

# SB 359

## PAUSD Math Placement *Recommendations* for Students and their Parents/Guardians to Guide their Math Course Choices

2019-20 –Revision: June 3, 2019

(Living Document; revisited annually)

### Contents

California and National Secondary Math Coursework Expectations .....	3
Table 1: Common Expectations of Secondary Math Coursework for Students in California .....	3
Overview .....	4
Table 2: CCSS-M Practices and Standards.....	5
Grade 5 to Grade 6.....	6
Sixth-Grade Math Differentiation .....	6
Table 3: Common Differentiation Opportunities.....	7
Alternative Placement of the Unusual or Atypical Math 6 Student .....	7
Grade 6 to Grade 7.....	10
The Criteria Table: Advice for moving from Math 6 to Seventh-Grade Math .....	10
<b>Table 4: Criteria Table: Moving students from Math 6 to Seventh-Grade Math</b> .....	11
Grade 7 to Grade 8.....	12
Skipping Algebra 8.....	14
Grade 8 to Grade 9.....	16
Ninth-Grade Placement Checkpoints (SB 359) .....	16
Determining Ninth-Grade Placement .....	16
Eighth-Grade Math Course: <b>MATH 8</b> .....	17
Eighth-Grade Math Course: <b>Algebra 8</b> .....	18

Math Course taken in Eighth-Grade: <b>High School Geometry H</b> .....	19
Details of the PAUSD Grade 6 through Grade 12 Secondary Math Pathways and Offerings .....	20
PAUSD Secondary Math Flow Chart: <i>Common</i> Pathways.....	21
PAUSD Secondary Math Flow Chart: <i>Flexible</i> Pathways .....	22
Pathways to Calculus in High School: When the Path May Include Summer Work .....	22
Table 5: Sample Pathways to AP Calculus AB .....	23
High School Math Electives and Where They Fit into the Student’s Schedule .....	25
Computer Science for ALL PAUSD Students.....	26
FAQs .....	26
• My student is “right on schedule” for mathematics—what does a “right on schedule” pathway look like? .....	26
• My student really struggles in mathematics and has earned Cs or less in middle school courses. What does a struggling student’s pathway look like, assuming the student earns at least a C in each high school course? .....	27
• My student is advanced in mathematics, that is, my student is a year or more in advance of “right on schedule” students. What do <i>advanced</i> student pathways look like? .....	27
• What is the difference between AP Calculus <b>AB</b> and <b>BC</b> ? .....	28
• When can students take AP Statistics? .....	28
• What types of computer science courses are available to students? Can students get math credit for computer science courses? .....	29
• My student is a ninth-grader in Geo A but is earning a C or less. The high schools do not allow the ninth-grade students to transfer or enroll in the grade-level 10 <sup>th</sup> grade geometry course. What will the four high school years look like for my student? .....	29
• What is the down-side to encouraging/pushing my student into more advanced math courses? .....	30
• When do students take Math Placement Tests? How do I arrange a math placement test for my student? .....	32
• Why doesn’t PAUSD allow a sixth-grade student to be placed in a seventh-grade math class? .....	32
• What are the differences among grade-level-lane, A-lane, and H-lane courses? .....	34
• My student did <b>not</b> take Algebra in middle school can they still get to Calculus by 12th grade?.....	35
• My student wants more mathematical enrichment, what options are available to them? .....	36
• What are some basic entrance expectations from colleges and universities regarding student transcripts?.....	39

## California and National Secondary Math Coursework Expectations

As students move from elementary to secondary school (elementary is grades Pk-5; secondary is grades 6-12 in PAUSD) the complexities of mathematical cyphering and mathematical thinking shifts from *skills and their underlying concepts* to *concepts and their underlying skills*. Mathematical production moves from the concrete to the abstract, and the mathematical thinking moves from situational to systematic. Unlike the work done in a variety of other countries, the California and National high school math coursework becomes less integrated and more specialized.

The basic math completion expectation for college-bound students is listed in Table 1 below. Each of the courses named in the table are California Department of Education Common Core Standards courses (Common Core State Standards or CCSS-Math). Most states in the United States have adopted similar courses. To review the CCSS-Math courses and their standards, go to <https://www.cde.ca.gov/be/st/ss/documents/ccssmathstandarAug2013.pdf>.

Table 1: Common Expectations of Secondary Math Coursework for Students in California

Grade	Course	Remarks
MIDDLE SCHOOL		
6	Math 6	
7	Math 7	
8	Math 8	
HIGH SCHOOL: Students create their transcripts during the high school years.		
9	Algebra 1	
10	Geometry	
11	Algebra 2	This course is the last requirement for admission to a UC or Cal-State university.
12	Precalculus	A fourth year of math is strongly recommended for admission to a UC or Cal-State university.

To *successfully* complete each course, students must earn a grade of C- or better. In high school, if the student earns less than a C- the student must repeat the course. Generally, when students apply to colleges and universities, their Grade Point Average (GPA) of most of their high school semester grades is reported on the student's transcript. GPAs range from zero to five by assigning the values in the following way: A = 4; B = 3; C = 2; D = 1; and F = 0. To earn a GPA higher than a 4.0, the student must take honors or AP courses that are *weighted* with one point, in which case an A = 5; B = 4; C = 3; D = 2; and F = 1.

PAUSD's secondary math offerings include CCSS-Math courses as well as advanced/accelerated courses, honors courses, AP courses and dual-enrollment courses.

## Overview

Hello, Students and Parents/Guardians: This is a lengthy document (approximately 40 pages), but its intention is to make students and their parents/guardians *insiders* in PAUSD's secondary mathematics program. PAUSD's secondary math program is a student-parent/guardian choice program; reliable information is needed to make good choices that support students' meaningful and joyful engagement in mathematics. PAUSD parents have reviewed this document and have added clarifications and emphasis for you.

PAUSD secondary mathematics teachers know that the transition from elementary school to secondary school is more than a transition in grade levels or school buildings. The students' transition is social, emotion, physical, and academic. Children become adolescents. Adolescents become young adults.

Middle school students are "...both transformed and destabilized by this first stage of adolescence."<sup>1</sup> The students' brain growth is evidenced as well, and this interval is commonly a time for students' brains to complete their concrete level of thinking and begin to move into more generalizing, system-based abstract thinking. Epstein (1986) noted that there are statistically significant peaks in brain growth rates at age 7, 11-12, and 15 years. While the students transform, schoolwork becomes more codified, more complex, more integrated, and more challenging. Middle school students find themselves taking risks, making errors, trying new ideas, awakening to themselves, building and knocking down their self-confidence, making friends, and feeling lonely; they are *becoming* young adults. During this time, they are also reformatting their relationships with their parents/guardians and other adults in their lives.

The transition takes time. The PAUSD secondary math program, spanning from grade 6 through grade 12, allows for a difference in growth rates. We have crafted courses that meet the California Common Core State Standards in Mathematics (CCSS-M) for *every* student throughout the district. PAUSD offers three types of math coursework in our flexible lanes of challenge: coursework that is *at* grade level, coursework that is both *accelerated and advanced*, and coursework that *honors* students' interests to work *far beyond usual expectations*. (The CCSS-M standards are comprised of two types of standards: eight Mathematical Practice Standards, and the Math Content Standards (see Table 2).)

As students move from the middle school to the high school, additional changes become evident—social, emotional, physical and academic. Students move toward independence and adulthood. High school students prefer their friends' counsel to their parents/guardians' advice. Freshmen and sophomore students, particularly, need more sleep to fuel their physical growth, including their brain growth. Students begin to mature toward adulthood, showing marked maturity development in their freshmen and sophomore years.<sup>2</sup> Students' reasoning skills develop, and students begin to develop the long view of their lives, including their academic lives. High school students begin to pursue their areas of passion while experiencing and investigating the shifting array of opportunities available at PAUSD's comprehensive high schools. PAUSD offers a variety of math courses (*all* meeting graduation requirements, state standards, and CSU/UC

---

<sup>1</sup> C.E. Pickhardt; <https://www.psychologytoday.com/blog/surviving-your-childs-adolescence/201104/adolescence-and-the-transition-middle-school>

<sup>2</sup> A. Morin; <https://www.understood.org/en/learning-attention-issues/signs-symptoms/developmental-milestones/developmental-milestones-for-typical-high-schoolers>

requirements) with the intention that students will find the appropriate level of challenging math course in which they can successfully learn on their own. Both the students' parents/guardians and their math teachers will have insights and advice as the students make their choices and build a substantial path to support their hearts' desires.

The math teachers' and Mathematics Instructional Leader's **recommendation** for placement are based on students' data and interests, follow the trends of years of successful student placement, and is further informed by placement failure and rescue experiences. Regardless of the recommendation, teachers, counselors and mathematicians recognize the conundrum of the *case of the individual* versus the *flow of the trend*. **Therefore, beginning in Grade 7, and throughout high school, PAUSD students and their parents/guardians are urged to choose the most appropriate math course *annually* to give the student the suitable amount of challenge for academic growth and successful learning within that course.**

Table 2: CCSS-M Practices and Standards

Insight into the mathematical practices as well as the content standards are available through the California Department of Education:

<https://www.cde.ca.gov/re/cc/mathresources.asp>

THE EIGHT MATHEMATICAL PRACTICES	MATH CONTENT STANDARDS
<ol style="list-style-type: none"> <li>1. Make sense of problems and persevere in solving them</li> <li>2. Reason abstractly and quantitatively</li> <li>3. Construct viable arguments and critique the reasoning of others</li> <li>4. Model with mathematics</li> <li>5. Use appropriate tools strategically</li> <li>6. Attend to precision</li> <li>7. Look for and make use of structure</li> <li>8. Look for and express regularity in repeated reasoning</li> </ol>	<p>The content standards describe the expectations of content (topics, skills and concepts) that build mathematical understanding, hone skills, develop and deepen knowledge, and work toward expertise throughout the years from K through 12. The content standards for the different grade levels have been developed to coincide with brain development, keeping both concrete and abstract stages of development in consideration. The general areas of Math Content Standards are</p> <ul style="list-style-type: none"> <li>Number, Quantity, and Operations</li> <li>Algebraic Thinking and Algebra</li> <li>Functions</li> <li>Modeling</li> <li>Geometry</li> <li>Measurement, Data, Statistics and Probability</li> </ul>

## Grade 5 to Grade 6

PAUSD provides an exceptional math program that supports students developmentally. Our sixth-grade math teachers positively transition elementary students into successful middle school students. In order to support the students' transition from Grade 5 Elementary School to Grade 6 Middle School, **all** students matriculate from Math 5 to Math 6. (For students receiving Special Education Services, the mathematics placement will be determined by the student's IEP team.)

In sixth grade our students typically have two teachers for the four core subjects as they learn high order study skills, self-advocacy, and build friendships that are necessary to navigate their secondary schools. As students learn to manage the myriad of middle school challenges, the flexible clustering available in the heterogeneous grouping in the core classes allow students and teachers to suspend any hasty evaluations as they support the students' growth and prepare students for a variety of burgeoning interests.

In Math 6 students study the Sixth-grade California Common Core State Standards for Math (CCSS-M6). Students work both independently and in cooperative groups with instruction that is differentiated to appropriately challenge all students. Sixth-grade teachers are completely prepared to support students who require extension, support, and enrichment opportunities. Math 6 teachers are generalists, like their K-5 colleagues, and hold Multiple-Subject Credentials.



### Sixth-Grade Math Differentiation

Differentiation is not *different from*, rather, it is meeting a math student's interest and academic needs **within** the Math 6 topic or concept.

Differentiation is defined by Tomlinson<sup>3</sup> as a common-sense approach to effective teaching in which teachers create opportunities that help students access the appropriate depth of curriculum, and experience *learning to learn* in terms of their interest and previous experience. Teachers provide different types of experiences within the curriculum: supportive (in order to meet grade-level expectations), at grade level (to maintain interest and engagement), and in depth (to

<sup>3</sup> Tomlinson, C; *The Differentiated Classroom, Responding to the Needs of all Learners*; 2013; ISBN-13: 978-1-4166-1860-7

stimulate inquiry or exploration in order to understand the concepts more deeply). She notes that “...teachers can differentiate four ways: 1) through content, 2) process, 3) product, and 4) learning environment based on the individual learner.” In Math 6, differentiation can help small groups of students access different aspects of the topics and content that all sixth-grade students master. For interested and advanced students, differentiation may be deeper investigations of the topic, moving the student to more deeply understand the systematic nature of mathematics, applications of the topic, or challenging math problems within the topic. Differentiation is *not* delving into successive math coursework. For struggling students, differentiation may be additional help with the teacher or another person, more time to master the content, a different environment or avenue for assessment, or additional supportive time within or outside of the student’s school day.

Students may experience the following common differentiations as their interests develop and as their needs arise.

