A. (2021). Separate and unequal under one roof: How the legacy of racialized tracking perpetuates within-school segregation. *RSF: The Russell Sage Foundation Journal of the Social Sciences*, *7*(1), 187-202. https://doi.org/10.7758/rsf.2021.7.1.11

GAISE College Report ASA Revision Committee. (2016). Guidelines for Assessment and Instruction in Statistics Education (GAISE) college report 2016. https://www.amstat.org/asa/files/pdfs/GAISE/GaiseCollege_Full.pdf

Gould, R. (2010). Statistics and the modern student. *International Statistical Review*, *78*(2), 297-315. https://doi.org/10.1111/j.1751-5823.2010.00117.x

Gould, R. (2023, December 27). *All students need to learn data science*. EdSource. https://edsource.org/2023/all-students-need-to-learn-data-science/703117

Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). *Assisting students struggling with mathematics: Response to Intervention (RtI) for elementary and middle schools* (NCEE 2009-4060). National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. https://ies.ed.gov/ncee/wwc/publications/practiceguides/

Grouws, D. A., Tarr, J. E., Chávez, Ó., Sears, R., Soria, V. M., & Taylan, R. D. (2013). Curriculum and implementation effects on high school students' mathematics learning from curricula representing subject-specific and integrated content organizations. *Journal for Research in Mathematics Education*, *44*(2), 416-463. https://doi.org/10.5951/jresematheduc.44.2.0416

Hattie, J., Fisher, D., & Frey, N. (2017). *Visible learning for mathematics: What works best to optimize student learning*. Corwin.

Jimerson, S. R., Burns, M. L., & VanDerHeyden, A. M. (2016). From response to intervention to multi-tiered systems of support: Advances in the sciences and practices of assessment and intervention. In S. Jimerson, M. Burns, & A. VanDerHeyden (Eds.), *Handbook of Response to Intervention: The Science and Practice of Multi-Tiered Systems of Support* (pp. 1-6). Boston. MA: Springer US.

Kraft, M. A., Blazar, D., & Hogan, D. (2018). The effect of teacher coaching on instruction and achievement: A meta-analysis of the causal evidence. *Review of Educational Research, 88*(4), 547-588. https://doi.org/10.3102/0034654318759268

Maryland State Department of Education (MSDE). (2024). *Blueprint for Maryland's future*. Maryland Public Schools. https://blueprint.marylandpublicschools.org/

Mathematical Association of America (MAA). (2004). Undergraduate programs and courses in the mathematical sciences: CUPM Curriculum Guide 2004

Moschkovich, J. N. (2015). Academic literacy in mathematics for English learners. *The Journal of Mathematical Behavior, 40*, 43–62. https://doi.org/10.1016/j.jmathb.2015.01.005

National Center on Education and the Economy (NCEE). (2013). *What Does It Really Mean to Be College and Work Ready?*. Retrieved from https://ncee.org/book-report/what-does-it-really-mean-to-be-college-and-work-ready .

National Council of Teachers of Mathematics (NCTM). (2014). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.

National Council of Teachers of Mathematics (NCTM) (2018). *Catalyzing Change in High School Mathematics*. National Council of Teachers of Mathematics.

National Mathematics Advisory Panel (NMAP). (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel*. U.S. Department of Education. Retrieved from https://files.eric.ed.gov/fulltext/ED500486.pdf

Oakes, J. (2005). *Keeping track: How schools structure inequality*. Yale University Press.

Oakes, J., & Guiton, G. (1995). Matchmaking: The dynamics of high school tracking decisions. *American Educational Research Journal*, *32*(1), 3-33. https://doi.org/10.2307/1163210

Patali, E. A., Cooper, H., & Robinson, J. C. (2008). The effects of choice on intrinsic motivation and related outcomes: A meta-analysis of research findings. *Psychological Bulletin, 134*(2), 270–300. https://doi.org/10.1037/0033-2909.134.2.270

President's Council of Advisors on Science and Technology (PCAST). (2012). *Engage to Excel: Producing one million additional college graduates with degrees in STEM".* Washington, DC: White House Office of Science and Technology Policy. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/fact_sheet_final.pdf .

Riegle-Crumb, C., King, B., & Irizarry, Y. (2019). Does STEM stand out? Examining racial/ethnic gaps in persistence across postsecondary fields. *Educational Researcher*, *48*(3), 133–144. https://doi.org/10.3102/0013189x19831006

Roach, A. T., & Elliot, S. N. (2008). Best practices in facilitating and evaluating intervention integrity. In A. Thomas & J. Grimes (Eds.), *Best Practices in School Psychology V* (pp. 195-208). Bethesda, MD: National Association of School Psychologists.

