Adda Clevenger School, Upper School Mathematics

The goal of the ACS math program is to create confident, flexible thinkers and to promote personal growth. Personal growth is obtained by setting and achieving goals pertaining to the grade as well as reflecting on individual strengths and weaknesses. Goal setting is an instructional focus marked by the desire to add the 'why' to math work instead of just the 'how' of math work.

Our goal will be to take students beyond learning mathematical methods, to challenge our students to think about how to solve problems, how to investigate and find mathematics and patterns in the world. We aim to make the experience of every student in math class more practical and engaging from kindergarten through eighth grade.

The upper school math program begins in fifth grade. Our program teaches math in sequence, using age and grade appropriate math activities to progressively build understanding, skills, and confidence, creating a firm foundation for students that allows them to excel within an accelerated mathematics curriculum. Throughout the year our students make decisions about how to approach a problem. Students develop their ability to grasp underlying mathematical relationship without relying on rote memorization. They should successfully generalize from concepts they have mastered. They should improve their problem-solving skills, confidence, abstract-thinking skills, and hopefully their love of mathematics. They will express solutions clearly and logically using the appropriate mathematical notation. Students will develop generalizations, represent them in algebraic form and apply them in new situations. They will take clear notes from classroom instruction and demonstrate their understanding through assigned tasks, working in groups and individually. Students will take an assessment test at the end of each section of study. They will receive short and long-term homework assignments that will require them to demonstrate good study skills and manage their time effectively.

What to expect in 5th Grade:

Math 5 begins to build the bridge between arithmetic skills learned in lower grades with the analytical problem-solving skills used in middle school mathematics. The course focuses on explaining the "why" of mathematical problem solving, not just the "how" of working problems. The introduction of variables opens a huge door to the abstraction of algebraic thinking, coupled with expanding the study of numerical systems to include decimals and fractions. Students will use fundamental properties i.e. commutative, associative, and distributive, to solve problems more effectively. A second core concept explored in fifth-grade math involves building an understanding of patterns and algebraic thinking. The overall goal of Math 5 is to build flexible thinkers open to multiple ways to solve problems, comfortable with adapting to new ways of thinking about math.

Students will build on their understanding of the structure of the place value system by extending that understanding to decimals. By the end of the unit, students will have a deep understanding of the base-ten structure of our number system, by comparing this system to another base and comparing and contrasting each base system.

Students will continue thinking about other bases to introduce fractions and why operations with fractions are complicated in a base ten system. Students will obtain competency and a strong understanding of computing operations with fractions, decimals, and multi-digit numbers.

In the second semester, 5th graders will begin identifying, observing, and expressing patterns. They will study displaying patterns and coming up with skills to identify them. This includes graphing on the coordinate-plane and determining how they want to represent patterns. Students will apply this thinking to functions and real-world data, learning ways to characterize data, visually display, and organize data.

Students will end the year converting between units of measurement and learning about fundamental geometric concepts. Students will explore the compass and straightedge capabilities and think critically about how to construct regular polygons and bisections. Lastly, students will explore volume of cubes and rectangles and think critically about the volume of pyramids and cones.

What to expect in 6th Grade:

The sixth-grade mathematics course at ACS is based on some key ideas fostered throughout the curriculum. These define the type of math student we are developing at ACS. These 'big ideas' include an ability to reason and make sense of math, the productive use of discourse to explain and justify mathematical thinking, computation with flexibility, accuracy and efficiency, use of various tools to represent math ideas, and most importantly, confidence and perseverance in solving problems.

Beyond the big ideas underlying math study at ACS, the sixth-grade student is engaged in the study of pre-algebra concepts and ideas. Developing algebraic reasoning beyond arithmetic skills is crucial as students prepare for the more abstract world of algebra involving variables, functions and equations. As noted by authors Ann Lawrence and Charlie Hennessy, algebraic thinking includes: using or setting up mathematical models, gathering and recording data, organizing data and discerning patterns, describing and extending those patterns, generalizing findings into a rule and using findings to make predictions.