Table 3: PAUSD’s Common Differentiation Opportunities

COMMON MATH 6 DIFFERENTIATION FOR MATH SUPPORT OR ADDITIONAL HELP	COMMON MATH 6 DIFFERENTIATION FOR EXTRA CHALLENGE AND DEEPER MATH EXPERIENCES
<ul style="list-style-type: none"> <li>• Working with the Teacher outside of class time</li> <li>• Math Workshop course (where available) or other class-scheduled support time</li> <li>• Alternate assessment environment</li> <li>• Alternate homework assignment</li> </ul>	<ul style="list-style-type: none"> <li>• Working with the Teacher outside of class time</li> <li>• Alternate assessment</li> <li>• Alternate homework assignment</li> <li>• Investigation and extension challenges</li> <li>• Contextual math applications</li> <li>• Problem-solving challenges</li> <li>• Joining the Math Club</li> <li>• Packets of Middle School Math Challenges to work out individually</li> </ul>

#### Alternative Placement of the Unusual or Atypical Math 6 Student

All sixth-grade students begin in sixth-grade math. Sixth-grade math teachers use a *variety of district-aligned methods* to evaluate each student at the beginning of the year to diagnose each student’s readiness for Math 6. Occasionally a teacher recognizes that an individual is working *well beyond* the sixth-grade level, that is, at eighth-grade or a further level of math. Students *somewhat* advanced, perhaps somewhat familiar with the sixth-grade curriculum are not considered for acceleration. Remaining with their classmates during this pivotal transformational period supports their healthy social-emotional growth, thus alternative placement into Math 7A is not appropriate. If a student were to be placed in a Math 7A course, the student would be out of synch during the *flexible*

*clustering* of what are often teambuilding or other memorable activities. During this transition year from Elementary to Middle school, math is balanced along with other academic, social, emotional, and well-being considerations. Students who might be ready for Math 7A as incoming sixth-graders will instead deepen their understanding of the mathematical system, gain insight into their own mathematical practices, and will learn to lead mathematically. *Sixth-grade math teachers are equipped to differentiate for students who are advanced within a year ahead which allows the student to remain in the sixth-grade class.*

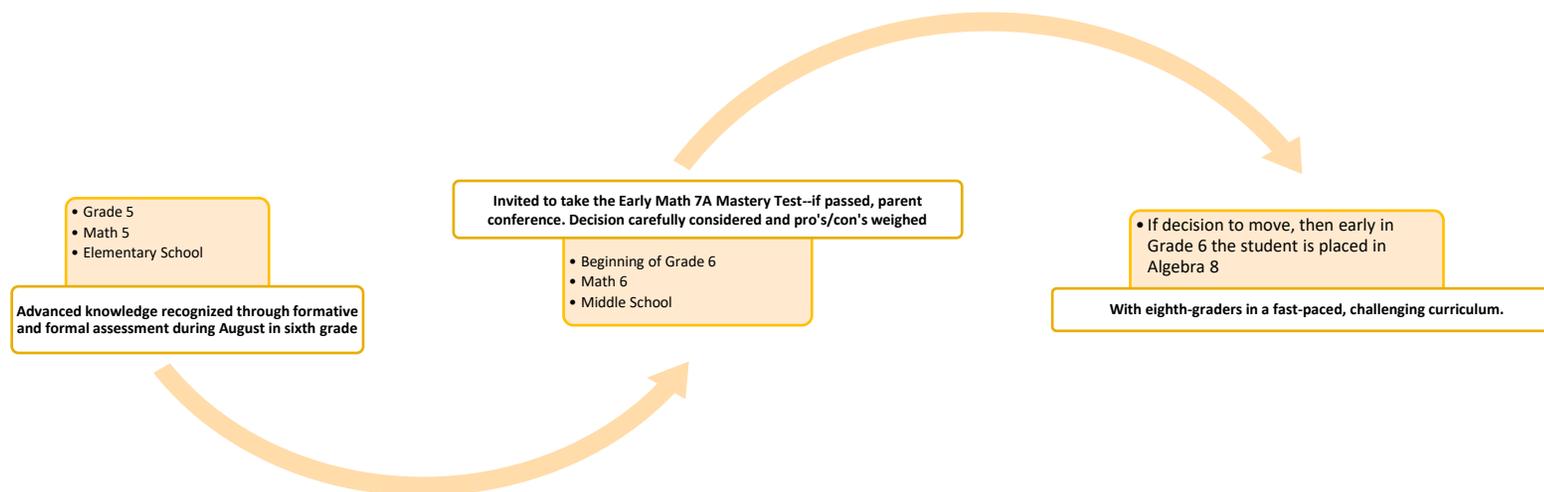
However, when the sixth-grade math teacher identifies a student who is potentially ready for Algebra (typically an eighth- or ninth-grade course), the teacher notifies the parents/guardians and offers the student an opportunity to take the *Early Math 7A Mastery Test*. A few students or parents/guardians are not interested in acceleration, and they decline the invitation as it is not appropriate for them. Most students and parents/guardians are interested in the possibility, and the student takes the test. Should the student pass the test, a parent/guardian-student-teacher-Math IL-conference is called to make the appropriate *personal* decision with the student. (Students who do not pass the test may have a conference as well.) Algebra 8 is both an accelerated and an advanced course that is two years ahead of Math 6. The curriculum is composed of three curricular areas (which prepares sixth-grade students for the honors high school courses): Basic and advanced topics in CCSS-M for Math 8 and Algebra, and the high schools' advanced Algebra 1A course. Algebra 8 is a fast-moving, deep course, that brings the students through Algebra 1 in some topics to the Algebra 2 depth, and in other topics into a system analysis of mathematics. Homework and assessments include challenging problems. The homework expectations in terms of time and difficulty are double the expectations for sixth-grade. The pacing of the Algebra 8 course is brisk. Although the student's mathematical readiness for Algebra 8 may be indicated, the student's social needs and the level of the student's interest and joy in math are considered. Parents/Guardians and teachers consider answers to many of the following questions when considering moving a sixth-grade student to Algebra 8. The decision should be focused on student interests, intent, and persistence.

- Does the student enjoy math and work independently at it? Is the student curious about math and investigate *what if* questions?
- Does the student progress without math tutoring using the student's own initiative?
- Does the student ask provocative mathematical questions in class, or after class of the teacher?
- Does the student enjoy working on challenging math problems with others?
- Does the student both complete homework and turn it in without prompting?
- Does the student have effective coping skills when frustrated or stressed?
- Does the student thrive in a fast-paced environment?
- Does the student recognize that learning takes time and requires attention to details, that mistakes will be made, and embraces challenges?
- How is the student performing in other subject areas? Can the student thrive in other subject areas if more time and demands are required in math?

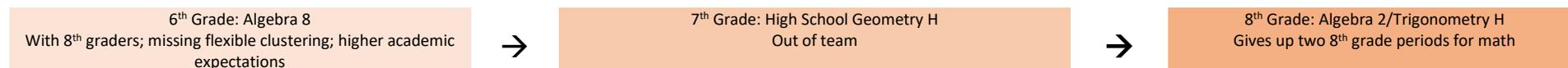
- What additional demands for time might the student face that could impact family time, sports time, music time, or free time? Can the student balance school work and extra-curricular activities while caring for physical and emotional health?
- If the student is struggling and the teacher recommends a different course option, will the student and parents/guardians be open and flexible to moving to a different course better suited for the student?

Current and subsequent logistical challenges<sup>4</sup> for the next few years are considered. If chosen, placement in Algebra 8 is completed as soon as possible.

Students who are successfully placed as sixth-graders in Algebra 8 tend to rank among the top few students in the course. As they continue through subsequent courses, successful students tend to earn As or high Bs throughout. The graphic below illustrates *Alternative Placement rather than Math 6*.

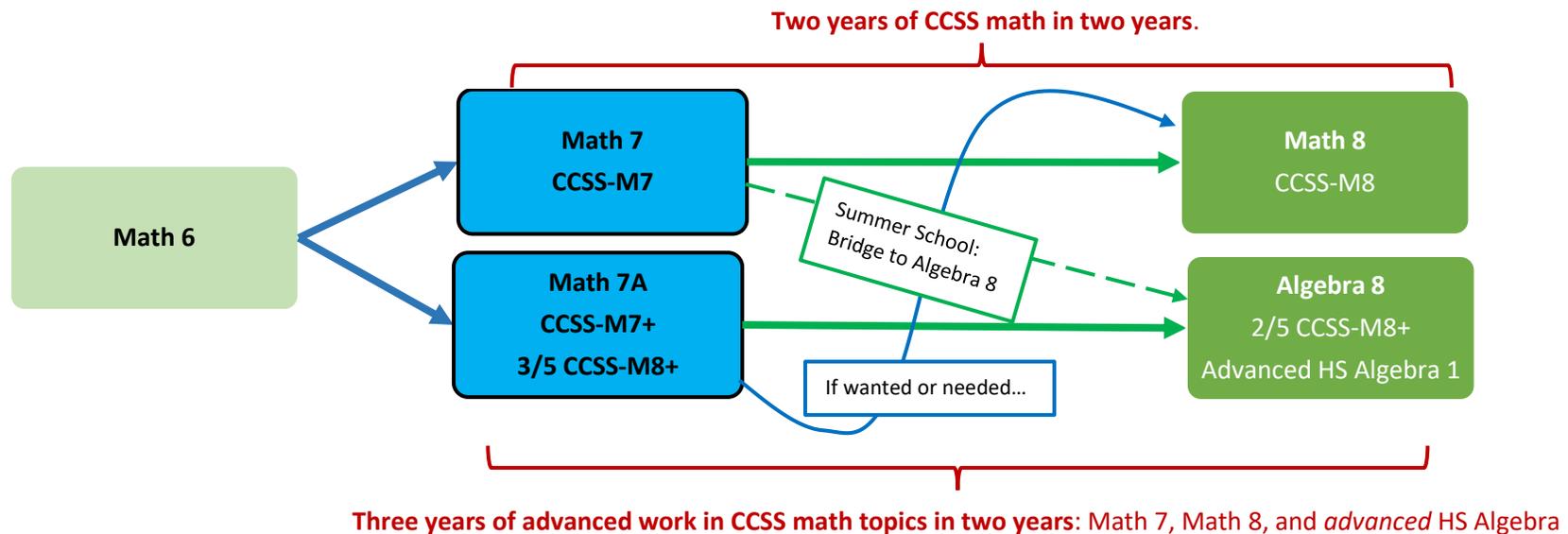


<sup>4</sup> Logistical Challenges: **(a) During sixth grade:** (1) The sixth-grade student is placed in an eighth-grade class, in which the students are developmentally more advanced. The sixth-grade student is generally the only sixth-grade student in the class. (2) The sixth-grade student will miss any flexible clustering activities which take place during the Algebra 8 class. (3) The sixth-grade student will be expected to meet the more onerous requirements demanded by the Algebra 8 course, e.g., larger homework assignment, timed tests, etc. **(b) Subsequently:** (1) In **seventh grade**, the student is placed in Geometry H, a high-school-level *honors* geometry course which covers geometry far beyond the Common Core Standards for geometry. The student will not be a full member of a teaching team as the student will have a unique Geo H teacher. (2) In **eighth grade**, the student will need to commute to one of the two high schools in order to enroll in Algebra 2/Trigonometry Honors. Students who make this commute typically give two periods of their schedule to mathematics, as both high schools use block scheduling—with periods ranging in length from 50 minutes to 90 minutes. That being said, the high schools endeavor to offer the course either at the beginning of the day or at the end of the day in order to support these students, sometimes assigning the student to more than one teacher. (3) In **High School**, the student will continue along the honors coursework pathway, completing AP BC Calculus in tenth grade, after which the student may choose from a variety of math electives. Throughout the high school years, these students are expected to earn As in mathematics.



## Grade 6 to Grade 7

Middle school math courses flow from one heterogeneous but differentiated sixth-grade math course into two *lanes*<sup>5</sup> of coursework in seventh grade. The seventh- and eighth-grade teachers hold Single Subject Credentials in math and are math specialists. The two seventh-grade courses help to provide the appropriate balance of “level of challenge and success” to seventh-grade students. *Math 7* meets all the Common Core State Standards for Math 7 (CCSS-M7) requirements. *Math 7A* is both an accelerated and an advanced course. Math 7A exceeds all the CCSS-M7 requirements and about three-fifths of the CCSS-M8 requirements. Math 7A compresses more than one-and-a-half years of advanced CCSS-M topics into one year of study. This compression allows students to complete three years of advanced mathematics in two years at an *advanced* level, namely Math 7, Math 8, and high school advanced-level Algebra 1.



### The Criteria Table: Advice for moving from Math 6 to Seventh-Grade Math

The Criteria Table of Sixth Grade Teacher Input for Seventh Grade Math Course placement emphasizes the academic validity of student work and subsequent student academic achievement exhibited on summative assessments. The teacher input on this document gives the students and their

<sup>5</sup> *Lanes* of coursework: PAUSD mathematics offer *lanes*, not tracks, of on-grade-level courses. In this manner, as students mature, emotionally and academically, students can choose the level of course to meet their needs of challenge and success, and to meet their goals. In some cases, moving to more challenging courses involves summer work, whereas moving to less challenging courses do not. Students change to less challenging courses to find more time in their daily schedules, to build academic confidence, and to find more time for courses more pertinent to their interests. Students move to more challenging courses when their interest in mathematics deepens.

parents/guardians advice regarding their choice of a seventh grade math course. While PAUSD recognizes the conundrum of the *case of the individual* versus the *flow of the trends*, parents/guardians and students are urged to choose the most appropriate math course that will give the student the suitable amount of challenge and success within it. Teachers will place an “X” in the column for each item in the criteria table (below) which creates an indication of the best “fit” for the student’s academic challenge and success level in the seventh-grade math course. If **two** or more of the Xs are **in the Math 7A column**, the suggested course is Math 7A. Students who have three Xs in each column are likely do succeed in the course of *their* choosing.

If a student earned Xs in the Math 7A column only (six Xs in the Math 7A column), the student is invited to try a small group of math challenge-questions in a testing environment, and has the opportunity to take the longer *May Math 7A Mastery Test*<sup>6</sup> which, if passed, demonstrates that the student has deep knowledge of Math 7A topics and is ready to enroll in Algebra 8 as a seventh-grader.