Rose, H., & Betts, J. R. (2001). *Math matters: The links between high school curriculum, college graduation, and earnings*. San Francisco: Public Policy Institute of California.

Saxe, K., Braddy, L., Bailer, J., Farinelli, R., Holm, T., & Mesa, V. (2015). *A common vision for undergraduate mathematical sciences programs in 2025*. Washington, DC: Mathematics Society.

Sharma, S. (2024). *Math Mind: The Simple Path to Loving Math* (Unabridged.). Penguin Random House.

Schoen, H. L., & Hirsch, C. R. (2020). The Core-Plus mathematics project: Perspectives and student achievement. In *Standards-Based School Mathematics Curricula* (pp. 311-344). Routledge.

Steen, L. (2001). *Mathematics and democracy: The case for quantitative literacy*. Woodrow Wilson Natl Foundation.

Stein, M. K., & Meikle, E. (2017). The nature and role of goals in mathematics education. In D. Spangler & J. Wanko (Eds.), *Research Companion to Principles to Actions* (pp. 1-11). National Council of Teachers of Mathematics.

Student Achievement Partners (SAP). (2021). *Preparation for Success in Algebra: Exploring Math Education Relationships by Analyzing Large Data Sets (EMERALDS)*. Retrieved from https://achievethecore.org/page/3367/preparation-for-success-in-algebra-exploring-math-education-relationships-by-analyzing-large-data-sets-emeralds

Tarr, J. E., Grouws, D. A., Chávez, Ó., & Soria, V. M. (2013). The effects of content organization and curriculum implementation on students' mathematics learning in second-year high school courses. *Journal for Research in Mathematics Education*, *44*(4), 683-729. https://doi.org/10.5951/jresematheduc.44.4.0683

Tauer, S. (2002). How does the use of two different mathematics curricula affect student achievement? A comparison study in Derby, Kansas. Retrieved from https://files.eric.ed.gov/fulltext/ED511909.pdf .

University System of Maryland (USM). (2019). *First in the world Maryland mathematics reform initiative (FITW MMRI): Project overview*. University System of Maryland. http://ts3.nashonline.org/wp-content/uploads/2019/05/FITW-MMRI_One-pager_2019-04-1631.pdf

U.S. Bureau of Labor Statistics. (2021, September 8). *Highest paying occupations*. https://www.bls.gov/ooh/highest-paying.htm

U.S. Department of Education. (2021). *Raise the Bar: Postsecondary and Career Pathways*.

Appendix A – Two-Year Integrated Algebra Pathway

The Integrated Algebra Pathway consists of two full-year courses that strategically integrate algebra, geometry, and statistics to highlight their interconnected nature, which fosters a more coherent and deeper understanding of mathematics. **This approach does not compress multiple years of coursework into a shorter timeframe; rather, it thoughtfully weaves together essential mathematical ideas while refining the content scope to focus on the most relevant and widely applicable content.** By prioritizing key core concepts and reducing redundancy, this approach ensures that all students build a strong mathematical foundation while shifting more specialized topics to secondary math pathway courses where they can be explored in greater depth. Additionally, it streamlines the content by removing topics that do not meaningfully contribute to students' mathematical reasoning and problem-solving abilities, making space for deeper engagement with essential mathematics.

COURSE CONTENT OVERVIEW

Integrated Algebra 1

Integrated Algebra 1 is a full-year course that introduces students to mathematical structures through patterns of change, data analysis, and geometric reasoning. The course focuses on comparing linear and exponential patterns, formalizing them into functions, and using data and statistics as a context for exploration. Geometry concepts are interwoven, particularly in the study of lines, angles, transformations, and spatial relationships among congruent figures and special shapes.

Core Topics (Not exhaustive)

- Recognizing and Modeling Patterns of Change
    - Identify and model linear and exponential trends in bivariate data.
    - Explore and analyze linear and exponential functions.
    - Model real-world scenarios with linear and exponential functions and use multiple representations to solve problems in context.
- Quantitative Reasoning and Data Analysis
    - Represent, analyze, and compare one-variable data sets.
    - Justify claims or formulate conjectures based on real-world data sets.
- Developing Proficiency in Equations and Inequalities
    - Solve and interpret linear equations, inequalities, and systems.
    - Graph and analyze solution sets.
    - Solve systems using multiple methods.
- Exploring Geometric Structures and Transformations
    - Explore rigid motions and their role in congruence.
    - Verify triangle congruence and figure properties.

    - Use coordinate geometry to analyze geometric relationships.
- Exploring Structure and Transformations of Functions
    - Investigate absolute value and piecewise functions using technology.
    - Analyze graph transformations of key functions.

