High School Algebra 1

Algebra 1 Expect to spend two months on pre-Algebra, and a month per session for Algebra 1. This is a full Algebra 1 course, with the first session covering pre-Algebra concepts. This course is designed to cover an entire year (35 weeks of instruction).

Please make sure that your student is very comfortable with performing all four operations (addition, subtraction, multiplication, and division) for fractions and decimals, and be fluent in handling ratios, proportion, and percent to be ready for algebra. Our first session is a two-month pre-algebra course, so all students can start out with the fundamentals.

Students that complete *Algebra 1* will have the following concepts handled:

Session #1: ***Pre-Algebra: Operations on Integers and Variables, Terms and Expressions*** Types of numbers; operations with integers (positive & negative); order of operations; algebraic properties including identity, zero, associate commutative, & distributive; factoring & prime factorization; translating phrases into algebraic expressions; inequalities; handling exponents; combining like terms; number line graphs; absolute value; practical applications of algebra using physics topics such as orbital mechanics and Kepler's Laws of Planetary Motion.

Session #2: ***Equations*** Order of operations; solving one and two step equations, algebraic properties including identity, zero, associate commutative, & distributive; translating phrases into algebraic expressions; handling exponents; combining like terms; practical applications of algebra using physics topics such as orbital mechanics and universal gravitation concepts.

Session #3: ***Rational Numbers and Inequalities*** Simplify algebraic expressions and equations; represent math relationships using algebra; evaluate variable expressions and functions; absolute value in expressions and equations; number line representations and modeling; interpret and solve linear equations and inequalities.

Session #4: ***Graphing*** Solve systems of linear equations using graphing, elimination and substitution methods; simplify algebraic expressions and equations; represent math relationships using algebra; graph linear functions; model and describe slope as a rate of change; identify the slope from a graph, table or equation; evaluate variable expressions and functions; scatter plots for bivariate data.

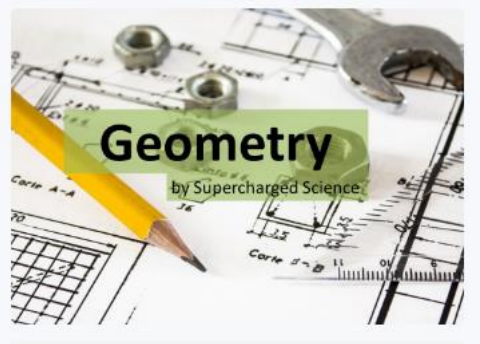
Session #5: ***Systems of Linear Equations*** Solve systems of linear equations using graphing, elimination and substitution methods; simplify algebraic expressions and equations; represent math relationships using algebra; graph linear functions; model and describe slope as a rate of change; identify the slope from a graph, table or equation; evaluate variable expressions and functions.

Session #6: ***Polynomials, Factoring and Exponents*** Solve non-linear equations using factoring, greatest common factors, differences in squares and cubes, sum of cubes, completing the square, trinomial solving techniques, four terms, mixed factoring, and third-degree polynomial techniques. Students will continue to practice word problems, simplifying algebraic expressions and equations; representing math relationships using graphs and functions; and evaluating variable expressions and functions.

Session #7: ***Quadratic Formula and Equation, Rational and Radical Expressions*** Handling variables, terms, expressions; linear and non-linear equations and expressions as they appear in word problems; factoring and related methods of solving polynomials and systems of linear equations; simplifying algebraic expressions and equations; representing math relationships using graphs and functions; and evaluating variable expressions and functions.

Students are now ready for Geometry.

High School Geometry



Geometry Expect to spend 3 – 6 weeks per session for Geometry. This is a full High School level Geometry course.

Please make sure that your student has completed a full Algebra 1 course before starting this Geometry course. This Geometry course is algebra-based, and students will be solving linear equations, graphing functions, using exponents, rational numbers, and more.

Students are expected to bring to each class these math tools: protractor, compass, calculator (with the ability to do inverse, exponents, square roots, and trig functions – we recommend the TI-30Xa), ruler (with increments in both centimeters and inches), pencil, eraser, and math notebook or paper.

In addition to the regular content, each session also includes a full hands-on Math Lab Challenge Project that students are expected to complete. Students will require materials to do their lab projects (refer to the Geometry Unit for full shopping list) so please be prepared before starting this course.

Students that complete *Geometry* will have the following concepts handled:

Session #1: *Shapes and Constructions I* Geometry fundamental concepts (point, line, plane, intersections, parallel, perpendicular, angle, colinear, congruence); constructions (triangles, circles, arcs, hexagons, bisectors, copying angles); transformations (dilation, translation, rotation, reflection); types of triangles; multiplying segments; word problems; technical drawing techniques; solving problems through modeling and geometric constructions.