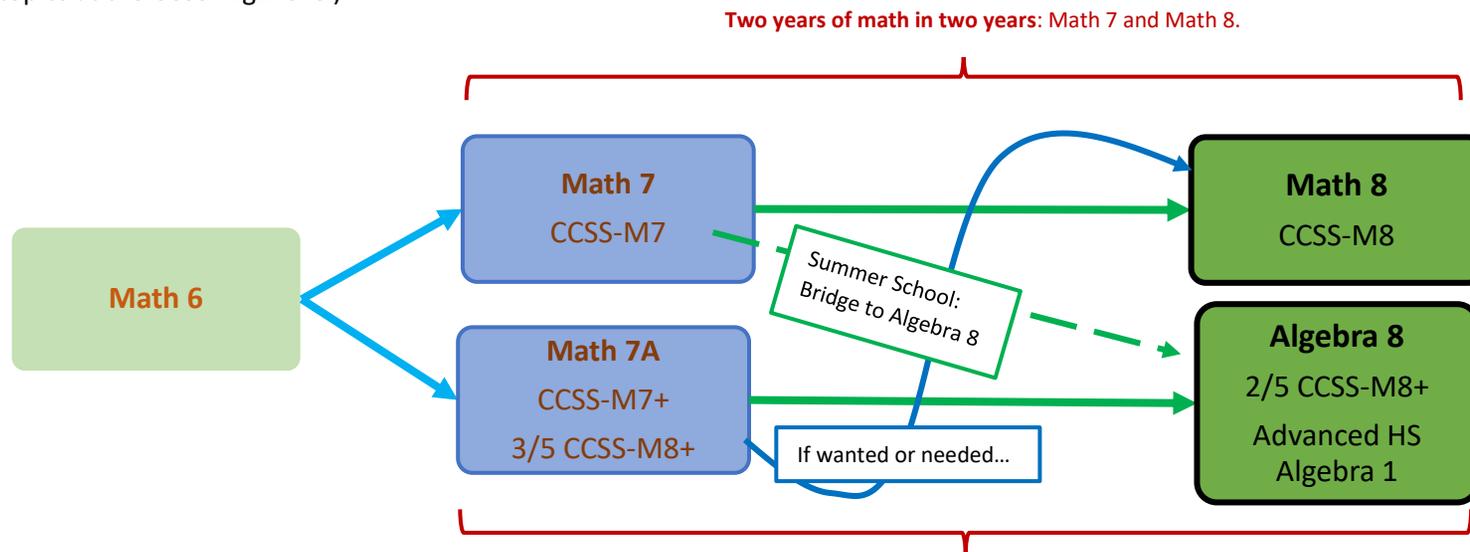
Table 4: Criteria Table: Moving students from Math 6 to Seventh-Grade Math (Note: 6 criteria possible)		
SIXTH GRADE TEACHER INPUT FOR STUDENTS AND PARENTS/GUARDIANS FOR SEVENTH GRADE MATH COURSE PLACEMENT		
AVERAGES AND SCORES ARE NOT ROUNDED.		
Criteria	Math 7A 2 or more Xs in this column, choose Math 7A	Math 7 3 or more Xs, student should choose course
Classroom Unit Tests Average (First score on each unit test)	[First scores indicate comfort with the pace of the course.]	
	94.00% to 100% or Rubric Score of Mode 4 Will receive an X in the Math 7A column	
	90.00% to 100% or Rubric Score of Mode 3 or above Will receive an X in the Math 7A column	
End of Year Comprehensive Test, Part 1		
	92.00% to 100% Will receive an X in the Math 7A column	
	85.00% to 100% Will receive an X in the Math 7A column	
End of Year Comprehensive Test, Part 2		
	92.00% to 100% Will receive an X in the Math 7A column	
	85.00% to 100% Will receive an X in the Math 7A column	

<sup>6</sup> Mastery Tests: Placement in math courses ahead of grade level can be accomplished by passing a *Mastery Test* with a score of 85% or more. The mastery tests contain the more challenging questions from the tests given in the associated course and are timed tests (2 hours). The *May Math 7A Mastery Test* is offered in May to outgoing sixth-graders who have earned Xs in the Math 7A column only of the *Sixth Grade Teacher Input for Students and Parents/Guardians for Seventh Grade Math Course Placement* document. A student may attempt the *May Math 7A Mastery Test* one time. Contact your school’s Math IL for details of date, time and place of testing.

The teacher’s input for enrollment is based on historical progress of many students moving through middle school math courses. In seventh grade, regardless of the input, students may enroll in Math 7 or Math 7A; students may enroll in any lane of the course *at their grade level*. Students having difficulty in their course despite putting in their best effort can request a lane change. Such changes are contingent on class size and must be approved by the Math IL. Changes can only be made before the end of the first quarter or at the semester break. Students who change lanes during the first semester carry their grade at the time to the new course. (Please note: The grade-level course, Math 7, meets the standards of the CCSS-M Math 7. The Math 7 course is followed by Math 8, or, with summer work, Algebra 8.)

## Grade 7 to Grade 8

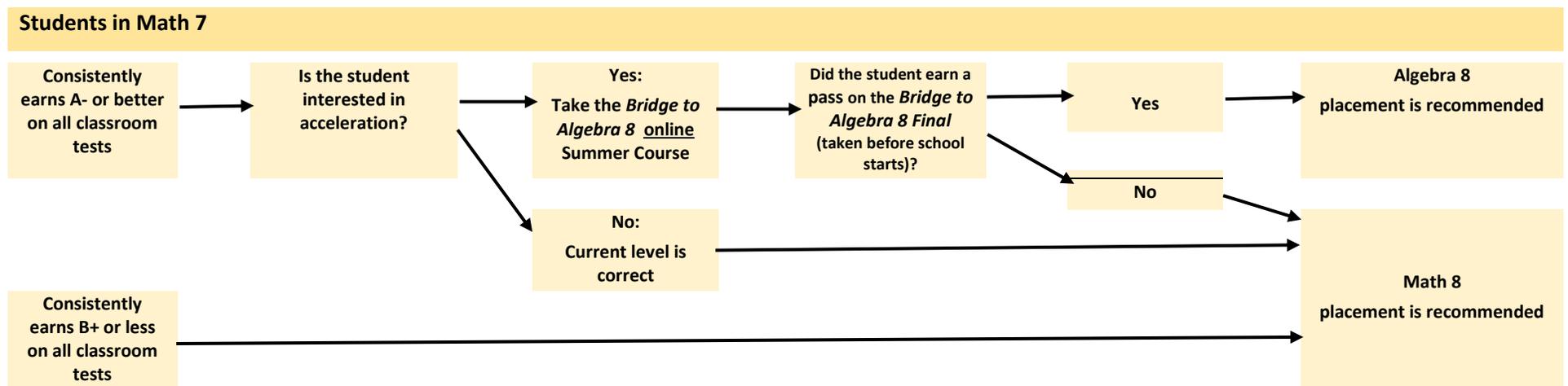
PAUSD strives to offer math courses that give students the appropriate amount of challenge and success in order to build confidence and joy in studying mathematics. Students with a proper balance of challenge and success can manage homework/practice on their own, look forward to new challenging problems, and enjoy working with others in unlocking concepts and ideas. Seventh-grade students are enrolled in one of two courses: Math 7 or Math 7A. Math 7A is an accelerated and advanced course comprised of CCSS-M7 and 3/5 of CCSS-M8 (both including deeper work). Math 7 satisfies the CCSS-M7 standards. In eighth grade, two courses are available to students: Math 8 and Algebra 8. Math 8 satisfies the CCSS-M8 standards. Algebra 8 is both an accelerated and advanced course. Algebra 8 is comprised of the last 2/5 of CCSS-M8 (CCSS-M8 plus deeper problems) and all advanced Algebra 1 (CCSS-Alg1 + more challenging problems, including some topics at the CCSS-Alg2 level).



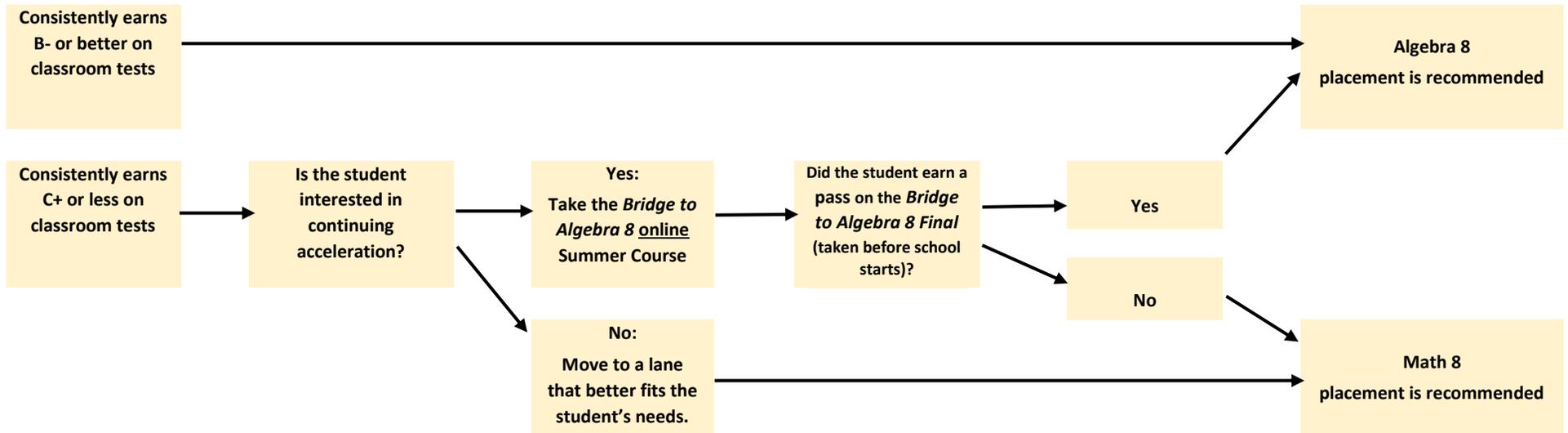
When students and their parents/guardians consider math placement for eighth grade, the seventh-grade student’s many classroom test scores are the most reliable indicators of the student’s mastery of the Math 7 or Math 7A content. Although the overall math grade may include behavior such as study skills, homework completion or remittance, or classroom participation, the overall grade tends to be less of a reliable indicator of academic knowledge. The overall grade, however, does indicate motivation and organization, which students and their parents/guardians should take into account when they feel they are falling between the two lanes of choice. For appropriate *academic* placement, students and their parents/guardians should use the student’s *first* experiences of the classroom tests. Successive experiences of classroom tests may indicate *mastery over time*, but *not necessarily mastery within the pacing* of the coursework. Additional considerations for Accelerated/Advanced-lane placement include the student’s positive motivation about and appreciation for mathematics, as well as willingness to engage in more challenging and deeper problem-solving.

As middle school students grow and develop, they foster varied appreciation for one academic subject over another. Flexibility is appropriate as a student moves from grade 7 to grade 8. To move to Algebra 8 from Math 7 requires a summer course (Bridge to Algebra 8) which covers Math 8 topics not covered in Math 7, introduces the first unit of Algebra 8, and gives students the experience of the faster pacing expected in Algebra 8. Students who are likely to be successful in moving to Algebra 8 have earned high marks on their Math 7 classroom exams the first time they take them. In 2019, the *Bridge to Algebra 8* course is offered online.

The flow charts below show recommendations for both the more usual move within a lane and changes in lanes. For students receiving special education services, the mathematics placement may be determined by the student’s IEP team.



## Students in Math 7A



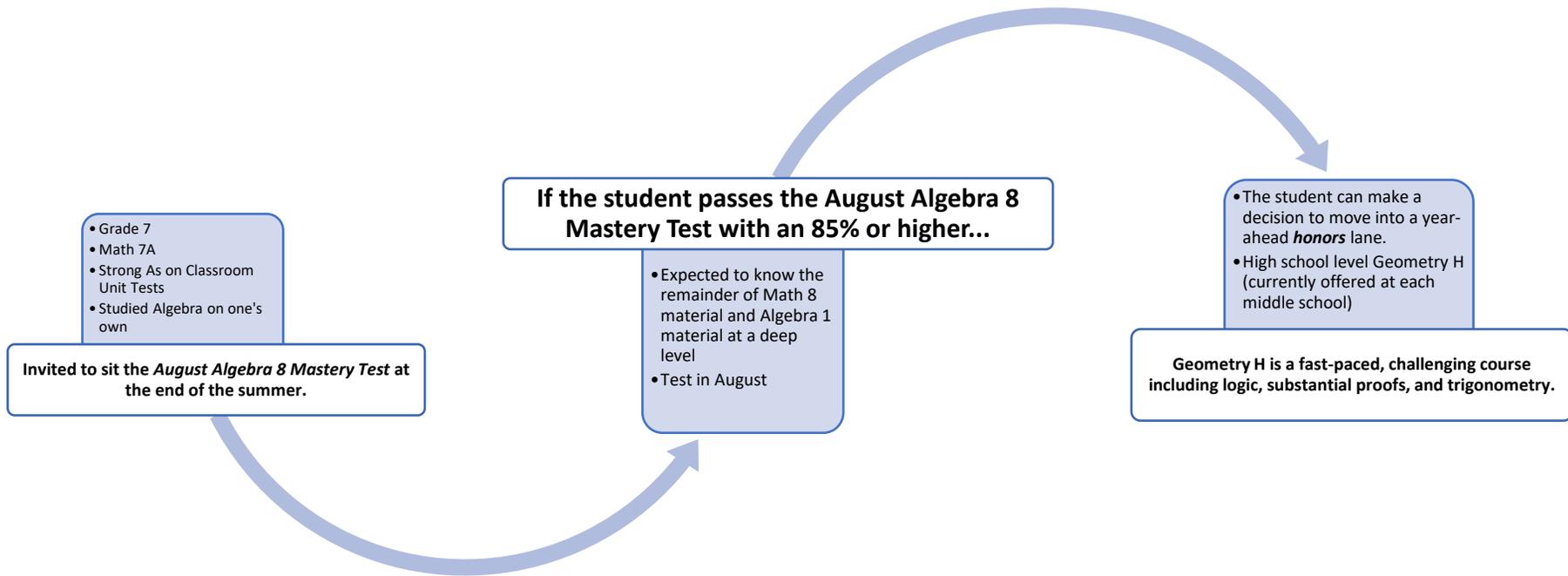
Regardless of the recommendation, students and their parents/guardians are urged to choose the most appropriate math course annually to give the student the suitable amount of challenge and success, so that the student maintains independence in mathematics work, builds confidence, and enjoys school. Students having difficulty in the course, despite putting in the student's best effort, can request a lane change. Such changes are contingent on class size and must be approved by the Math IL. Changes can only be made before the end of the first quarter or at the semester break. Students who change lanes during first semester carry over their grade at the time to the new course.