Integrated Algebra 2

Integrated Algebra 2 is a full-year course that builds on Integrated Algebra 1. It delves into quadratic functions as a new pattern of change, providing a foundation for further algebraic growth and deeper connections to data and data analysis. Students also engage in an in-depth exploration of similarity, right triangle trigonometry, and circles, while making connections to algebraic concepts.

Core Topics (Not exhaustive)

- Extending Patterns of Change
    - Compare patterns of change in linear, exponential, and quadratic relationships.
    - Recognize and interpret quadratic functions across tables, graphs, and equations.
- Transforming and Solving Quadratic Equations
    - Describe transformations of quadratic functions.
    - Convert quadratic functions between standard, vertex, and factored forms to reveal key properties.
    - Solve quadratic equations using graphing, factoring, completing the square, and the quadratic formula.
- Modeling with Data and Polynomial Expressions
    - Use regression and digital tools to model data with quadratic functions.
    - Perform polynomial operations and analyze their effects on graphs and equations.
- Exploring Geometric Relationships
    - Explore dilations, similarity, and proportionality.
    - Apply the Pythagorean Theorem and trigonometry to right triangles.
    - Model real-world objects using geometric relationships and equations.
    - Investigate circles.

Note: Integrated Algebra 1 and 2 are recommended to be implemented as full-year courses to reduce gaps in students' mathematical experiences and allow students to engage with the intended progression of concepts as a continuous narrative. This structure provides the most effective pacing and aligns with the intentions of the course frameworks.

RATIONALE FOR SHIFT

Addressing Misalignment with Post-CCR Opportunities

- The *Blueprint for Maryland's Future* initiates post-CCR opportunities at the end of 10th grade (MSDE, 2024). However, the mathematical foundations within the traditional three-year AGA sequence are not fully developed for most students until after 11th grade.
- The two-year integrated approach identifies essential content from Algebra 1, Algebra 2, Geometry, and Statistics and restructures it across two years to better align with the AIR study findings (AIR, 2023) and the CCR opportunities defined by the Blueprint for Maryland's Future.

Ensuring All Students Access Essential Content for Post-Secondary Success by the End of 10th Grade

- The Maryland CCR Empirical Study (AIR, 2023) highlights the importance of algebraic content for post-secondary success.
- Analysis of current content standards reveals that many of these algebraic skills are not fully covered until the completion of Algebra 2.
- The AIR study finds that:
    - Many geometry standards are not highly aligned with the prerequisite competencies for post-secondary mathematics success.
    - Statistics content and standards are relevant for college and career success (Maryland CCR Empirical Study: Final Report – Exhibit 19, p. 56).
- Research from the National Center on Education and the Economy (NCEE, 2013) concludes that the most demanding mathematics in required college courses primarily derives from Algebra 1, selected Algebra 2 content, and limited Geometry topics.
- High school statistics education is increasingly essential for career readiness and provides critical data analysis skills applicable across various fields (Gould, 2010, 2023; NCTM, 2018).
- The U.S. Department of Education (2021) emphasizes that integrating statistics enhances workforce readiness through:
    - Data visualization, hypothesis testing, and performance trend analysis.

Additional Support for the Shift

- Research supports the benefits of an integrated approach to mathematics instruction (Grouws et al., 2013; Schoen & Hirsch, 2020; Tarr et al., 2013; Tauer, 2002).
- NCTM's Principles and Standards for School Mathematics states:
    - "When students see the connections across different mathematical content areas, they develop a view of mathematics as an integrated whole… As students' knowledge of mathematics, their ability to use a wide range of mathematical representations, and their access to sophisticated technology and software increase, the connections they

make with other academic disciplines, especially the sciences and social sciences, give them greater mathematical power" (NCTM, 2014, p. 354).

- The development of the two-year integrated sequence has been informed by:
    - K-12 mathematics experts, higher education faculty, and College Board prerequisites (see Appendix B).

Appendix B. Prerequisite Mathematics Concepts for Advanced Mathematics

AP Precalculus Prerequisite (College Board, 2024)

- Proficiency with:
  - Linear functions (Integrated Algebra 1)
  - Polynomial addition and multiplication (Integrated Algebra 2)
  - Factoring quadratic trinomials (Integrated Algebra 2)
  - Using quadratic formula (Integrated Algebra 2)
  - Solving right triangle problems involving trigonometry (Integrated Algebra 2)
  - Solving linear and quadratic equations and inequalities (Integrated Algebra 1 & Integrated Algebra 2)
  - Algebraic manipulation of linear equations and expressions (Integrated Algebra 1 & Integrated Algebra 2)
  - Solving systems of equations in two and three variables (Integrated Algebra 1)
- Familiarity with:
  - Piecewise-defined functions (Integrated Algebra 1)
  - Exponential functions and rules for exponents (Integrated Algebra 1 & Integrated Algebra 2)
  - Radicals (Integrated Algebra 2)
  - Complex numbers (Integrated Algebra 2)

