

Course Title: Algebra 1

Course Description:

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 this course, all topics and units will be covered. A minimum of 50% of the units will be covered in-depth through a variety of instructional experiences that may include: internships, independent projects, workshops, individual and small group seminars, college classes, online courses, field studies, traditional research, written reflections, tutoring, student exhibitions, and lectures from outside experts. A credentialed instructor in this subject area will analyze the rigor of the work completed in order to ensure that the learning objectives were addressed with adequate depth.

In addition, all students will be expected to demonstrate each unit in a compilation of at least two project based assignments for the course. Along with the project work, students will be required to complete all assigned readings and conduct active research embedded in their internship projects centered on the selected topic/s agreed upon by their advisor/teacher and mentor as they relate to the course standards. In keeping with the Big Picture philosophy, academic learning will be linked to student interests and connected to real world experiences. This active learning must include both primary and secondary source analysis and written reflections of these source materials as supporting study for successful completion of the final products for all student work.

Students will use the textbook *Mathematics: Modeling Our World* as a reference. Relevant homework problems will be assigned for each student to enhance his or her understanding of key concepts involved in the project work. Students will have access to other standards-based academic texts, the Internet, primary and secondary sources, mathematics tutorials and specialized sequential workshops as well as expertise at their internship site and outside experts as lecturers. Since Mathematics is a sequential discipline, often students will be required to demonstrate more basic skills in order to complete higher level units. Students at Big Picture Schools utilize a variety of resources to demonstrate mastery of sequential skills, from directed instruction with standards-based textbooks and assessments, to standards-based online or software programs and assessments, to college entrance math assessments and courses.

Assessment of students will be threefold. First, a credentialed instructor in this subject area will analyze the rigor of the work completed in order to ensure that the learning objectives were addressed with adequate depth. Second, students will demonstrate their skill proficiency and conceptual understanding through quarterly presentations of their mathematics portfolio. Students will be asked to discuss the reasoning behind the work they've done, as well as the logic behind sequential steps. Third, each student's advisor will insure breadth of coverage of the standards through assessment of the student's learning plan and detailed project work.

Course Outline:

TOPIC	UNITS	SAMPLE ACTIVITIES & PROJECTS
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<p>Basic Numbers:</p> <p><i>CA (1.0) Students 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:</i></p> <p><i>CA (2.0) Students 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.</i></p> <p><i>CA (3.0) Students solve equations and inequalities involving absolute values.</i></p> <p><i>CA (4.0) Students simplify expressions before solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$.</i></p>	<ul style="list-style-type: none"> ▪ Number Lines ▪ Order of Operations ▪ Basic Statistics ▪ Equations and Functions ▪ Rational Numbers 	<p>Number Lines</p> <ul style="list-style-type: none"> ▪ Piece movement on a board game ▪ Weather/temperature charting ▪ Time in different time zones around the world ▪ Checking account project (Independent Living) Students chart balance of checking account on a number line. <p>Order of Operations</p> <ul style="list-style-type: none"> ▪ Investments – buying/tracking stock values ▪ Perimeter problems ($P= 2s + 2(s+3)$) ▪ Figuring the volume of pyramids in Egypt, Peru, Mexico ▪ Elevator Project – elevator goes up and down, track absolute value of movement. ▪ \$1,000,000 spreadsheet project where students are required to use Excel to spend \$1,000,000, accounting for all costs for a year. <p>Basic Statistics</p> <ul style="list-style-type: none"> ▪ MPG study of new cars ▪ Weights of students in class ▪ Number rounding problems ▪ Mutant Candy Project – what is better, 1 candy and doubling it every hour, or 100 candies per hour ▪ -graphs ▪ -exponential growth vs. linear growth <p>Equations and Functions</p> <ul style="list-style-type: none"> ▪ Study the Distributive Property ▪ Study the Commutative Property ▪ Study the Associative Property <p>Rational Numbers</p> <ul style="list-style-type: none"> ▪ Students research and design word problems dealing with adding and subtracting rational numbers ▪ Students research and design word problems dealing with multiplying and dividing rational numbers ▪ Culminating problem, written by students, involving all four routines with rational numbers
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<p>Linear Equations:</p> <p><i>CA (5.0) Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.</i></p> <p><i>CA (6.0) Students 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 inequality (e.g., they sketch the region defined by $(2x + 6y < 4)$).</i></p> <p><i>CA (7.0) Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations by using the point-slope formula.</i></p> <p><i>CA (8.0) Students understand the concepts of parallel lines and perpendicular lines and how those slopes are related. Students are able to find the equation of a line perpendicular to a given line that passes through a given point.</i></p> <p><i>CA (9.0) Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets.</i></p>	<ul style="list-style-type: none"> ▪ Solve Equations With Addition and Subtraction ▪ Solve Equations With Multiplication and Division ▪ Solve Multi-Step Problems ▪ Solve System of Linear Equations and Inequalities 	<p>Solve Equations With Addition and Subtraction</p> <ul style="list-style-type: none"> ▪ Use equations to compare how one NFL team did over the season than another ▪ Design problems utilizing the Addition Property of Equality ▪ Design problems utilizing the Subtraction Property of Equality <p>Solve Equations With Multiplication and Division</p> <ul style="list-style-type: none"> ▪ Wheelchair ramp problem where rise can be no higher than 1” for a run of 12”. ▪ Design problems utilizing the Multiplication Property of Equality ▪ Design problems utilizing the Division Property of Equality <p>Solve Multi-Step Problems</p> <ul style="list-style-type: none"> ▪ Phone Cost Project: $y = mx + b$, where the y-intercept (b) = monthly rate and the slope (m) = cost per minute. ▪ Pool Filling Problem: $y = mx + b$, where b = number of gallons in the pool at the start (most likely 0), and m = gallons per minute that go into the pool. ▪ Cricket Chirps/Temperature Problem ▪ Taxi Project: $y = mx + b$, where b = starting cost and m = cost per mile. ▪ Mountain Hiking Problem: $y = mx + b$, where b = starting elevation and m = steepness of the trail. ▪ Pointing Lines <ul style="list-style-type: none"> ○ graph lines given ○ name point on line given x-value ▪ Ruler of Your Domain ▪ Ex. $p(t) = 2.50t - 450$ graph domain and range ▪ Simple Interest vs. Compound Interest <p>Solve System of Linear Equations and Inequalities</p> <ul style="list-style-type: none"> ▪ Playing Catch Up – two hikers starting on same trail at different times with different rates of speed. How fast does one need to travel to catch up to another hiker in front going a certain speed after a certain time hiking. ▪ Graph a system of populations of two different kind of species to see when the populations equaled each other ▪ Study Supply and Demand curves (Economics) of a certain product and ascertain the precise selling price to bring the highest income
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<p>Polynomials:</p> <p><i>CA (10.0) Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.</i></p> <p><i>CA (11.0) Students apply basic factoring techniques to second- and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials.</i></p> <p><i>CA (12.0) Students simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms.</i></p>	<ul style="list-style-type: none"> ▪ Polynomials in Art ▪ Polynomials in Business ▪ Using tiles of different sizes and patterns to understand polynomials. 	<p>Polynomials in Art</p> <ul style="list-style-type: none"> ▪ Students study Piet Mondrian’s art <p>Polynomials in Business</p> <ul style="list-style-type: none"> ▪ Students invest money using the px^t formula <p>Using tiles of different sizes and patterns to understand polynomials.</p> <ul style="list-style-type: none"> ▪ Patio Building Project ▪ Box Design Project
<p>Graphs:</p> <p><i>CA (17.0) Students determine the domain of independent variables and the range of dependent variables defined by a graph, a set of ordered pairs, or a symbolic expression.</i></p> <p><i>CA (18.0) Students determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion.</i></p>	<ul style="list-style-type: none"> ▪ Cartography ▪ Scatter Plots ▪ Technical Graphing 	<p>Cartography</p> <ul style="list-style-type: none"> ▪ Longitude/Latitude project <p>Scatter Plots</p> <ul style="list-style-type: none"> ▪ Biology populations charts ▪ Endangered species exportation graphs <p>Technical Graphing</p> <ul style="list-style-type: none"> ▪ Students know Definition of the Domain and Range of a Relation ▪ Economics: Unemployment graphs ▪ Economics: Retail sales ▪ Probability: Students learn odds of number combinations of two dice rolled randomly
<p>Quadratic Formula:</p> <p><i>CA (19.0) Students know the quadratic formula and are familiar with its proof by completing the square.</i></p> <p><i>CA (20.0) Students use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations.</i></p>	<ul style="list-style-type: none"> ▪ Understanding the Quadratic Formula by graphing real life problems. 	<p>Understanding the Quadratic Formula by graphing real life problems.</p> <ul style="list-style-type: none"> ▪ Bouncing Ball Project – Looking at angle of trajectory and speed, graph the path of a bouncing ball at various time intervals. Use the quadratic equation to describe this path. ▪ Shooting a Basket Project ▪ Volunteering numbers vs. age of volunteers ▪ Students study the SkillsTutor. Louis Arch which is a catenary. The shape of the arch can be approximated by the graph of the function

<p><i>CA (21.0) Students graph quadratic functions and know that their roots are the x-intercepts.</i></p> <p><i>CA (22.0) Students use the quadratic formula or factoring techniques or both to determine whether the graph of a quadratic function will intersect the x-axis in zero, one, or two points.</i></p> <p><i>CA (23.0) Students apply quadratic equations to physical problems, such as the motion of an object under the force of gravity.</i></p>		<p>$f(x) = -0.00635x^2 + 4.0005x - 0.07875$, where $f(x)$ is the height of the arch in feet and x is the horizontal distance from one base</p>
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Learning Outcomes. The student will be able to understand:	Learning Activities and Projects that address the stated Learning Outcomes (Be sure to include how mastery of the learning outcomes will be evaluated):	How Standard was Met	Grade for Topic	Advisor Initials	Date Year Tri.
1. Basic Numbers					
2. Linear Equations					
3. Polynomials					
4. Graphs					
5. Quadratic Formula					

Key:

Internship = LTI Independent Project = IP Workshops = W Advisory = A College Classes = CC Online Courses = OC	Summer School = SS Field Studies (day trips, summer travel) = FS Pick Me Ups / Lecture = L Test = T Interviews = IV
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Date Code:

Number of the quarter, and the year (for example: Q1 0405)