Strengthening Ohio's High School Math Pathways Initiative
Advisory Council Statement of Support

The Advisory Council for the Strengthening Ohio's High School Math Pathways initiative (hereafter referred to as the "*Pathways Initiative*") supports the development and implementation of high school mathematics pathways that branch off from high-quality Algebra 2 equivalent courses. These courses should be equally rigorous to a traditional Algebra 2 course, but more relevant for the diverse career pathways students might pursue.

A solid mathematics education is vital for individual student success, as well as for the economic growth of Ohio. Recognizing the importance of mathematics in the role of college readiness, Ohio mandated that all its students complete an "Algebra 2 or its equivalent" course to meet the state's graduation requirements. Unfortunately, implementation of this legislation often devolved into a mentality of "Algebra 2 for all students," unintentionally creating inequities and barriers for some students.

To address this issue, the Ohio Department of Education (ODE) and the Ohio Department of Higher Education (ODHE) have partnered to develop career-aligned math pathways in high school. By creating more specific guidance around "Algebra 2 equivalence," the state will increase opportunities for students to connect high school math with their future college and career decisions. The courses offered as part of this initiative will provide relevant mathematics options for students without diminishing the depth of thought and level of reasoning needed to prepare them for their future.

The Advisory Council is committed to pathways that are:

- equally **rigorous** to ensure equity;
- **relevant** to students' career interests;
- **coherent** between high school and postsecondary course offerings;
- **flexible** and **equitable**; and
- based on **student choice**.

This statement of support includes background information on the initiative, a discussion of the advantages of the pathways, a vision of practice, and recommendations for implementation.

Background

The Ohio Department of Education (ODE) and the Ohio Department of Higher Education (ODHE) are leading a collaborative effort to create coherent, relevant, and rigorous high school mathematics pathways. The goal of the *Pathways Initiative* is to prepare all Ohio students for future success.

The *Pathways Initiative* builds on previous efforts: (1) the Ohio Mathematics Initiative's (OMI) development of equivalent courses in higher education and (2) the legislative mandate that required "Algebra 2 or its equivalent" for high school graduation.

(1) The work of the OMI has resulted in the development and acceptance of additional "gateway" mathematics courses at the higher education level that provide students with meaningful alternatives beyond the traditional College Algebra course leading to Calculus. Presently, those alternatives at the higher education level include courses such as Quantitative Reasoning, Introductory Statistics, Technical Mathematics, and Mathematics for Elementary Education.

The **Ohio Mathematics Initiative (OMI)** is a collaborative effort of mathematics faculty members from the state's public colleges and universities and Ohio high schools that is revisiting and rethinking mathematics courses and curricula at the higher education level and the relationship of mathematics to other disciplines.

(2) Because Ohio faced an urgent and growing need for educated, credentialed workers, Algebra 2 or "its equivalent" was mandated as a high school graduation requirement. It was an attempt to ensure that all students had the opportunity to learn rigorous mathematics and to require them to engage with and use their mathematical knowledge. However, implementation of the legislation was often actualized as "Algebra 2 for all." While this approach did help many students reach their postsecondary goals, it was an impediment for others.

The *Pathways Initiative* recognizes that Algebra 2 is not the only mathematical content that is rigorous or that provides students with the opportunity to learn and use mathematics that will prepare them to succeed at Ohio's postsecondary institutions or to be competitive for Ohio's in-demand jobs. Together, the *Pathways Initiative* and the Ohio Mathematics Initiative present an unprecedented opportunity for students to have a seamless experience across K-12 and postsecondary in taking mathematics courses that are aligned with their interests and career goals.

Organizational Structure

Collectively, the Advisory Council for the *Pathways Initiative* represents a broad coalition of stakeholders from across the state. Its role is to offer guidance on systems alignment and supports, communications, and equity. The initiative is also supported by other groups. The Math Pathways Architects oversee the high-level frameworks for each pathway. Course-specific working groups are charged with developing of guidance documents and other resources for each of the identified pathways. This organizational structure helps ensure that the resulting equivalent courses represent the best professional thinking of Ohio's educators and stakeholders.