All of these abilities need to be developed within each student through repeated explorations and reflections on those explorations. To accomplish this, students build their conceptual understanding through a wide variety of real-world, hands-on experiences involving pictures, tables, graphs, models and eventually symbols, throughout this course.

Main Learning Targets (Goals and Objectives) and Skills: Each unit planned for this course incorporates these big ideas, with the goal of weaving together the previous year's strands of solving expressions and equations, working with ratios, sampling populations, and geometry into a coherent understanding of linear equations, functions, and moving shapes in space. Main learning targets include:

> a. Learning to reason about and with expressions and equations, including square and cube roots and both positive and negative integer exponents.
> b. Modeling the connections - including proportional relationships and other patterns of association -- between two variables with a linear equation. Solving both single and pairs of linear equations with a variety of methods.
> c. Gaining familiarity and confidence in understanding what functions are, how they can be compared, and how they are used to show relationships between different amounts.
> d. Knowing how to work with and describe changes to figures in space through a variety of formats, and further explore applications of the Pythagorean Theorem.

What to expect in 7th Grade:

Seventh-grade math students at Adda Clevenger begin an intensive Algebra 1 course, setting them up for a solid foundation and advanced placement high school. Symbolic reasoning and calculations with symbols are central in algebra. Through the study of algebra, a student develops an understanding of the symbolic language of mathematics and the sciences. In addition, algebraic skills and concepts are developed and used in a wide variety of problem-solving situations. In seventh grade students will:

-   Identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers, including closure properties for the four basic arithmetic operations where applicable. Students use properties of numbers to demonstrate whether assertions are true or false.

-   Understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.

-   Solve equations and inequalities involving absolute values and solve multistep problems, including word problems, and provide justification for each step. Students simplify expressions before solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x - 2) = 12$.

-   Graph a linear equation and compute the x- and y-intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequalities (e.g. they sketch the region defined by $2x + 6y < 4$). Students verify that a point lies on a line, given an equation of the line and are able to derive linear equations by using the point-slope formula. They understand the concepts of parallel lines and perpendicular lines and how their slopes are related, and they are able to find the equation of a line perpendicular to a given line that passes through a given point.

-   Solve a system of two linear equations in two variables algebraically and interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution set.

Throughout the year our students make decisions about how to approach a problem. Students develop their ability to grasp underlying mathematical relationships without relying on rote memorization. They should successfully generalize from concepts they have mastered. They should improve their problem-solving skills, confidence, abstract-thinking skills, and their love of mathematics. They will express solutions clearly and logically using appropriate mathematical notation. Students will develop generalizations, represent them in algebraic form and apply them in new situations. They will take clear notes from classroom instruction and demonstrate their understanding through assigned tasks, working in groups and individually. Students will take an assessment test at the end of each section of study. They will receive short and long-term homework assignments that will require them to demonstrate good study skills and manage their time effectively.

What to expect in 8th Grade:

Geometry is about finding creative ways to solve for unknowns related to shapes, figures, and coordinate points. To summarize the process one must infer, eliminate, and execute, in no particular order. To master these skills, students must seek out and identify all information known, given and inferred. The student must also be able to eliminate unnecessary information that isn't required in the solution. This process happens in no particular order and there is not an algorithm to solve problems most efficiently. Geometry is a collaborative learning experience, working together is key and unraveling the mysteries is thrilling!

To build up these skills and to execute them successfully, students must build up a database of properties, postulates, and theorems. In accomplishing this first task, students must be exposed to all characteristics, properties and theorems. Students must be exposed to all characteristics and properties of shapes, solids, and different functions on the coordinate plane and understand the terms and new vocabulary associated with them. Students will derive their own properties and re-derive them to solve future problems.

Students will reflect on the parallels between algebra and geometry and overlap their skills to solve problems from both perspectives. This will be apparent in the coordinate plane transformations, distance formulas, use of the Pythagorean theorem, and solving for unknowns. Students will strengthen their algebraic skills and continue their growth using geometry as a medium and primary focus.

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