AP Statistics Prerequisite (College Board, 2024)

- A second-year course in algebra (Integrated Algebra 2)

IB Mathematics: Diploma Programme (DP) Math Courses

- No specific pre-requisites required

Appendix C – Secondary Math Pathways

An effective mathematics curriculum should reflect the diverse interests, goals, and opportunities available to students beyond high school. Expanding mathematics pathways in high school invites students to engage with mathematical content that is relevant to their future studies and careers while providing coherent experiences that maintain rigor and support their growth as mathematicians (AMATYC, 2014; Dana Center, 2020; NCTM, 2018; PCAST, 2012; Saxe et al., 2015).

Higher education institutions are diversifying undergraduate mathematics pathways to better align with various academic and career fields (Douglas et al., 2023; USM, 2019). Secondary mathematics pathways can build on this shift by offering flexible pathways that prepare students not only for college but also for direct career entry and technical training. Aligning secondary mathematics with diverse post-secondary opportunities ensures students are equipped for success in STEM, data-driven industries, social sciences, and other fields requiring strong quantitative reasoning.

Providing students with informed choices in their mathematics coursework fosters motivation, engagement, and ownership of learning. Research suggests that when students are given opportunities to choose experiences that align with their interests, goals, and aspirations, they demonstrate increased intrinsic motivation, effort, task performance, and self-efficacy (Patali et al., 2008).

OVERVIEW OF THE FOUR SECONDARY MATHEMATICS PATHWAYS

The four high school mathematics pathways—Quantitative Reasoning, Data and Data Analytics, Algebraic Foundations of Calculus, and Statistics and Probability—offer students flexible options that align with their interests, aspirations, and post-secondary goals. Students may follow a single pathway or blend pathways to align with their evolving interests and post-secondary plans.

For example, a student in the Data and Data Analytics pathway who decides to pursue data science in college may incorporate coursework from Algebraic Foundations of Calculus for additional preparation. Similarly, a student focused on Quantitative Reasoning for its real-world applications might later integrate Statistics and Probability if they develop an interest in research.

Quantitative Reasoning (QR)

This pathway focuses on applying mathematical skills in real-world contexts, including strategic problem-solving, modeling, financial literacy, and data-informed decision-making. It equips students with the ability to analyze patterns, make evidence-based arguments, and apply mathematical reasoning to project planning, budgeting, and technical problem-solving (Akar et al., 2023; Daro & Asturias, 2019; Dana Center, 2020; Steen, 2001).

- **College Connections:** Supports students pursuing degrees in humanities, social sciences, and liberal arts, where QR is essential for understanding research and trends.
- **Career Connections:** Beneficial for careers in business, public policy, and technical fields where data-driven decision-making is critical.

Data and Data Analytics

As computational literacy and data fluency become increasingly important, this pathway provides students with foundational skills in data analysis, programming, and mathematical reasoning for data-driven explorations (DiSessa, 2018; Erickson, 2019; Boaler, 2019; Gould, 2023; NCTM, 2018). Students engage with technology to analyze real-world datasets, preparing them for a data-centric future.

- **College Connections:** Prepares students for programs in Data Science, Computer Science, and Business Analytics.
- **Career Connections:** Supports careers in Data Analytics, Cybersecurity, Marketing Research, and other fields that require expertise in Big Data.

Algebraic Foundations of Calculus

This pathway is designed for students pursuing STEM fields and provides a deep exploration of functions and change as preparation for Calculus. Research indicates that taking advanced math courses, like Calculus, has long-term benefits for labor market success (Chen, 2013; Riegle-Crumb et al., 2019; Black et al., 2021; Rose & Betts, 2001; U.S. Bureau of Labor Statistics, 2021).

- **College Connections:** Essential for students entering STEM programs such as Engineering, Physics, and Mathematics, where Calculus is a foundational requirement.
- **Career Connections:** Critical for careers in Engineering, Medicine, and Scientific Research, where advanced mathematical modeling and problem-solving skills are required.

Statistics and Probability

With the growing demand for statistical literacy, this pathway develops students' understanding of data, uncertainty, and statistical inference. Engaging in mathematical inquiry (i.e., quantitative research) related to real-world phenomena strengthens conceptual understanding and critical thinking skills (MAA, 2004; CBMS, 2016; GAISE, 2016; Gould, 2010).

- **College Connections:** Supports fields such as Social Sciences, Health Sciences, and Law, where data analysis and statistical reasoning are essential.
- **Career Connections:** Applicable to any profession requiring trend analysis, risk assessment, and decision-making based on quantitative models.

History

A. Adopted March 25, 2025