### Skipping Algebra 8

Skipping a foundational course, such as Algebra, is counterproductive to a student's progress in higher-level mathematics. However, if a student in Math 7A has consistently earned strong As on classroom tests, and *has been learning the algebra curriculum on one's own*, the student has the opportunity to take the *August Algebra 8 Mastery Test*<sup>7</sup> to demonstrate proficiency. The test is comprised of the same level of questions from the Algebra 8 unit-tests and is timed (2

<sup>7</sup> The *August Algebra 8 Mastery Test* is offered in August. A student may only attempt the *August Algebra 8 Mastery Test* **one** time. Non-PAUSD students who perform well on the eighth-grade Placement Test and who demonstrate some Algebra knowledge to an eighth-grade math teacher (a few informal questions which require demonstrated work)

hours). Passing requires a minimum score of 85%. (Regardless of the outcome of the test, if the student or parent/guardian wishes, a student-math-pathway-planning conference can be held with the student’s teacher and the Math IL.) If the student passes the *August Algebra 8 Mastery Test*, the student is placed (as an eighth-grader) in an honors level high school course, Geometry H, offered at each of the middle school sites when enrollment at a site is approximately fifteen or more, or jointly at one or two sites when enrollment is less. Geometry H encompasses geometry far beyond the CCSS-Geo level, and includes logic, substantial proofs, and trigonometry. The student will not be a full member of a middle school cross-curricular teaching team as the student will have a unique Geo H teacher. (The middle school cross-curricular teaching teams are comprised of the four core teachers, Social Studies, English-Language Arts, Math, Science, and one elective teacher. The teams plan projects and testing dates based on one another’s calendars in order to minimize the impact of project-stacking.) The graphic below illustrates *Skipping Algebra 8*.



may attempt the *August Algebra 8 Mastery Test*. Students transferring in from non-PAUSD schools must pass the test to be placed ahead of grade level. Contact your school’s Math IL for details of date, time and place.

## Grade 8 to Grade 9

Successful high school math placement of rising ninth-grade students is dependent on a variety of factors. When students and their parents/guardians consider math placement for ninth grade, the eighth-grade student's many classroom test scores are the most reliable indicators of the student's mastery of the Math 8 or Algebra 8 content. Although the overall math grade may include behavior such as study skills, homework completion or remittance, or classroom participation, the overall grade tends to be less of a reliable indicator of *academic* knowledge. The overall grade, however, does indicate motivation and organization, which should be considered if students and their parents/guardians feel that appropriate placement is between two courses. For appropriate *academic* placement, students and their parents/guardians should use the student's *first* experiences of the classroom tests in eighth-grade. Successive experiences of classroom tests may indicate *mastery over time*, but *not necessarily mastery within the pacing* of the coursework. Additional considerations for Accelerated/Advanced-lane (*A-lane*) or Honors-lane (*H-lane*) placement include the student's positive motivation about and appreciation for mathematics, as well as willingness to engage in more challenging and deeper problem-solving. The student's overall schedule should be considered additionally; will the student have time for homework completion and reflection given the student's expected daily activities? Moreover, in ninth-grade, the student begins to build transcript data; transcripts and their associated GPA (Grade Point Averages) are part of the information that colleges and universities use to determine admissions among their applicants. For more information, check with your student's academic counselor at the high school, and see the FAQ in this document, *What are some basic entrance expectations from colleges and universities regarding student transcripts?*

### Ninth-Grade Placement Checkpoints (SB 359)

During the first three weeks of high school, all ninth-grade math students are assessed for proper placement. In the ninth-grade algebra courses, the students are formatively assessed by their instructors, and the students take a CCSS-Algebra aligned readiness test for Algebra I. In freshman geometry courses (Geometry A and Geometry H), ninth-grade students are formatively assessed by their instructors, and the students take a CCSS-Geometry aligned readiness test for advanced or honors geometry. Ninth-grade students in non-standard math placements (not any type of Algebra 1 or Geometry) are assessed by their instructors both formatively and summatively in the first four weeks of school within the context of their placement.

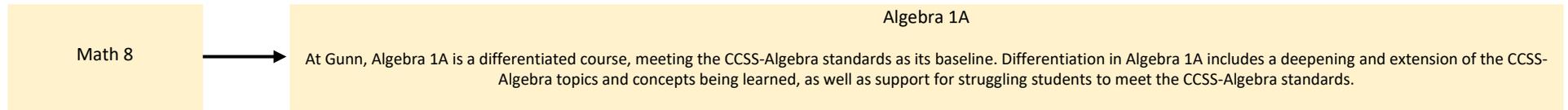
### Determining Ninth-Grade Placement

In eighth grade, most students are enrolled in one of two courses: Math 8 or Algebra 8. A few students are enrolled in *High School* Geometry H, a high school honors course. Recommended ninth-grade placement can be determined by traversing the flow charts headed by the particular eighth-grade course title.

Note that there are some differences in ninth-grade course offerings at Henry M. Gunn and Palo Alto Senior High Schools. The differences are noted in each flow chart.

**Eighth-Grade Math Course: MATH 8**

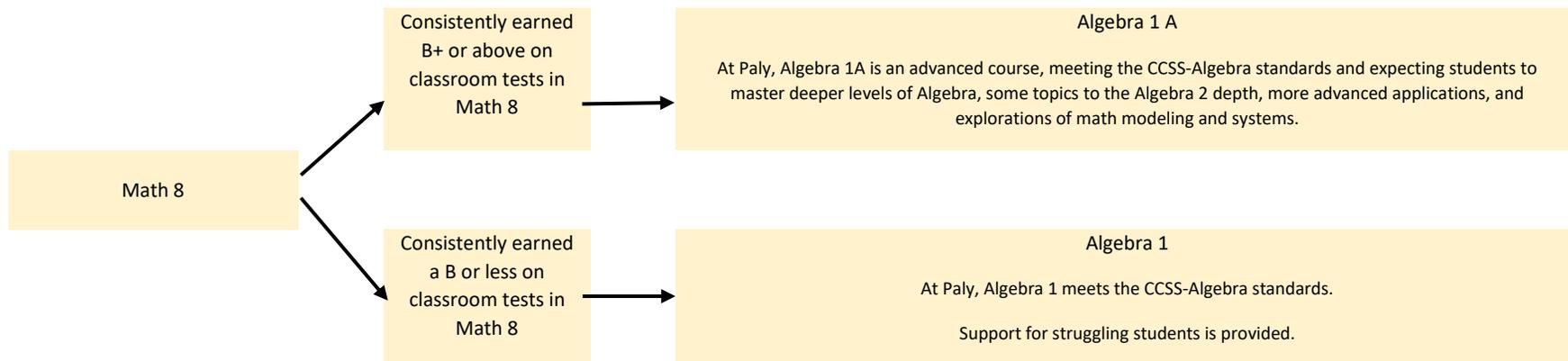
At Henry M. Gunn High School (aka, **Gunn**)



At Palo Alto High School (aka, **Paly**)

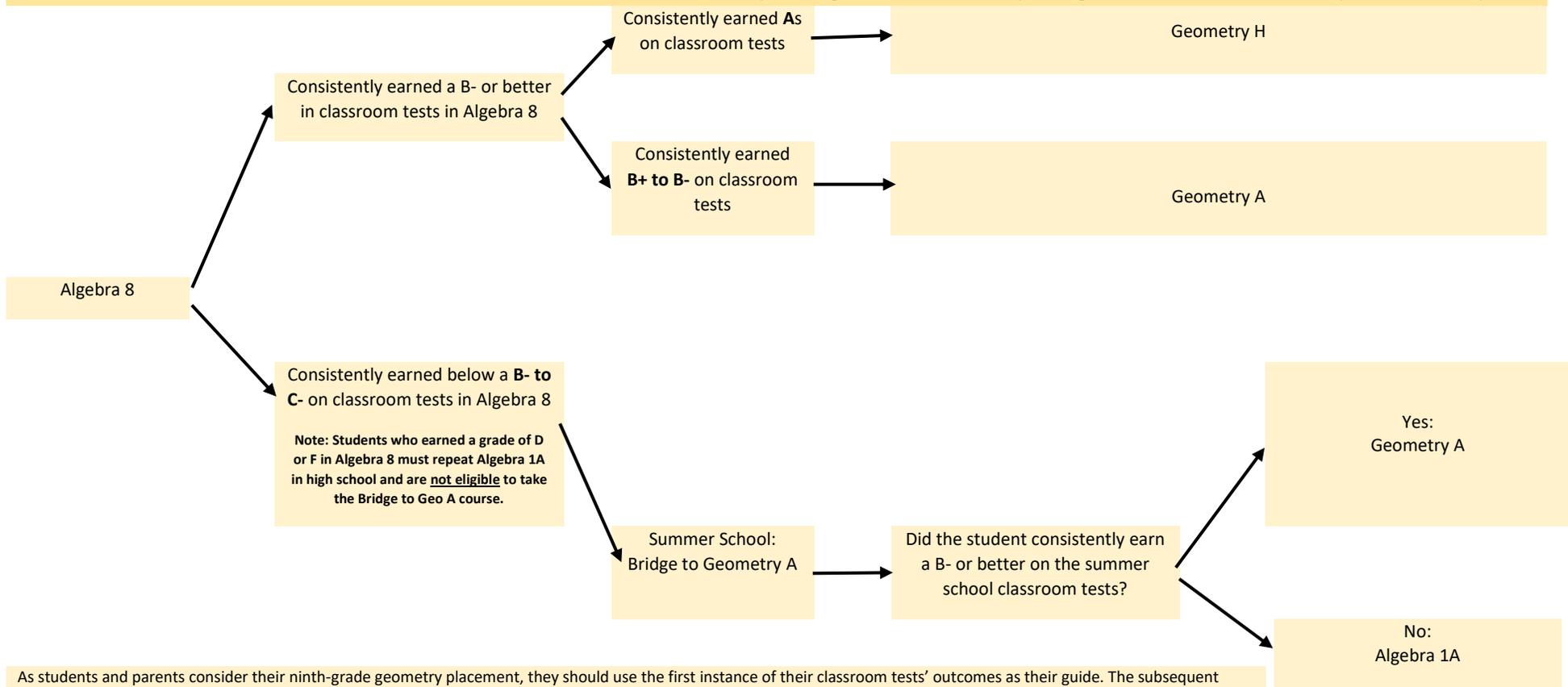
Middle school math teachers provide Math 8 students and their parents/guardians with recommendations for placement when requested.

Note that Math 8 students may enroll with any *lane* of the ninth-grade Algebra 1 courses. Students having difficulty in their class despite putting in their best effort can request a lane change. Such changes are contingent on class size and must be approved by the Math IL. Changes can only be made before the end of the first quarter or at the semester break. Students who change lanes during first semester carry over their grade at the time to the new course.



# Eighth-Grade Math Course: Algebra 8

Middle school math teachers provide Algebra 8 students and their parents/guardians with recommendations for placement when requested.



As students and parents consider their ninth-grade geometry placement, they should use the first instance of their classroom tests' outcomes as their guide. The subsequent retakes on tests mask the student's management of the pacing of the course. The Geometry H course expects that the students begin the course with deep understanding and quick facility with Algebra. The Geometry A course expects that more challenging Algebra topics will be reviewed as they are encountered in geometric applications. Both Geometry A and H courses are more advanced than the CCSS-Geometry course.

Students who consistently earned a C+, C or C- in the first instance of their classroom tests struggle with the Algebra concepts, ideas, or skills. In order to successfully traverse the honors or advanced coursework in Geo A, students must rebuild a stronger foundation in Algebra. Taking the *Bridge to Geometry A* course in the high school's summer school gives students a second chance to master the coursework. **Students who earn a D or F in their Algebra 8 course must repeat Algebra. They may take either Algebra 1A or Algebra 1.**

**If a student does not thrive in Geometry A, fortifying the Algebra foundation, on which Calculus depends, is the right path. Such students are successful, academically and emotionally, when students and parents choose to "restart" the advanced courses by taking Algebra 1A. (The 'now confident' student's path would be Alg 1A, Geo A, Alg2/Trig A, and IAC.)**

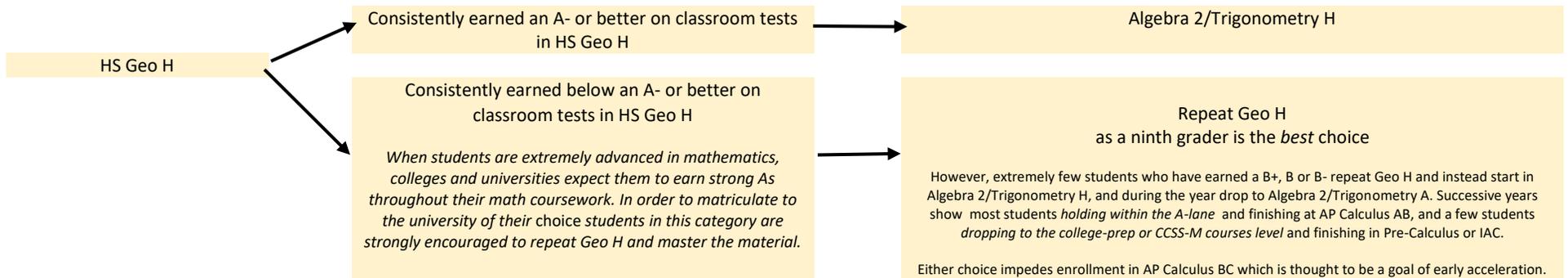
Note that Algebra 8 students consistently earning a B- or above on classroom tests may enroll in either the A-lane or H-lane of the Geometry courses. The grade-level Geometry course (Geometry) is reserved for sophomores or older students.

Conferencing with the student's math teacher and/or the school's Math Instructional Leader is useful in creating and choosing the appropriate pathway.

Students having difficulty in their class despite putting in their best effort can request a lane change. Such changes are contingent on class size and must be approved by the Math IL. Changes can only be made before the end of the first quarter or at the semester break. Students who change lanes during first semester carry over their grade at the time to the new course.