Professional Affiliations of the Advisory Council

- Buckeye Association of School Administrators
- Higher Education Admissions
- Ohio 8 Coalition
- Ohio Association for Career and Technical Education
- Ohio Association of Community Colleges
- Ohio Association of Secondary School Administrators
- Ohio Council of Teachers of Mathematics
- Ohio Education Association
- Ohio Excels
- Ohio Federation of Teachers
- Ohio Mathematics and Science Coalition
- Ohio Mathematics Initiative
- Ohio Parent Teacher Association
- Ohio School Boards Association
- Ohio School Counselor Association

The Advantages of the High School Mathematics Pathways

The high school mathematics pathways will do the following:

1. Expand course options for students in high school that are better connected to their interests and postsecondary goals;
2. Align with math course options in college;
3. Address the state's need for educated, credentialed workers;
4. Ensure a rigorous mathematical experience outside the context of Algebra 2;
5. Promote relevancy of mathematics by delivering hands-on, career-focused lessons; and
6. Provide a more equitable opportunity for all students to succeed.

The *Pathways Initiative* will **expand third- and fourth-year math course options** for all high school students. This is important because the requirement for a credit of Algebra 2 has long been a barrier for many students and has had a disproportionate impact on minority students (Jimenez, 2016; EdSource, 2012; Burdman, 2018). In 2018-2019, 94.2% of Ohio students who did not graduate also did not earn a credit in Algebra 2/Math 3. Even with Algebra 2 as a requirement for graduation, 23% of the class of 2018 that matriculated to a public Ohio higher education institution enrolled in remedial math.

College Algebra has been seen as the gatekeeper course for student success in college and in life. Yet, only 50% of students pass College Algebra, and of those who do, fewer than 10% go on to take Calculus (Gordon, 2008). Moreover, "80% of students do not need an algebra-intensive curriculum, nor calculus, to succeed in their degree programs" (Gordon, 2008). Ohio's higher education institutions have recognized that taking an alternative third-year math course will benefit their students. Research implies that quantitative and statistical pathways at the

collegiate level have three to four times the success rate of traditional pathways in only half of the time (Huang, 2018). According to the What Works Clearinghouse standards, there is strong evidence at the postsecondary level that students who take an alternative quantitative pathway, such as statistics, are not only more likely to graduate but also more likely to pass advanced quantitative courses (Logue, 2019, 2016; Burdman, 2019). Because of this, higher education institutions both within and outside Ohio have embraced gateway math courses that are aligned to student's majors. However, there is now a lack of coherence between high school and college. Creating new math pathways in high school with **align with course options in college.**

Requiring all high school students to complete Algebra 2 is an obsolete concept. The equivalent course options (see graphic on p. 5), which could include courses such as Computer Science, Discrete Mathematics, Data Science Foundations, Quantitative Reasoning, and Statistics and Probability, will better meet the needs of students and help address **Ohio's urgent and growing need for educated, credentialed workers.**

Definition of Rigor Developed by the Math Pathways Architects:
Students use mathematical language to effectively communicate their strategies with clarity and precision. Students explain how, when, and why their reasoning is appropriate, thereby answering the question, "How do we know?"

The Pathways courses being developed will maintain a level of **mathematical rigor comparable to that found in traditional Algebra 2 courses**. At the same time, the courses will be more relevant and engaging to high school students. The Algebra 2 equivalent courses and associated professional development will provide support for high school math teachers to **promote the relevancy of mathematics by delivering innovative, hands-on lessons taught with a career-focused lens**.