Session #2: *Shapes and Constructions II, Angles* Geometry fundamentals, constructing shapes and figures using a straight edge and ruler; angle relationships; complementary, supplementary, vertical and adjacent angles, writing and solving linear equations; using a protractor to measure angles; bisecting lines and angles; constructing perpendiculars; properties and working with circles; constructing squares, rectangles, and parallelograms; relationships with alternating interior angles.

Session #3: *Triangles* Geometry fundamental concepts constructions (triangles, bisectors, angles); types of triangles; angle relationships; types of angles; applying triangle knowledge to real world problems; write and solve linear equations; angle relationships within a triangle; triangle inequality theorem; relating angles and sides of triangles; solving problems through modeling and geometric constructions.

Session #4: *Circles* Calculate area and circumference of a circle and use them to solve word problems; understand the relationship between the circumference and area of a circle; metric and standard measurement systems**.**

Session #5: ***Plane Geometry I - Rectangles, Parallelograms, Triangles, Trapezoids, and Composite Figures*** Calculate perimeter and area of different types of triangles, trapezoids, squares, rectangles, parallelograms, and quadrilaterals; composing and decomposing shapes into other shapes; creating solving real-world problems with composite figures.

Session #6: ***Plane Geometry II - Similarity*** Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale; calculate perimeter and area for geometric shapes and composite figures in real world applications; use models and formulas to connect perimeter, circumference and area; determine critical attributes of similarity; solve problems involving similar shapes and scale drawings.

Session #7: ***Surface Area*** Calculating the total and lateral surface area of solid shapes such as pyramids, prisms, cones, cylinders, cubes, spheres, and composite figures; solve real-world problems involving surface area calculations; plane sections; engineering and physics applications.

Session #8: ***Volume*** Solve real-world problems involving volume of prisms, pyramids, cones, cylinders, spheres, and cubes; compute length, area and volume from given data; word problems; engineering and physics applications.

Session #9: ***Trigonometry of Right Triangles*** Constraints of triangles; parallel lines cut by transversals; types of angles including complementary, supplementary, adjacent, vertical, alternating interior and exterior, and criteria for similar triangles; compute length and areas from scale drawings; reproduce a scaled drawing of different scales; construction of triangles from three measures (angles or sides); unique, more than one or no triangle considerations; Pythagorean Theorem and converse; trigonometric functions (sin, cos, tan) to define triangles and solve for unknown sides and angles; engineering and physics applications.

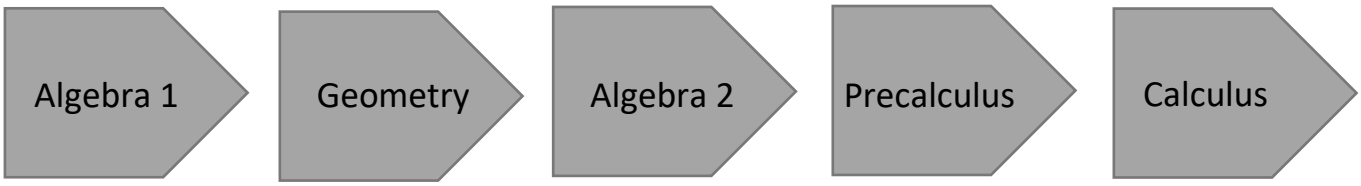
Session #10: ***Arithmetic & Geometric Number Sequences, Geometry Proofs*** Students explore numbers that follow specific patterns, finding the n^{th} term, understanding the sum of terms, and applying sequences to real-world problems in fields like finance, engineering, and computer science. Students also learn how to prove geometric theorems through a sequence of deductive steps, employing postulates, theorems, and definitions. Key concepts include properties of shapes, angles, congruence, similarity, and the relationships between points, lines, and planes. The emphasis is on developing critical thinking and the ability to communicate mathematical reasoning clearly and rigorously.

Students are now ready for Algebra 2.

High School Math Topic Progression

Students need to take math every year. For most high schools, students begin with where they left off from middle school and complete as much of the math courses in the chain below as they can in four years of high school.

Standard Progression for Middle & High School for Science/Engineering Students:

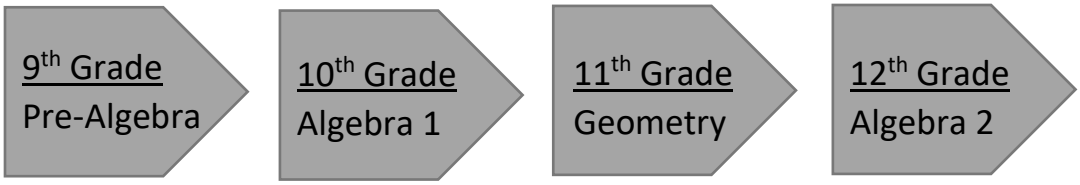


Students can begin their Algebra 1 coursework when they are ready, based on what they have mastered. Students need to be very comfortable with performing all four operations (addition, subtraction, multiplication and division) with both fractions and decimals, and also be fluent in handling ratios, proportion, and percent in order to be ready for Algebra 1.