## Math Course taken in Eighth-Grade: *High School Geometry H*

Note: Enrollment has never exceeded more than 50 students, district-wide. Generally, the district enrollment falls at around 40 students. Middle school math teachers provide eighth-grade HS Geo H students and their parents/guardians with recommendations for placement when requested.



Note that eighth-grade HS Geo H students who matriculated to Algebra 2/Trigonometry H in ninth-grade, but who are having difficulty in their class despite putting in their best effort can request a lane change to repeat Geometry H or enroll in Geometry A as ninth graders.

Ninth-grade students who struggle in Algebra 2/Trig H are in a complicated position. Ninth-graders so far advanced (they are two years ahead in the honors lane) are expected to be at the top of the class by the colleges and universities. Not continuing to be enrolled in the most challenging courses can have a dampening effect on the student's application process. Repeating the Geometry H maintains the student's position in the most challenging courses, and the student is still a year ahead. When considering whether to repeat Geometry H, instead of dropping to Algebra 2/Trig A, students and their parents should consider the "end game." That is, what coursework does the student hope to complete in the high school years? What path will help the student achieve the goal? Conferencing with the student's math teacher, academic counselor, and/or the school's Math Instructional Leader is useful in creating and choosing the appropriate pathway to the goal. (See the FAQ, *What are some basic entrance expectations from colleges and universities regarding student transcripts?*)

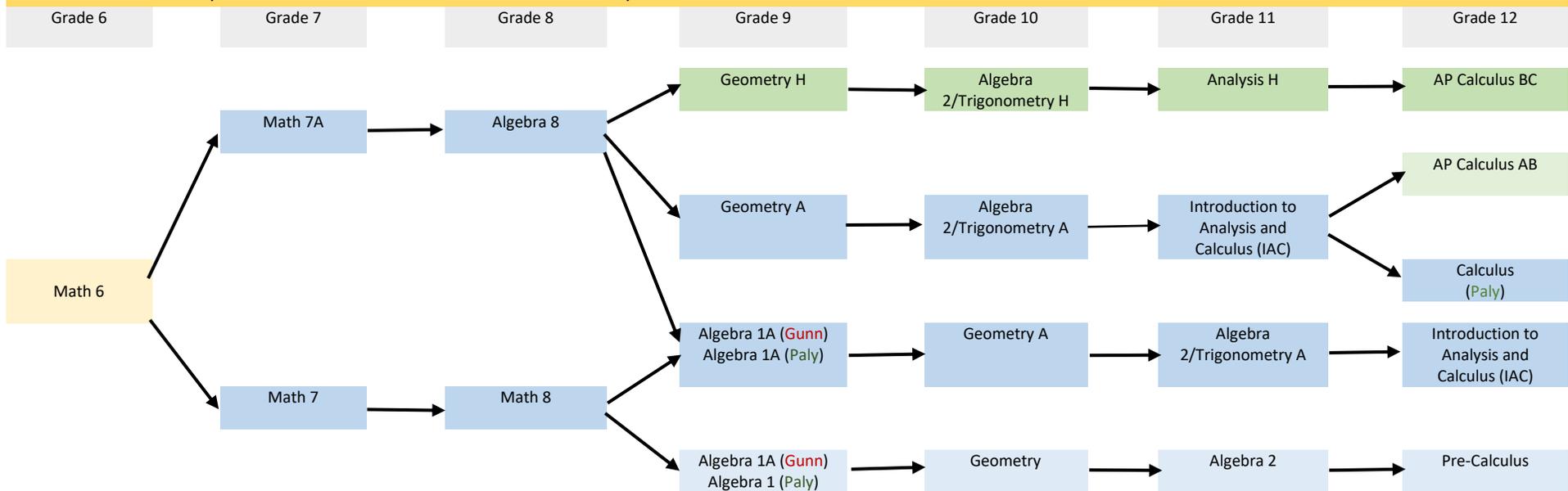
Such changes are contingent on class size and must be approved by the Math IL. Changes can only be made before the end of the first quarter or at the semester break. Students who change lanes during first semester carry over their grade at the time to the new course.

## Details of the PAUSD Grade 6 through Grade 12 Secondary Math Pathways and Offerings

PAUSD's variety of levels of mathematical experience ranges from CCSS-M *grade-level standard courses*, through *advanced* and *accelerated* exploration of the topics and their applications of those standards, to the highly abstract investigations of mathematical systems in the *honors* courses. These are called the *lanes* of math in PAUSD: grade-level or college-prep, advanced, and honors. It is important for students and their parents/guardians to choose their placement based on finding the appropriate balance of challenge and success in the student's day. Furthermore, in high school courses, the learner must also be aware of the impact of the transcript grade in the college application process. It is recommended that students look to choose the most rigorous course of study available to them in which they can earn an A or a B *on their own*. As students mature academically, many will discover academic areas of passion—mathematics may or may not be among them. The workload and pace of the A-lane (or advanced courses) are more demanding than the grade-level/college-prep courses. The workload and pace of the H-lane (or honors courses) are more demanding than the A-lane courses. In deference to students' natural growth, PAUSD offers these *lanes* rather than *tracks* of math, among which students can move as on a highway. If a student wishes to move to more advanced or deeper coursework, the student may need to complete summer work. If a student wishes to move to less challenging or may basic coursework, the student can generally move at the end of a semester without any additional work. *All* mathematics courses in the next two flow charts are CSU/UC approved courses.

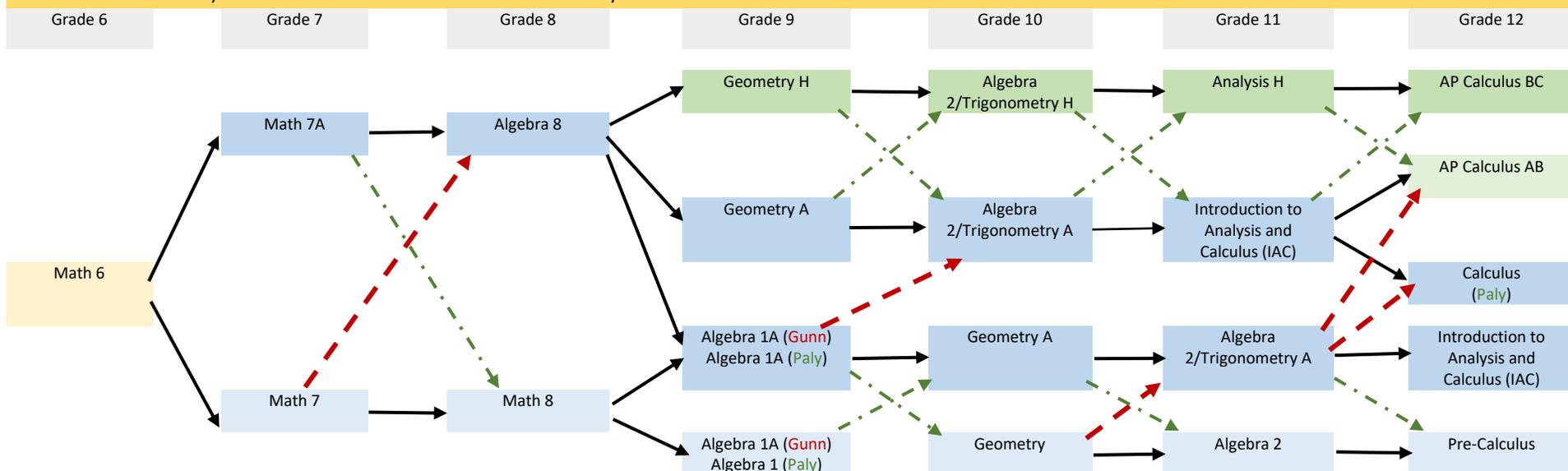
Two flowcharts are below. In the first, the common pathways are depicted (without the flexibility included) so that the basic configuration of the flow is more obvious. In the second flowchart the most common flexible pathways are illustrated, showing summer work when required. Common pathways show a natural, linear flow of concepts and skills from one level to another. In the figure below, the addition of an *A* or an *H* in the title of a course indicates an *Advanced* course or an *Honors* course, respectively.

## PAUSD Secondary Math Flow Chart: *Common Pathways*



In the next flow chart, movement among the lanes of courses is indicated. Movement to more challenging courses may require summer work, indicated by a dotted **red** arrow. The summer work often involves completing an entire course in a classroom or online, or a substantial part of a course studied on one's own. Movement that does not require any summer work is indicated by a dotted **green** arrow. *However*, the student should be earning high marks on tests in their current course and should expect to encounter an increased pace and depth in the more advanced course. (It is helpful for such students to form a study-group in the new class for extra support during the first quarter of the more advanced course.) Generally, if a student is moving to a less demanding course, no summer work is required. If students or parents/guardians are interested in making a shift to another lane, start a conversation with your current math teacher. The Math Instructional Leader (Math IL) at your site will also be able to give you more long-range information to plan the math pathway that meets the needs of the student. Course changes made during the year are contingent on class size and must be approved by the Math IL. Changes can only be made before the end of the first quarter or at the semester break. Students who change lanes during first semester carry over their grade at the time to the new course.

## PAUSD Secondary Math Flow Chart: *Flexible Pathways*



### Notes:

- The changed direction of path is indicated by a dotted arrow. Red arrows indicate needed summer work, such as a summer school course. Green arrows indicate little or no content work is needed. Talk to your student's math teacher for the details of the summer work.
- If a student is in Geo A as a ninth-grader, or Alg2/Trig A as a tenth-grader, and is struggling, the student will likely move to the grade-level courses of Alg 2 as a tenth-grader, and Pre-Calculus as an eleventh-grader, respectively. The student's twelfth-grade course would be chosen among IAC, Calculus (at Paly), or AP Calculus AB. See the FAQ: Struggling student who is a year-ahead in the A-lane high school pathway.
- The Graduation Requirements and the UC/CSU Admissions Requirements are three years of math during high school, including Algebra 1, Geometry and Algebra 2, minimally. A fourth year of math is recommended for UC/CSU admissions. The Algebra 2 courses that meet the third-year requirement are Algebra 2, Algebra2/Trigonometry A and Algebra 2/Trigonometry H. The Geometry course must be taken *in the district* (Geometry, Geometry A or Geometry H). Any successful completion of an Algebra 2 course *validates* the Algebra 1 course requirement, but not the Geometry requirement. Students wishing to take a graduation requirement course off-campus must obtain **prior approval** from the appropriate high school administrator. <https://www.pausd.org/high-school-education-9-12/high-school-graduation-requirements>

### Pathways to Calculus in High School: When the Path May Include Summer Work

The CSU/UC Requirements for Admission, and the PAUSD Graduation Requirements in mathematics is both the successful completion of three high school math courses, *and* the successful completion of Algebra 1, Geometry, and an Algebra 2 course. For CSU/UC admissions and to meet the prerequisite of the successive course, the course grades must be a C- or better. For PAUSD Graduation Requirements, the course grade must be a D or better. Math courses that meet the Algebra 2 requirement are *Algebra 2*, *Algebra 2/Trigonometry A*, and *Algebra 2/Trigonometry H*. Keeping in mind the minimum work needed for graduation or college admissions, many parents/guardians and students in the PAUSD community are interested in reaching a Calculus course by their senior year—particularly, AP Calculus AB. (Please note that many of our fourth-year courses contain some calculus: Pre-Calculus includes Limit Theory and some basic derivatives; IAC includes Limit Theory and Differentiation through the Chain Rule; and Calculus (Paly only) includes Limit Theory, Differentiation, and Integration.)

The following table shows some sample pathways to AP Calculus AB. Because of the flexible nature of PAUSD’s math offerings, not every possible pathway is shown. Summer courses are highlighted. For Summer 2019, we have added a *Core Topics of IAC* course. Please see the last column of the table for the 2019 sample pathway.

Table 5: Sample Pathways to AP Calculus AB				
Grade Level	↓ Sample Path to AP Calculus AB ↓	↓ Sample Path to AP Calculus AB ↓	↓ Sample Path to AP Calculus AB ↓	↓ Sample Path to AP Calculus AB ↓ (beginning in <b>summer 2019</b> )
Grade 6	Math 6	Math 6	Math 6	Math 6
Summer after sixth grade				
Grade 7	Math 7	Math 7	Math 7A	Math 7
Summer after seventh grade		<b>Bridge to Alg 8</b> 4 weeks: Math 8 topics; increased pacing; preview of the first section of Alg 8 <b>Online for 2019</b> Final Exam required in Early August		
Grade 8	Math 8	Alg 8	Alg 8	Math 8
Summer after eighth grade		<b>Bridge to Geo A</b> 4 weeks: 5 hours/day w/2 hrs/day homework Designed for students who earned a C+, C or C- in Alg 8 who want to solidify their Algebra knowledge so that they have a better opportunity to succeed in Geometry A as freshmen. (Students who earned a D or F in Alg 8 <i>must</i> repeat Algebra at the High School by enrolling in Algebra 1A.) At the high school summer school site		
Grade 9	Alg 1A	Geo A	Geo A	Alg 1A
Summer after ninth grade	Geo A 6 weeks: ALL of Geo A; 5 hrs/day course w/3 hrs/day homework Graded; 10 units of credit			
Grade 10	Alg 2/Trig A	Alg 2/Trig A	Alg 2/Trig A	Geo A
Summer after tenth grade				
Grade 11	IAC	IAC	IAC	Alg 2/Trig A
Summer after eleventh grade	<b>Optional: Transition to Calculus Course</b> 3 weeks: Preview of the Calculus concepts of Limit Theory, Differentiation and Integration with Polynomial and Rational Functions 5 hrs/day w/1+ hr/day homework This course is also open to students finishing IAC who wish to build confidence in the calculus concepts before the AP course.	<b>Optional: Transition to Calculus Course</b> 3 weeks: Preview of the Calculus concepts of Limit Theory, Differentiation and Integration with Polynomial and Rational Functions 5 hrs/day w/1+ hr/day homework This course is also open to students finishing IAC who wish to build confidence in the calculus concepts before the AP course.	<b>The Confidence-builder Course:</b> <b>Optional: Transition to Calculus Course</b> 3 weeks: Preview of the Calculus concepts of Limit Theory, Differentiation and Integration with Polynomial and Rational Functions 5 hrs/day w/1+ hr/day homework This course is also open to students finishing IAC who wish to build confidence in the calculus concepts before the AP course.	<b>Core Topics of IAC</b> <i>Beginning in Summer 2019, Session I</i> Topics: The Laws of Sines & Cosines, DeMoivre’s Theorem, Sequences & Series, 2-D & 3-D Vectors, Basic Graphing in 3-D, Matrices, Probability & Counting, Parametric Equations, Polar Coordinate & Functions, and Limit Theory 3 weeks: 5 hrs/day course w/3 hrs/day homework Not graded; 0 units of credit <b>This class is only open only to rising 12<sup>th</sup> grade students.</b>  <b>Recommended: Transition to Calculus Course</b> <i>Offered in Session II</i> 3 weeks: Preview of the Calculus concepts of Limit Theory, Differentiation and Integration with Polynomial and Rational Functions 5 hrs/day w/1+ hr/day homework This course is also open to students finishing IAC who wish to build confidence in the calculus concepts before the AP course.
Grade 12	AP Calculus AB	AP Calculus AB	AP Calculus AB	AP Calculus AB

For students to be successful, their academic, physical and emotional maturity play an important part in their engagement and enjoyment in math. All of the PAUSD math courses meet the CCSS-M standards. The variety is designed to help students find the appropriate level of challenge so that students can satisfyingly grapple with math on their own. There no reason to hurry the process of working toward a twelfth-grade (or college freshman) calculus course if your student requires constant tutoring so that the student may learn the skills of the course, sometimes without understanding the concepts or mathematical system. There are plenty of opportunities to create a path that leads to calculus either in high school or within the first few years of university work. Be sure to find out what is in your child's heart as you and your student determine which math course is the best fit for the child. If you would like collaboration in thinking about possible pathways and building a flexible plan with your student, contact your student's math teacher or your school's Math IL.