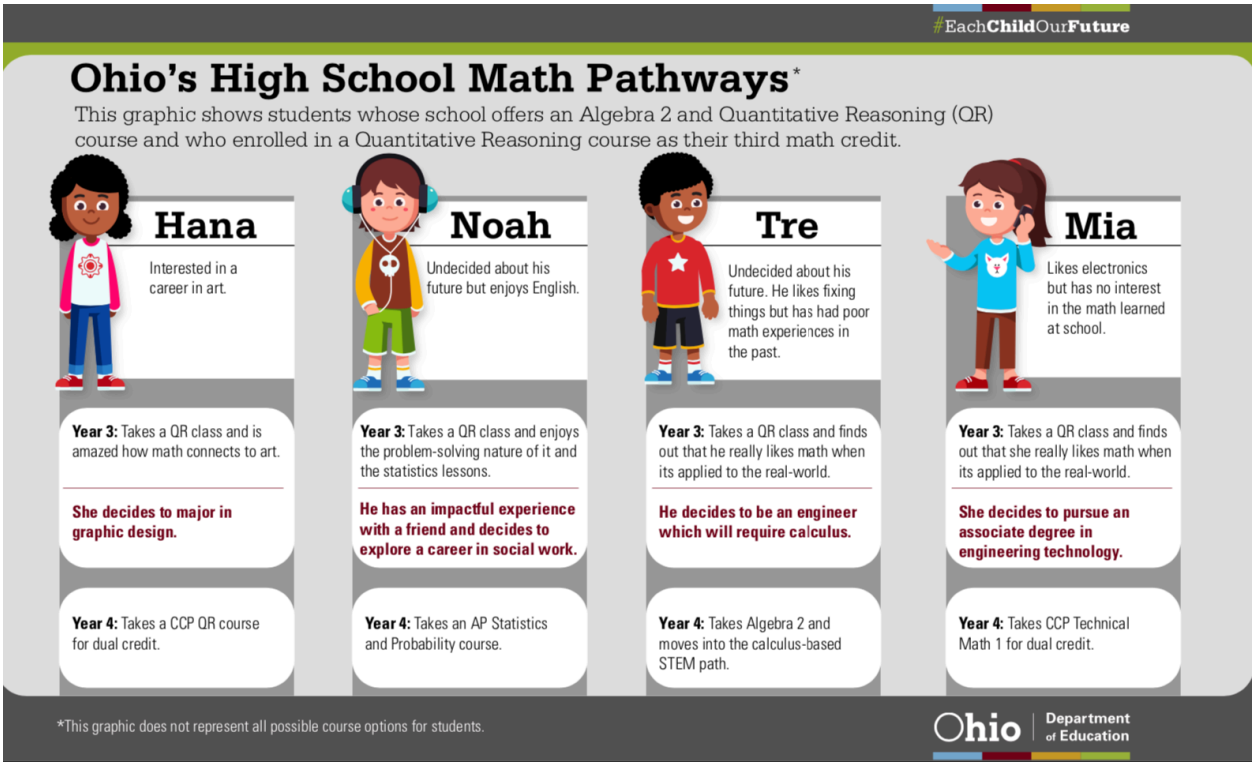
Perhaps most importantly, the pathways will provide a more **equitable opportunity for all high school students to succeed** and become confident in their abilities as mathematicians. Some may argue that requiring the same Algebra 2 content for all students is the best way to ensure "equity" in students' high school mathematics experience. But this is not the case. Students have different interests and goals, and many do not need particular content-specific skills that are specific to one course. The pathways offer equitable alternatives that provide students the opportunity to become the drivers of their own educational journey—without sacrificing the learning of significant mathematics that they will need for careers or personal decision making. Robert Moses described mathematics as a "civil right" (Moses & Cobb, 2002). Having multiple pathways choices will make mathematics more accessible and desirable to more students, advancing this civil right.

The Vision in Practice

The graphic below shows the proposed high school math pathway options and how they connect to majors highlighted in Ohio's Guaranteed Transfer Pathways. The diagram demonstrates the student experience moving from Algebra/Math 1 to Geometry/Math 2, and then into an Algebra 2 Equivalent course that is aligned to a set of career fields. The wheel

identifies Algebra 2 and four equivalent options from which schools and districts may consider: Statistics and Probability, Data Science Foundations, Discrete Math/Computer Science, and Quantitative Reasoning. There are many factors that will play into the decision by schools and districts to add one or more of these options into their high school curricula. These considerations are explored further in the “Recommendations for Implementation” section of this document.

Schools and districts across the state will make different decisions about which and how many pathways to offer based on what is best for their students. Offering even one Algebra 2 equivalent course, such as Quantitative Reasoning (QR), will provide numerous options for students. The graphic below demonstrates this scenario: how four high school students - each with their own unique interests and postsecondary goals - might progress through the math pathways if they each choose QR as their third credit.



Recommendations for Implementation

The Advisory Council for the *Pathways Initiative* strongly recommends the following activities and actions at the state, postsecondary, and K-12 level to ensure equitable and effective implementation of the high school math pathways:

1. Provide individualized advising and student supports.
2. Develop and deliver educator professional development and supports.
3. Ensure alignment between high school and college admissions, assessments and course placement.
4. Provide guidance to schools and districts on course offerings and implementation strategies.
5. Conduct multi-faceted evaluation of high school pathway courses.

Provide Individualized Advising and Student Supports
Students will need differentiated guidance and support from high school counselors and college advisors to help them make informed pathway choices so that they can reach their college and career goals. This includes information on how to switch pathways if they change their minds.