College, universities and technical training vocational schools usually require completion up through Algebra 2 in order to apply to their programs. At the very least, they usually want to see the completion of a full four years of math courses for high school.

If your student is starting their high school years with Pre-Algebra, their math course progression will look like this:

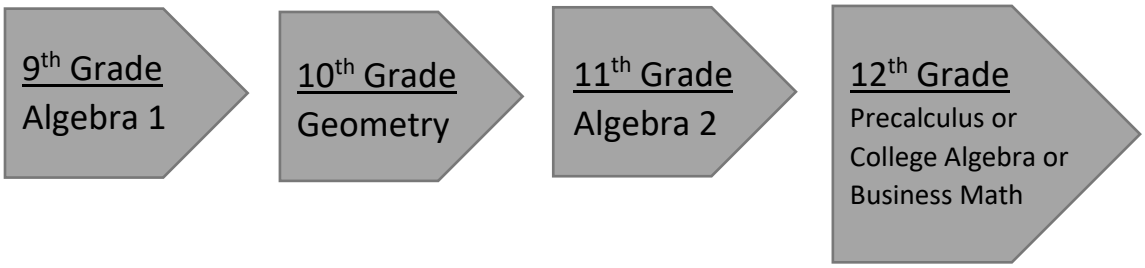
Starting 9th Grade with Pre-Algebra in High School:



This is the sequence for students that have not had any algebra prior to high school. There's not enough time to re-taking any coursework, so you'll need to be sure your student makes steady, consistent progress daily toward completing their yearly courses.

This progression is good for students that are not bound for science or engineering majors at colleges and universities.

Starting 9th Grade with Algebra 1 in High School:



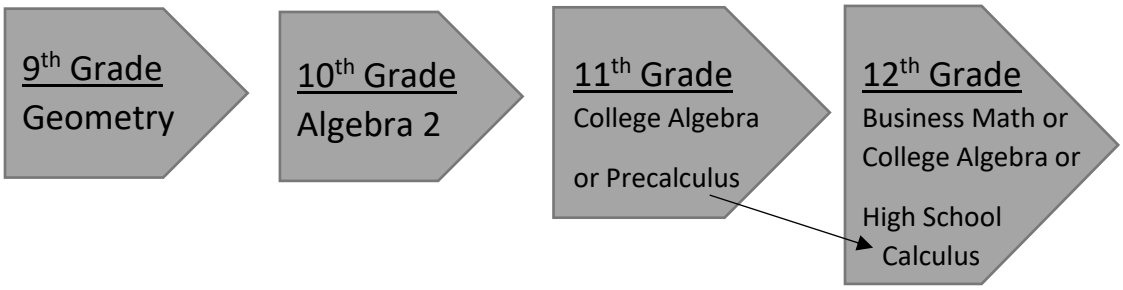
If your student has already completed Pre-Algebra in 8th grade, then they may start with Algebra 1 in high school, and they will finish Algebra 2 in 11th grade.

The fourth year (12th Grade) has three options:

- Precalculus – students will take this if they are interested in science or engineering studies in college
- College Algebra – this picks up where Algebra 2 leaves off; good for students interested in mathematics studies at college and universities
- Business Math (also called *Consumer Math* and *Commercial Math)* – practical math skills that are used in every day in marketing, commerce, and commercial businesses.

Note that interspersed in the progression are studies in other topics, such as probability, statistics, and logic. These are usually integrated throughout the four years at the discretion of the instructor.

Starting 9th Grade with Geometry in High School:



If your student has already completed Algebra 1 in 8th grade, then they may start with Geometry in high school, and they will finish Algebra 2 in 10th grade.

The third *and* fourth years (11th & 12th Grade) have options:

- 11th Grade:
  - Precalculus – students will take this if they are interested in science or engineering studies in college
  - College Algebra – this picks up where Algebra 2 leaves off; good for students interested in mathematics studies at college and universities
- 12th Grade:
  - Business Math (also called *Consumer Math* and *Commercial Math)* – practical math skills that are used in every day in marketing, commerce, and commercial businesses.
  - College Algebra – this picks up where Algebra 2 leaves off; good for students interested in mathematics studies at college and universities. If you already took this in 11th Grade, then you'll pick Business Math instead.