## High School Math Electives and Where They Fit into the Student’s Schedule

Any math course beyond the Algebra 1-Geometry-Algebra 2 PAUSD graduation and CSU/UC entrance requirements is defined as an elective math course. Certain courses fit into the linear stream of work arriving at calculus: Pre-Calculus, IAC, Analysis H, Calculus (Paly), AP Calculus AB, and AP Calculus BC as you have already noticed in the flow charts. There are additional, rich courses that students may take to deepen their experiences in particular areas of mathematics. The offerings vary somewhat at each high school site. These courses also earn credits in mathematics in the elective category.

Henry M. Gunn High School <b>Gunn</b>			Palo Alto Senior High School <b>Paly</b>		
Course	Prerequisite	Duration	Course	Prerequisite	Duration
<b>Gunn BEAM</b> Business, Entrepreneurship, and Mathematics	Successful completion of Algebra 1A Grades 10-12	Year (UC Approved)	<b>Stats Applications</b> This course is designed to be a project-based introduction to applied statistics.	Successful completion of Algebra 2 Grades 10-12	Semester (UC Approved)
<b>Applied Math</b> Emphasis is on hands-on, project-based learning. Topics of study include Linear Programming, Decision Trees, Financial Analysis, Queuing, Game Theory, and Applied Statistics.	Successful completion of Algebra 2 Grades 11-12	Semester (UC Approval Pending)	<b>Advanced Problem Solving</b> The objective of this course is to foster excellence in mathematics through problem solving and competition.	Concurrent enrollment in A- or H-lane mathematics Grades 9-12	Four Semesters are Available: APS 1, 2, 3 and 4 (not UC Approved)
<b>AP Statistics</b>	Successful completion of Algebra 2 Grades 11-12	Year (UC Approved/UC Weighted)	<b>AP Statistics</b>	Successful completion of Algebra 2 Grades 11-12	Year (UC Approved/UC Weighted)
Dual Enrollment courses offered through a collaboration with <b>Foothill Community College and PAUSD</b> when enrollment supports the course. (This set of courses meets at <b>Foothill, Paly</b> or <b>Gunn</b> timed in the day (likely around 4 pm three times per week) so that students may safely commute to the course site. The set of courses are likely to be offered at <b>Paly in 2019</b> . Instructors may be Foothill or PAUSD math staff.)					
<b>Course</b>		<b>Prerequisite</b>		<b>Duration</b>	
<b>MATH 1C CALCULUS</b> Introduction to functions of more than one variable, including vectors, partial differentiation, the gradient, contour diagrams and optimization. Additional topics include infinite series, convergence and Taylor series.		Successful completion of AP Calc BC Grades 10-12		College Quarter FALL (earns dual credit)	
<b>MATH 1D CALCULUS</b> Introduction to integration of functions of more than one variable, including double, triple, flux and line integrals. Additional topics include polar, cylindrical and spherical coordinates, parameterization, vector fields, path-independence, divergence and curl.		Successful completion of Math 1C Grades 10-12		College Quarter WINTER (earns dual credit)	
<b>MATH 2B LINEAR ALGEBRA.</b> A first course in Linear Algebra, including systems of linear equations, matrices, linear transformations, determinants, abstract vector spaces and subspaces, eigenvalues and eigenvectors, inner product spaces and orthogonality, and selected applications of these topics.		Successful completion of Math 1C Grades 10-12		College Quarter SPRING (earns dual credit)	

Out of all of the electives, **AP Statistics** is the course that is commonly taken by a variety of students as juniors and seniors. This course can be taken concurrently with IAC, Analysis H, Calculus, AP Calc AB, or AP Calc BC. It is also commonly taken instead of IAC or Pre-Calculus. For a few students who complete

Pre-Calculus as a junior, the student opts for AP Statistics instead of IAC or AP Calc AB. In the rare cases of students who have completed calculus by their junior year, AP Statistics is an attractive course expanding their breadth of mathematics. See the FAQs for a variety of sample pathways.

## Computer Science for ALL PAUSD Students

Every student should have a high school experience of Computer Science (CS). It is difficult to consider any aspect of modern life that does not rely on technology and computers. PAUSD has a variety of courses appropriate for students who come into high school with little or no CS experience, to students who are using their CS experience to help companies solve problems. CS courses earn credits in the CTE category (Career Technical Education), but CS has a strong relationship with the mathematics departments. Generally, mathematics teachers with CS expertise, experience, and interest teach CS courses. The offerings are listed below:

At Henry M. Gunn High School <i>GUNN</i>	At Palo Alto Senior High School <i>PALY</i>
AP Computer Science Principles (AP CSP)	AP Computer Science Principles (AP CSP)
AP Computer Science A (AP CS A)	AP Computer Science A (AP CS A)
Functional and Object-Oriented Programming (FOOP)	Functional and Object-Oriented Programming (FOOP)
Programming for Mobile Devices (not UC approved) (PMD)	Computer Science Capstone Project (CS Cap)
Computer Science Capstone Project (CS Cap)	Web Development

## FAQs

- My student is “right on schedule” for mathematics—what does a “right on schedule” pathway look like?

Two common “right on schedule” pathways are shown in the table below:

6 <sup>th</sup> Grade	7 <sup>th</sup> Grade	8 <sup>th</sup> Grade	9 <sup>th</sup> Grade	10 <sup>th</sup> Grade	11 <sup>th</sup> Grade	12 <sup>th</sup> Grade
Math 6	Math 7	Math 8	Algebra 1 (Paly) Algebra 1A (Gunn)	Geometry	Algebra 2	Pre-Calculus or AP Statistics
Math 6	Math 7	Math 8	Algebra 1A (Gunn and Paly)	Geometry A	Algebra2/Trig A	IAC AP Statistics (Could take one or the other, or could take both simultaneously)

Depending on the student’s level of success in Math 8 (eighth grade) and Algebra (ninth grade), the student may find success in the grade-level *college-prep* courses or in the *advanced* courses in high school.

- My student really struggles in mathematics and has earned Cs or less in middle school courses. What does a struggling student’s pathway look like, assuming the student earns at least a C in each high school course?

Parents/guardians can support their struggling student by helping their student build an organizational structure to help the student keep up with the curriculum. Checking *Schoolology* with their student for the math teacher’s expected assignments and upcoming assessments, can help the student recognize the pace and demands of the course. Offering to check a “turn this in folder” so that a student is prepared for each day can be helpful. Parents/guardians are welcome to build a collaborative relationship with the teacher to problem-solve strategies for moving the student forward academically. Some students utilize additional school-organized courses such as ‘math workshop classes’ in the middle schools, drop-in homework help opportunities at the schools, or support classes in the high schools. At times, the Algebra 1 courses at the high schools are co-taught with a learning specialist, who can help your student improve their study skills and learning/retention techniques.

6 <sup>th</sup> Grade	7 <sup>th</sup> Grade	8 <sup>th</sup> Grade	9 <sup>th</sup> Grade	10 <sup>th</sup> Grade	11 <sup>th</sup> Grade	12 <sup>th</sup> Grade
Math 6	Math 7	Math 8	Paly: Alg 1 Gunn: Algebra 1A with a support class	Geometry	Algebra 2	Pre-Calculus or no math

Good to know:

1. The student may need a support class or enroll in a support program to move successfully through each course in both middle school and high school.
  2. If the student earns a D or an F in a *high school course*, the student must *repeat the course to move on to the next course*. To be graduate, the student must complete Algebra 2 with a D or better.
- My student is advanced in mathematics, that is, my student is a year or more in advance of “right on schedule” students. What do *advanced* student pathways look like?

First, if your student is *one* year ahead, your student should be earning B+’s or better by themselves and should be happy with the work. If your student is *more than one year* ahead, your student should be earning As. None of these students should require regular tutoring to remain in these courses.

Number of years ahead	6 <sup>th</sup> Grade	7 <sup>th</sup> Grade	8 <sup>th</sup> Grade	9 <sup>th</sup> Grade	10 <sup>th</sup> Grade	11 <sup>th</sup> Grade	12 <sup>th</sup> Grade
1	Math 6	Math 7A	Algebra 8	Geometry A	Alg2/Trig A	IAC	<b>AP Calc AB</b>
1	Math 6	Math 7A	Algebra 8	Geometry H	Alg2/Trig H	Analysis H	<b>AP Calc BC</b>
2	Math 6	Algebra 8	HS Geometry H	Alg2/Trig H	Analysis H	<b>AP Calc BC</b>	In order of suggested preference: <b>AP Statistics</b> Or <i>Applied Math</i> Or the <i>dual enrollment courses of Math 1C, Math 1D and Math 2B</i>
3	Algebra 8	HS Geometry H	Alg2/Trig H Must commute to the HS to enroll in this course	Analysis H	<b>AP Calc BC</b>	In order of suggested preference: <b>AP Statistics</b> Or <i>Applied Math</i> Or the <i>dual enrollment courses of Math 1C, Math 1D and Math 2B</i>	In order of suggested preference: <i>Applied Math</i> Or the <i>dual enrollment courses of Math 1C, Math 1D and Math 2B</i>

- What is the difference between AP Calculus **AB** and **BC**?

“AP” is the abbreviation for *advanced placement*, which indicates a *college-level course*. The first year of college/university calculus is divided into three quarters of work, quarters **A**, **B** and **C**. The first quarter, **A**, is Limit Theory and Differentiation (definitions and applications). The second quarter, **B**, is Integration (definitions and applications, including volumes, and methods of integration). The third quarter, **C**, is the Sequences and Series of Calculus, as well as Calculus concepts in Polar and Parametric mathematics. AB Calculus is the first quarter’s and most of the second quarter’s work. BC Calculus reviews the first quarter (in about 7 days) and includes the second and third quarters’ work. Because of the overlap of the two courses, students may *not* take both AB and BC calculus for full credit. They must take one or the other. At the end of either course, the students sit an intensive exam, the AP Exam, which may earn them college credits when they move to their college or university (the university or college has the choice of awarding credit or not). Rarely, students who have taken AP Calculus AB as juniors or younger wish to move on to AP Calculus BC. These students may audit the first semester of AP Calculus BC and take the second semester for a grade; they may sit the AP Calculus BC test.

To preview and prepare for these college courses, the Pre-Calculus course includes Limit Theory, the IAC course includes Limit Theory and basic Differentiation (up to the Chain Rule), and the Analysis H course includes Calculus A, the first quarter of college calculus. Students wishing to preview the Calculus ideas found in AP Calculus AB are invited to take a three-week PAUSD summer school course, *Transition to Calculus*, in which Limit Theory, Differentiation, and Integration of polynomial and rational functions are studied.

- When can students take AP Statistics?

The following sample pathways highlights when many students take AP Statistics. Note that successful completion (C or better) of Algebra 2, Alg2/Trig A or Alg 2/Trig H is the prerequisite.

9 <sup>th</sup> Grade	10 <sup>th</sup> Grade	11 <sup>th</sup> Grade	12 <sup>th</sup> Grade
Algebra 1A (Gunn) Algebra 1 (Paly)	Geometry	Algebra 2	AP Statistics (instead of Pre-Calculus)
Algebra 1A	Geometry A	Algebra2/Trig A	Pre-Calculus and AP Statistics
Algebra 1A	Geometry A	Algebra2/Trig A	AP Statistics (instead of IAC)
Algebra 1A	Geometry A	Algebra2/Trig A	IAC and AP Statistics
Geometry A	Algebra2/Trig A	IAC	AP Statistics (instead of Calculus (Paly) or AP Calculus AB)
Geometry A	Algebra2/Trig A	IAC	AP Statistics and

			either Calculus (Paly) or AP Calculus AB
Geometry A	Algebra2/Trig A	IAC and AP Statistics	Calculus (Paly) or AP Calculus AB
Geometry H	Algebra2/Trig H	Analysis H	AP Calculus BC and AP Statistics
Geometry H	Algebra2/Trig H	Analysis H and AP Statistics	AP Calculus BC
Algebra2/Trig H	Analysis H	AP Calculus BC	AP Statistics

- What types of computer science courses are available to students? Can students get math credit for computer science courses?