This guidance should be coupled with proactive outreach to families so they can support their children in making wise choices to ensure postsecondary success. To be able to effectively provide this support, high school counselors and college advisors will need professional development on how to advise students on the connections between the math pathways and postsecondary degree programs and career options. In addition, since the math courses that students choose should not be based on their perceived ability, but on their future goals, schools will also need to provide any necessary academic interventions for students who are behind academically.

Develop and Deliver Educator Professional Development and Supports

Math pathways have the potential to provide new and exciting opportunities for students, but they also pose unique challenges for math educators. The math pathways present a philosophical shift from the education and experience of many math instructors. At both the K-12 and postsecondary level, significant efforts must be made to provide curricula-embedded professional development to do the following: (1) introduce the content of the new math courses, (2) help educators better understand the relevance of the math content to students' career interests, and (3) provide best practices for the instruction of this new curricula. Math educators also need to have access to high-quality instructional materials that will align with the standards of new math curricula. Additionally, networking and collaboration - both among high school educators and between high school educators and higher education faculty - will be key to the continued implementation of new math pathways. High school educators will need access to colleagues through professional learning communities to identify common challenges, share resources and best practices, and brainstorm solutions. They will also need access to college faculty and career professionals to serve as mentors and to ensure there is coherence among each sectors.

Ensure Alignment Between High School and College Admissions, Assessments and Course Placement

Students and families need to have the confidence that their math pathways they choose will open the doors to be competitive for college admissions. Having clear signals from the higher education community on the acceptance of the high school math pathways will go a long way in achieving that. Any changes made at the secondary level must be made in conjunction with changes occurring at the postsecondary level to ensure there is a continuity among high school math courses, college math courses and degrees, and career choices. A clear and mutual understanding must exist between K-12 and Ohio colleges and universities. The Algebra 2 pathway cannot be the only way for students to demonstrate sufficient preparation for college coursework; the higher education institutions must ensure the evaluation of Algebra 2 and Algebra 2 Equivalent courses is consistent with regard to admissions decisions. The state should also leverage the national movement around mathematics pathways to build buy-in and acceptance among higher education institutions outside of Ohio.

Ohio's postsecondary institutions will need to accurately assess students' math readiness to ensure proper course placement. Traditional assessments such as the ACT and SAT do not address many of concepts covered in newer math courses like Discrete Math and Data Science. Therefore, colleges and universities will need to adopt multiple measures regarding placement of students in math courses. Students leaving high school will need to have a clear route into the appropriate college math courses to ensure they are able to be successful at the introductory level and progress through degree completion.

Provide Guidance to Schools and Districts on Course Offerings and Implementation Strategies

Schools and districts will require guidance on how best to implement the new math pathways. Delivering on the initiative's promise of providing more equitable opportunity to students depends on more than adding new courses to the master schedule. Specific considerations will need to be addressed by the state that recognizes the unique needs of districts. Whether it be small, rural districts who may struggle implementing multiple pathways to large, urban districts looking to ensure equity of access to under-represented student populations, districts will need to have a clear understanding of the math pathways in order to determine locally what will be best for their students. This can be accomplished through effective communication and support at the state level. Providing districts with resources such as sample course descriptions, implementation tools, recommended instructional materials, professional development opportunities for administrators, and scheduling and staffing considerations will be key for districts to successfully create opportunities for their students.

Conduct Multifaceted Evaluation of High School Pathway Courses

The Ohio Department of Education and the Ohio Department of Higher Education should develop an evaluation plan for the implementation of the Pathways that addresses the following:

1. Efficacy of implementation at the district and high school level (e.g. course offerings, course taking patterns, etc.)
2. Longitudinal outcomes on student achievement (e.g. postsecondary enrollment and persistence, gateway course completion, employment, etc.)
3. Impacts of the *Pathways Initiative* on the mathematics learning of underrepresented student populations (e.g. students of color, female students, and students with disabilities).

Conclusion

For far too long, traditional Algebra 2 has been a roadblock to student success. In Ohio, higher education has made strides in overcoming this barrier by implementing alternative gateway course options that are directly connected to students' academic and career goals. Now, with the *Pathways Initiative*, high schools are seeking to do the same. By expanding students' mathematics coursework options in high school, the *Pathways Initiative* presents a tremendous opportunity for students to engage in rigorous mathematics coursework that is aligned with their interests and postsecondary plans. To deliver on this vision, K-12 and postsecondary systems will need to partner together to ensure that students, families, educators, and counselors have the support they need to effectively navigate the additional pathways. The Advisory Council, representing key stakeholders from across the state, fully supports this effort.