For students interested in science and engineering majors, it is highly recommended to take an **AP Prep Course** during the year you take Calculus if you plan to take the AP ("Advanced Placement") Exam. This is a separate test outside of any tests issued during your Calculus course. If you pass the AP test, you can get college credit for the high school course. Note that it's not a one-for-one credit, meaning that each year-long class of high school AP credit usually translates to either one semester or one quarter for *one class* in college.

Dual Enrollment is when a student takes a class at a local community college when they are still in high school. Depending on how you want this course to affect your GPA, you may opt to have it count toward your high school credits, college credits, or in some cases, *both.* Some universities will not accept credit for dual course enrollment if it's already being used for high school, so you will have to choose which one you'd rather have the credit go towards (high school or college).

The Most Important Factors for Student's Math Success

I strongly encourage you to stay actively engaged your child's math education, even if math isn't your forte or you don't have time to teach math yourself. There's a lot you can do outside of the math lesson that will significantly increase your child's math success in the long-term.

Here are the top five factors that matter the most for students to succeed in math:

1. **Self-Efficacy:** Students' belief in their own math abilities significantly influences their achievement. The study done by ScienceDirect on the Effects of Accelerated Mathematics on Self-Efficacy and Growth Mindset examined how accelerated math programs affect students' self-efficacy and growth mindset, finding significant declines in both. While students' math grades dropped, their test scores remained steady, suggesting that acceleration may improve performance but negatively impact students' confidence and beliefs about their ability to succeed.

2. **Teacher Attitudes and Practices**: How the teacher feels about math significantly impacts student learning. When teachers exhibit low confidence in math themselves *or* in their student's performance (not being at the level the teacher thinks they should be at), it can lead to lower student achievement. *Math Anxiety* studies from Standford and Harvard find multiple factors that lead to lower math achievement in students and the importance of having teachers that are competent in math, passionate about teaching, and able to reach their students at their level.

3. **Curriculum and Instruction:** The structure and delivery of math curriculum significantly affects student success. Math curriculum programs like ours have positive effects on the student's conceptual understanding and problem-solving skills due to the content being delivered in all learning four modalities (visual, audio, kinesthetic, and digital ← pages 41-46).

4. **Student Attitudes:** Positive student attitudes toward math are linked to higher achievement. A study found students' perceptions and feelings about math significantly influence their learning success. Even *more* important are the attitudes students perceive in their teacher about their abilities – having a teacher that takes the time to meet students at their level, modeling best practices in thinking, logic and translation (like breaking word problems down into math equations), and celebrating success is far more impactful than endless rounds of drill worksheets, AI generated "click the correct answer" (which students can learn to "game the system") and traditional standardized testing, all of which can negatively impact their overall confidence and real-world applications of math.

5. **Parental Involvement:** Active engagement of parents in a child's education supports math success. Studies suggest that parental support and involvement can enhance students' math performance.

Your involvement in your child's math education, even if you aren't a math expert, can play a crucial role in your child's success in math. You are your child's best teacher – by stepping in and switching gears when the math level isn't challenging enough to downshifting the pace when they need more time with a concept will significantly affect your child's growth in mathematics. What this means is that it is really the encouragement and active engagement we *both* provide that will ultimately influence your child's success in math the most.

Things I do NOT recommend doing

When we hear about students taking extra math classes in the summer, doubling up or trying to do only half the work so they can go at twice the speed through the course, my first question is usually: *"What's the rush?"*

If a student is really that far behind, no amount of cramming is going to catch them up. Our brains simply can't process that rapidly in a way that really sticks (can *you* remember the things you studied right before the big test? How much of those things do you remember now?). When you think about it, will the difference of a year or two really matter in the long run?

Why not take the time your student needs to really understand and make sense of the material now, when they have the time to devote to studies? They may not have this opportunity again once they get out in the work force.

Trying to do a crash course and learn math fast by doubling up on coursework or trying to catch up over summer holidays will actually set up *further behind*, not ahead, because you'll lose valuable time when your student starts to feel their confidence slacken and their belief about what they can do get weaker. The only way to make progress is to build on the student's confidence in their current abilities, in what they believe that they *can* do right now.

I had a teacher tell me once: *"If you learn it fast, you'll forget it fast"*. Your student needs time to think and process this new information in their courses, especially in classes as rigorous as high school courses tend to be. Instead, remember *"Slow is smooth, and smooth is fast."*

In Closing…

I hope this gives you a good idea about what's coming next after you work through our program and get into the high school years. We work hard to get your student ready for any option that they choose after they finish their work with us. There are so many great opportunities out there and even more ways to achieve them!

I highly recommend having a game plan, even if it's just a general outline, so you know your start and end points. You can figure out the rest in-between, but at least you know you are pointed in the right direction.

All the best to you and your family!

Aurora Lipper

Supercharged Math