At Henry M. Gunn High School GUNN	At Palo Alto Senior High School PALY
AP Computer Science Principles (AP CSP)	AP Computer Science Principles (AP CSP—beginning in 2018-19)
AP Computer Science A (AP CS A)	AP Computer Science A (AP CS A)
Functional and Object-Oriented Programming (FOOP)	Functional and Object-Oriented Programming (FOOP)
Programming for Mobile Devices (not UC approved) (PMD)	Computer Science Capstone Project (CS Cap)
Computer Science Capstone Project (CS Cap)	Web Development

In the past, students could request *elective math credit* (not counting toward the Algebra 1-Geometry-Algebra 2 required sequence) for computer science courses. However, in the past nine years, *all* students taking CS have opted for CTE (Career Technical Education) credit and use those credits as part of the CTE graduation requirement of 10 credits. The *math credit* option is not currently available for Computer Science courses. Clarification of types of credit will evolve over the next few years so we'll know more about the type(s) of credit that Computer Science can earn in PAUSD after district determination. (Note: The CDE approved the California Computer Science Standards in September, 2018 and rolled out the implementation plan in May, 2019.)

- My student is a ninth-grader in Geo A but is earning a C or less. The high schools do not allow the ninth-grade students to transfer or enroll in the grade-level 10<sup>th</sup> grade geometry course. What will the four high school years look like for my student?

The following pathways show how some year-ahead students built a strong math program despite significant struggles in their 9<sup>th</sup>-grade year.

9 <sup>th</sup> Grade	10 <sup>th</sup> Grade	11 <sup>th</sup> Grade	12 <sup>th</sup> Grade
Geo A successful transfer request to Algebra 1A during Quarter 1 or at the end of Semester 1	Geometry or Geometry A	Algebra 2 or Algebra 2/Trig A, respectively	Pre-Calculus or IAC, respectively
Geometry A	Algebra 2	Pre-Calculus	IAC
Geometry A	Algebra 2	Pre-Calculus	AP Statistics
Geometry A	Algebra 2	Pre-Calculus	IAC and AP Statistics

For many students struggling in Geometry A, moving to Algebra 1A during the first quarter of ninth grade was the most successful choice. **Strengthening the Algebra foundation, students built confidence which reopened the door to continue in the A-lane courses.** Otherwise the student completes Geometry A then moves to the grade-level college-prep courses for the rest of high school math. A few students struggling as ninth-graders in Geometry A have reached for AP Calculus AB after Pre-Calculus (during their 12<sup>th</sup>-grade), but almost no student who was struggling in 9<sup>th</sup>-grade Geometry A has successfully *completed* AP Calculus AB in the last ten years of our records.

- What is the down-side to encouraging/pushing my student into more advanced math courses?

Many children thrive on challenge—academic challenge, included. But some do not, or the challenge is too big, overwhelming the student. During middle school, children are building their identity and reformatting their relationship with their parents/guardians. The proper balance of challenge with success can build a strong learner who knows that something difficult is to be savored. When such a student successfully masters the challenge, the student feels elated and the experience builds the student’s academic confidence. However, if the work is too challenging and the **student cannot complete the work alone**, the student can feel needy whenever working in that academic area, and label themselves as a non-math (or other academic area) person. This is, of course, the opposite effect of what is wanted for the student.

Dr. Lynn Margolies, a psychologist and former Harvard Medical School Faculty currently in private practice in Newton Centre, MA., wrote an article about high school students and their parents, *The Paradox of Pushing Kids to Succeed*<sup>8</sup>. She recognizes that pushing students is well-intentioned, that our students are “embedded in a culture driven by competition and perfectionism,” and that parents “worry that (their student) will be left behind in a competitive world.” Margolies notes that the psychological capacities associated with success include “optimism, curiosity, a sense of oneself as capable (different from self-esteem, which is about self-worth), and the ability to manage negative emotions and weather obstacles” (which she attributes to Tough, 2012, *How Children Succeed*, HMH Publishing). When parents are hypervigilant or overly involved, a student’s ability to develop their own capacities are hampered. “... compliance replaces problem solving, judgment and autonomous thinking.” She warns that “...making the stakes too high engenders fear, leading teens to avert possible failure at all costs. This level of stress propels homework avoidance, compromises executive functions, inhibits curiosity and new challenges, and increases lying.” The dangers are sobering. Margolies continues to note that “The darker side of our culture of performance and perfectionism, and its manifestations in families, is well documented. It is associated with depression, anxiety disorders, alcohol and substance abuse, lying, eating disorders, recklessness, emptiness,

---

<sup>8</sup> <https://psychcentral.com/lib/the-paradox-of-pushing-kids-to-succeed/> Margolies, L; 2016; PsychCentral <https://psychcentral.com/lib/author/lynn-margolies/>

self-doubt and self-reproach, cutting and suicide,” (which she attributes to Levine, 2006, *The Price of Privilege*, HC Publishers). She continues with the challenges faced by “teens who are too good to be true,” and teens who are “self-esteem junkies.” She has a list of parental do’s and don’ts (page 4 of the article):

DO	DON'T
<ul style="list-style-type: none"> <li>• Encourage teens to make their own choices while helping them think through consequences of different decisions</li> <li>• Set limits on potentially dangerous activities</li> <li>• Be curious about what makes your teen happy or sad</li> <li>• Notice and encourage your teen’s natural interests</li> <li>• Notice and tolerate ways your teen is different from you</li> <li>• Be aware of ways your teen may be making up for your loneliness, rescuing you from anxiety, or doing well to make you feel like you’re a good parent</li> <li>• Protect where teens need protection</li> <li>• Be aware of trying to stay with your teen’s negative emotion versus rescuing or being reactive</li> <li>• Be aware of ways you may shame or punish perceived failure</li> </ul>	<ul style="list-style-type: none"> <li>• Don’t make a practice of using money or excessive rewards as a motivator for good grades (External reinforcement blocks internal motivation.)</li> <li>• Don’t shame or punish kids for their performance</li> <li>• Don’t make academic or other decisions for your teen</li> <li>• Don’t be intrusive and micromanage grades on tests (Don’t hang out on Schoology or Infinite Campus)</li> <li>• Don’t lecture or be a broken record (Teens feel smothered and tune out.)</li> <li>• Don’t use fear to motivate (It overwhelms teens’ capacities and creates superficial compliance in place of independence.)</li> <li>• Don’t act on anxiety (Don’t be reactive.)</li> <li>• Don’t rescue teens from natural consequences</li> <li>• Don’t be preoccupied and distracted. (Teens can tell. They need you to be fully present with them, but not intrusive.)</li> </ul>

Dr. Carol Dweck, the Lewis and Virginia Eaton Professor of Psychology at Stanford University<sup>9</sup>, writes about the child who wants to encourage pride in their parents/guardians but doesn’t seem to measure up to what the child thinks that the parents/guardians want. When the child fails, the child labels themselves negatively, and creates a fixed mindset for that academic area which persists, often into adulthood.

If the student continues in the *advanced* or *honors* courses, the struggle becomes greater, the grades fall, and when the student transfers to a more reasonable level of coursework (either A-lane or the grade-level, college-prep lane) for success—the student earns As or Bs at the new level. However, the student often *feels* like a failure and is ashamed of the transfer, even with these valued grades. This is a situation that can be avoided if the parent looks carefully and practically at what the student accomplishes by one’s-self and enjoys.

You can monitor your child’s enjoyment and success in math by watching how much the child can manage the work *alone*, and how much pleasure the child takes in the successful completion of the challenges. Keep in mind that the student may accelerate later than the parent/guardian expects, given the

<sup>9</sup> Dweck, C; 2006; *Mindset: The New Psychology of Success*, Ballantine Books

student's rate of brain growth and academic maturation. Dr. Kyle Pruett, a clinical Professor of Child Psychiatry at the Yale School of Medicine<sup>10</sup>, tackles the question of pushing kids too hard from an early age. He advises, "Don't push—period." Pruett claims that when pushing or pulling "... forces withdraw, (as they all eventually do), the structures fail, because they are not internally or structurally sound. Sensitivity, support, and encouragement will lead to a child who delights in learning, now and for life."

The best answer is not push or pull your student forward. Instead, talk with your student and find where the student's interest lies. Look at the student's entire day and consider if there is time for work required by advanced and honors mathematics in the balance of the student's life. What does the student turn to in enjoyment and curiosity? What questions and interests does the student bring to conversations? Take the student's lead and support the student's growth in a way that builds resilience and confidence.

- When do students take Math Placement Tests? How do I arrange a math placement test for my student?

For students who are new or returning to PAUSD, placement tests are generally given in August before school begins, at each of the secondary school sites. Contact the counseling department at your school for details of time, location and duration of the tests. Some placement tests require the use of a four-function, scientific, or graphing calculator, and a ruler. (The calculators are made available at the school site and some tests require a specific school calculator. In some high school placement instances students may use their own calculator. The test proctor will clear the memory of the calculator before the test.)

For incoming ninth-graders new to PAUSD, the high schools also offer placement tests in April and May. Contact the counseling department at your school for details of time, location and duration of the tests.

In some cases, the result of the initial placement test is inconclusive and an additional test is needed, usually arranged by the Math Instructional Leader for a subsequent day.

- Why doesn't PAUSD allow a sixth-grade student to be placed in a seventh-grade math class?

The sixth-grade year is the transition year from elementary to middle school. The academic level of complexity increases and the academic pace quickens. To support a comfortable transition, the sixth-grade teachers are elementary teachers holding multiple-subject credentials. The sixth-graders will experience two teachers, instead of one, for their core courses, and a variety of elective teachers. Students are grouped into cadres so that teams of teachers

---

<sup>10</sup> Pruett, K; 2016; *The High Price of Pushing Kids Too Hard*; Psychology Today, <https://www.psychologytoday.com/us/blog/once-upon-child/201601/the-high-price-pushing-kids-too-hard>

will get to know each of the students well, and to work in concert with each other to help move the students positively from their childhood into their adolescence. The teachers coordinate their assignments, projects and assessments to balance the more complicated demands made on the students as they mature academically, socially, and physically during middle school. The teaming continues throughout seventh-and eighth-grades.

The organization of sixth-grade is different from seventh grade. In sixth-grade the students have two core teachers on each teaching team as well as a PE teacher, a music teacher and four to six *Wheel* teachers. The sixth-grade teachers are generalists, rather than subject-specific, which supports the transition from elementary school to middle school which the students experience. (The sixth-grade core teachers teach in their favorite pair of disciplines, usually science and math or ELA and history-social studies, or another combination of the four core classes). This smaller teaching team supports flexible use of the teaching hours, as well as innovative use of the core hour (which the two core teachers use for SEL education, project work-time for the four core subjects, English-language arts, history-social studies, science and math, interdisciplinary work, exploratory work, and team events). A sixth-grade student moved out of the team structure for seventh-grade math, often misses the memorable events which assist the team-building that supports the healthy transition of our students from elementary school to middle school. Moving a sixth-grade student into a seventh-grade math course also hampers the work that the sixth-grade math teacher accomplishes with the student as pertinent knowledge of the student is decreased.

Seventh-grade organization groups five or six teachers on a teaching team. The teachers are specialists in their subject area, holding a single-subject credential for the area. Although the seventh-grade teachers coordinate their assignments, project and assessments to balance the student load, they do not take the sixth-grade team's work into account. Furthermore, the non-subject specific work is focused on seventh-grade topics and needs, not sixth-grade information. The disruption to the transition is not effective for a mere year-ahead placement, as the advanced student will likely move into the accelerated and advanced path when the student matriculates to seventh-grade. The accelerated/advanced path in math is Math 7A in seventh-grade and Algebra 8 in eighth-grade. These two courses comprise three years of Common Core Math (Math 7, Math 8 and Algebra 1) at a deeper and advanced level. Since the two advanced/accelerated courses compress three years of math into two years, there is no benefit to interfering with the student's transition in grade 6.

However, if the student is substantially advanced, the student will be identified early in sixth-grade by the Math 6 teacher, and the student will be invited to take the *Early Math 7A Mastery Test* to demonstrate their knowledge of both sixth- and seventh-grade math, and possibly advance into Algebra 8. Please see the *Alternative Placement of the Unusual or Atypical Math 6 Student* topic (page 7) in this document.

PAUSD builds strong foundational knowledge and moves the students solidly through curriculum with deep understanding and achievement. The advanced and honors secondary curriculum takes advantage of academic maturity and brain growth theory so that students encounter the curriculum at optimum times of growth. For example, Geometry is the first mathematical-systems course. It requires academic maturity to move beyond a perspective of

“shapes, their attributes, and rules” into mathematical reasoning and inference that expands mathematics into advanced topics. Such a course is best suited during the time that students’ thinking moves into abstraction and generalization—beginning around age 12 and usually maturing during the high school years<sup>11</sup>.

Finally, sixth-grade math teachers differentiate the Math 6 work into three flexible levels of study throughout the sixth-grade year. Students both self-select and are directed to the levels in order to extend and explore beyond CCSS-Math 6 depths, meet and master CCSS-Math 6, and build confidence and competency toward CCSS-Math 6. Recall that *differentiation* is meeting a group of math students’ interests and academic needs *within* the topic or concept. (*Differentiation* is not *different from* the topics or concepts. Differentiation for advanced students does not preview seventh-grade topics.) Sixth-grade math teachers differentiate in four ways: through content depth and inference, process complexity, products produced by the students, and learning environment needs. Differentiation ensures that each sixth-grade student’s foundation in arithmetic, algebraic generalization, function introduction, modeling skills, and geometry is robust. A good example of differentiation is homework assignments: in many assignments students have a choice among the standard assignment, the “plus” (+) assignment, or the “plus-plus” (++) assignment. All three assignments meet the CCSS-Math 6 requirement, but the *plus* assignment will have fewer of the baseline problems and more of the applications. The *plus-plus* assignment will have very few baseline problems, many applications and contextual problems, and puzzling, challenging, exploration, or modeling abstraction problems. At times students are directed to specific levels of assignments, and at times students choose their levels.

- What are the differences among grade-level-lane, A-lane, and H-lane courses?

The three lanes of PAUSD secondary mathematics begin with one lane of math in sixth grade: Math 6. In Math 6 the content is differentiated to meet student interests and need. In seventh- and eighth-grades, two lanes are available: A-lane (accelerated *and* advanced) and the grade-level-lane also known as the college-prep lane. In ninth- through twelfth-grade, there are three lanes available: H-lane (honors), A-lane (advanced) and the grade-level or college-prep lane. All PAUSD high school math courses are CSU/UC approved. Laning is flexible; students and their parents/guardians should make annual decisions about which course gives the student the appropriate level of challenge and success, meets the student interest level, builds toward the student’s desired outcome of mathematical study, and gives the student curriculum that the student can master alone.

The college-prep-lane courses meet the CCSS-M grade-level standards in full and no more. The names of these courses reflect the content standards for that course, such as, Geometry, which meets the CCSS-Geometry standards. The assessments are at the level of CCSS-Geometry standards. The homework in Geometry is expected to be about two to two-and-a-half hours per week. Students are collaborative and put in strong effort. These courses are CSU/UC

---

<sup>11</sup>Fischer, KW (2008); Dynamic cycles of cognitive and brain development: Measuring growth in mind, brain and education. (In Battro, Fischer & Lena, *The Educated Brain*, (pp. 127-150) Cambridge, U.K., Cambridge University Press <https://www.gse.harvard.edu/~ddl/articlesCopy/FischerCyclesCognBrain.EducBrainCUP.pdf>

approved. The twelfth-grade course in this lane is either Pre-Calculus, IAC (Introduction to Analysis and Calculus), or AP Statistics (which may be taken concurrently with Pre-Calculus or IAC, depending on student interest).

A-lane courses are *advanced* courses. The students are expected to master advanced explorations, implications and applications of the topics, and, at times, advancement into the next associated course's topics. For example, Geometry A meets and goes beyond the CCSS-Geometry standards. The proofs required are more challenging than CCSS-Geometry standard proof, and mastery of a variety of deductive proof-types is expected. Geometry A generally moves beyond the CCSS-Geometry standard in trigonometry by moving to the Algebra 2 level of right triangle trig problems. Good scores on assessments require mastery in the deeper types of problems. The assessments generally contain a new or unusual problem to challenge students to apply their knowledge. The homework in Geometry A is expected to be about three to three-and-a-half hours per week. Students are collaborative and are willing to lead. Students put in a strong effort and generally persist in problem solving. These courses are CSU/UC approved. The twelfth-grade course in this lane is either IAC (Introduction to Analysis and Calculus), AP Calculus AB, or AP Statistics (which may be taken concurrently with IAC or AB Calc, depending on student interest).

H-lane courses are *honors* courses. Students master advanced ideas associated with the topics in the course, and often the honors courses move into the next course's topics at a deep level, or even introduce topics that the students may encounter in successive years of mathematics courses. For example, Geometry H students study propositional logic, often considered a college course, before they begin the topics found in CCSS-Geometry. With this logical background, students are expected to tackle challenging deductive proofs, often fifteen or more "steps" long. Inductive proofs are introduced (a Pre-Calculus topic) and students are assessed on them. Trigonometry is taught beyond right triangle trig, with the introduction of the wrapping or winding function, and students build circular trigonometry from triangle trigonometry's ideas of reference angles. Success on assessments require students to master all extensions. The assessments usually contain unusual challenges that require students to apply their knowledge in new ways. The homework in Geometry H is expected to be about four to six hours per week. The students tend to be more competitive with each other, but in a friendly and helpful way. Many of the students in the honors courses also enjoy mathematical competitions and are members of Math Club. These courses are CSU/UC approved. The twelfth-grade course in this lane is AP Calculus BC. AP Statistics is often taken with Analysis H or BC Calc, depending on student interest.

- My student did **not** take Algebra in middle school can they still get to Calculus by 12th grade?

A student who has not taken Algebra in middle school can still get to Calculus (Paly) or AP Calculus AB (both Gunn and Paly) by the 12<sup>th</sup> grade. The pathway involves personal student interest in math, and one or two summer courses. To position oneself well for success in this endeavor, the student should strive to understand the mathematics deeply and demonstrate understanding on classroom assessments throughout middle school and high school math courses. The student should be motivated to embrace the requirements of each course and move beyond those requirements.

Grade	Pathway 1	Pathway 2
Grade 9	Alg 1A (Gunn or Paly)	Alg 1A (Gunn or Paly)
Summer after ninth grade	Geo A 6 weeks: ALL of Geo A; 5 hrs/day course w/3 hrs/day homework	
Grade 10	Alg 2/Trig A	Geo A
Summer after tenth grade		
Grade 11	IAC	Alg 2/Trig A
Summer after eleventh grade	<b>Optional*:</b> Transition to Calculus Course 3 weeks: Preview of the Calculus concepts of Limit Theory, Differentiation and Integration with Polynomial and Rational Functions; 5 hrs/day w/1+ hr/day homework This course is also open to students finishing IAC who wish to build confidence in the calculus concepts before the AP course.	Core Topics of IAC <b>Beginning in Summer 2019, Session I</b> Topics: The Laws of Sines & Cosines, DeMoivre's Theorem, Sequences & Series, 2-D & 3-D Vectors, Basic Graphing in 3-D, Matrices, Probability & Counting, Parametric Equations, Polar Coordinate & Functions, and Limit Theory 3 weeks: 5 hrs/day course w/3 hrs/day homework Not graded; 0 units of credit <b>This class is only open only to rising 12<sup>th</sup> grade students.</b> --The <b>Optional Transition to Calculus Course</b> is recommended for session II of summer school
Grade 12	Calculus (Paly) or AP Calculus AB	Calculus (Paly) or AP Calculus AB

\*The optional summer course, *Transition to Calculus*, is designed to help students build confidence as they approach a calculus course by previewing the major concepts in Calculus.

- My student wants more mathematical enrichment, what options are available to them?

There are a variety of opportunities for mathematical enrichment for students in Palo Alto. Many opportunities are offered through the secondary schools; some opportunities are private enterprises.

PAUSD Opportunities for Math Enrichment	Middle Schools	High Schools
	<ul style="list-style-type: none"> <li>• Math Clubs and Math Competitions <ul style="list-style-type: none"> <li>○ Generally, Math Clubs meet once/week and can include competitions as well as investigations into topics often found in competitions such as combinatorics and modularity.</li> <li>○ Math Clubs meet either during lunch or after school (or both) at each site.</li> </ul> </li> <li>• Middle School Math Camp—offered through Paly’s and Gunn’s Math Clubs (held in the afternoons at the site of the middle school summer school)</li> <li>• Online materials from the textbooks.</li> </ul>	<ul style="list-style-type: none"> <li>• Math Clubs and Math Competitions <ul style="list-style-type: none"> <li>○ Generally, Math Clubs meet once/week and can include competitions as well as investigations into topics often found in competitions such as combinatorics and advanced geometrical theorems.</li> <li>○ In the high schools, Math Clubs also investigate a variety of post-high school topics, such as group theory and multi-dimensional objects.</li> </ul> </li> <li>• Advanced Problem Solving <ul style="list-style-type: none"> <li>○ Advanced Problem Solving 1, 2, 3, and 4 are semester courses in which students explore a variety of unusual high school math topics, compete in Math Competitions, and learn to</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• Computer Science courses offered in the site’s elective program. (Computational thinking always supports and extends mathematical thinking.)</li> </ul>	<p>communicate mathematical thinking well. The course is extremely light-hearted and full of fun, but very serious about delving into mathematics.</p> <ul style="list-style-type: none"> <li>• Additional Math Application Courses: Gunn BEAM, Math Applications, and Stats Apps are elective courses available at one of the two high schools.</li> <li>• Computer Science Courses—computational thinking <ul style="list-style-type: none"> <li>○ The high schools offer a variety of Computer Science courses—all of which support mathematical and computational thinking. Computer Science is an excellent way to deepen and expand mathematics.</li> <li>○ The courses available are AP Computer Science Principles; Functional and Object-Oriented Programming; Programming for Mobile Devices (Gunn only); Computer Science Principals; AP Computer Science A; Computer Science Capstone Project; and Web Development (Paly only)</li> </ul> </li> <li>• Online materials from the textbooks</li> </ul>
--	--	--

### Opportunities for Math Enrichment *Off Campus*

This is an **incomplete** list of opportunities that our community has shared with us. These programs are private and many charge fees. We do not *recommend* them, we are simply sharing the list.

#### Middle School

##### Programs/Opportunities

- American Math Competitions: <https://www.maa.org/math-competitions>
- The Art of Problem Solving (AoPS): <https://artofproblemsolving.com/>
- Johns Hopkins Center for Talented Youth: <https://cty.jhu.edu/>
- Stanford’s Education Program for Gifted Youth: <https://giftedandtalented.com/>
- Math Circles: <http://mathcircle.stanford.edu/>

- <https://www.thecoderschool.com/paloalto/>
- [https://www.wizbots.com/connect/register/select\\_programs/after\\_school\\_programs](https://www.wizbots.com/connect/register/select_programs/after_school_programs)
- <https://code.org/>
- <http://www.bootstrapworld.org/materials/spring2017/courses/algebra/>

### Camps:

- <http://www.techknowhowkids.com/index.php> - winter camp
- Hampshire College Summer Studies in Mathematics: <http://hcssim.org/>
- Euclid Lab: <http://euclidlab.org/>
- Math Path: <http://www.mathpath.org/index.htm>
- AwesomeMath Summer Program: <https://www.awesomemath.org/summer-program/overview/program-information/>
- Texas Mathworks Honors Summer Math Camp: <http://www.txstate.edu/mathworks/camps/hsmc.html>

### ***High School***

#### **Programs/Opportunities**

- American Math Competitions: <https://www.maa.org/math-competitions>
- The Art of Problem Solving (AoPS): <https://artofproblemsolving.com/>
- Johns Hopkins Center for Talented Youth: <https://cty.jhu.edu/>
- Stanford's Education Program for Gifted Youth: <https://giftedandtalented.com/>
- Math Circles: <http://mathcircle.stanford.edu/>
- Stanford Pre-Collegiate Studies: <https://spcs.stanford.edu/>
- The Proof School: <http://www.proofschool.org/>
- Bay Area Mathematical Adventures: <http://www.mathematicaladventures.org/>
- Advanced coursework offered by local mathematician, Simon Rubinstein-Salzedo; the math courses are offered on the college quarter system in timing, and some courses require a background in calculus, but not all do. Contact Prof. Rubinstein-Salzedo: [complexzeta@gmail.com](mailto:complexzeta@gmail.com)

## Camps:

- Stanford University Mathematics Camp (SUMaC): <https://sumac.stanford.edu/>
  - Hampshire College Summer Studies in Mathematics: <http://hcssim.org/>
  - Euclid Lab: <http://euclidlab.org/>
  - Math Path: <http://www.mathpath.org/index.htm>
  - AwesomeMath Summer Program: <https://www.awesomemath.org/summer-program/overview/program-information/>
  - Texas Mathworks Honors Summer Math Camp: <http://www.txstate.edu/mathworks/camps/hsmc.html>
  - Stanford University Mathematics Camp (SUMaC): <https://sumac.stanford.edu/>
  - Prove it! Math Academy: <https://proveitmath.org/>
- 
- What are some basic entrance expectations from colleges and universities regarding student transcripts?

All colleges and universities seek to create a diverse and creative student population. Because of that goal, there are exceptions to the following general ideas. First, most public universities sort their applicants according to the students' GPAs (Grade Point Averages) at the beginning of the process. Private universities might go deeper during that first sorting.

The second idea that colleges and universities consider regarding admission is the *strength of the student's program* (i.e. rigor of curriculum) given the student's opportunities at their school site. In PAUSD, there are three levels of UC-approved mathematics courses: College-prep-level (also known as *Grade-* or CCSS-M level), Advanced level, and Honors level. Colleges and universities expect students to challenge themselves by taking rigorous courses in areas of strength or interest while maintaining quality of learning resulting in A and B grades earned in their overall course loads. In math, colleges and universities look for students earning As and Bs in the highest level possible that "fits" the student's interest and strengths. For example, a student earning a C in an Honors course, might transfer to an Advanced course where the student might earn an A or B. A similar example is that a student may be struggling in an Advanced course, maybe earning a C or D, but when transfers to the *College Prep* (grade-level) or CCSS-M level earns an A or a B. Placing a student where the student can experience the right balance of challenge and success, earning an A or B by the student's own efforts is the best placement. It is important for students to select

rigorous courses *within reason*; that is, that the students balance their academic load and extracurricular commitments, as well as allocate time to engage in healthy habits (i.e. exercise and enough sleep) and time with family.

For the student to continue in math successfully, the student needs to be grounded in the fundamentals of the current course so that the student can put the learning to use in the next course. That is best done by having the student personally understand the current work. If students understand their work, we generally see a student earning the same or better grades in successive courses (as the student matures, the student's study skills are sharpened and the student learns best methods for personal learning). If the student is overly tutored, relying on someone else to hone appropriate study skills, or doesn't build personal understanding, we often see the grades drop off over time, even dropping to Cs or Ds. Thus, it's important for students to understand their math and their learning mechanisms. Proper placement in the correct math level can help students be successful. Please review and choose the appropriate math course annually.

Of course, this is a rather simplified view of college entrance—overabundant numbers of applicants, and impacted major programs create challenges—so colleges and universities facing those problems have different methods for choosing their new student populations. Furthermore, every college or university has its own details of the above ideas.

A final reminder that students may not be accepted by their *first* choice of college or university site, but, generally, most PAUSD students are accepted to a 4-year college or university. Happily, in California, the 2-year Community Colleges are wonderful academic, economic, and social-emotional options for students who wish to transfer to 4-year colleges as juniors.

For more information about the College/University Application Process please contact your college and career counselor at your high school.