MAGIC CITY ACCEPTANCE ACADEMY

# ** 8th Grade Accelerated/Algebra 1**

The Grade 8 Accelerated course has been carefully aligned and designed for middle school students who have completed the Grade 7 Accelerated course and show particular motivation and interest in mathematics. In Grade 8 Accelerated, there are four content areas: Number Systems and Operations; Algebra and Functions; Data Analysis, Statistics, and Probability; and Geometry and Measurement. The algebra focus is on quadratic relationships. Students who successfully complete this course will be prepared to enter Geometry with Data Analysis in Grade 9 and then accelerate directly into Algebra II with Statistics in Grade 10, thus providing them with an opportunity to take additional, specialized mathematics coursework, such as AP Calculus or AP Statistics, in Grades 11 and 12. Refer also to  the standards for 8th Grade Math.

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| Timeline | Unit/theme | Standard | Student Focused Objective | Resources/ Suggested Activities |
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| | All topics will draw from the listed resources<br><br>*Note that math and science will be integrated so resources may crossover in t opic areas | | | AMSTI resources for 8th grade Algebra 1https://www.amsti.org/68-math-student-family<br>https://www.amsti.org/math-6-8-classroom<br><br>Math Nation (Illustrated Math) (access thru https://www.clever.com/ with school email account)<br>https://illustrativemathematics.org/<br><br>IXL online math (access thru https://www.clever.com/ with school email account)<br><br>Delta Math<br>https://www.deltamath.com/<br><br>Maneuvering the Middle math resources<br>https://www.maneuveringthemiddle.com/<br><br>Math Worksheets for Kids<br>https://www.mathworksheets4kids.com/<br><br>https://www.desmos.com/calculator |

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| | Real (rational and irrational) and complex (imaginary) numbers | See all standards for real numbers and integer exponents/radicals in the 8th grade standards.<br><br>Explain how the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for an additional notation for radicals in terms of rational exponents.<br><br>Rewrite expressions involving radicals and rational exponents using the properties of exponents.<br><br>Define the imaginary number i such that $i^2 = -1$. | In addition to being able to differentiate between rational and irrational numbers, students in Algebra learn about complex or imaginary numbers.<br><br>Square roots can also be written as fractional exponents.<br><br>Students will be able to simplify algebra phrases with fractional exponents by following the rules for exponents.<br><br>Define the imaginary number i such that $i^2 = -1$. | |

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| | Rewriting expressions in equivalent forms using algebraic methods<br><br>(includes 8th grade standards related to linear functions) | Interpret linear, quadratic, and exponential expressions in terms of a context by viewing one or more of their parts as a single entity.<br><br>Use the structure of an expression to identify ways to rewrite it.<br><br>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.<br><br>Factor quadratic expressions with leading coefficients of one, and use the factored form to reveal the zeros of the function it defines. | Example: Interpret the accrued amount of investment $P(1 + r)^t$ , where P is the principal and r is the interest rate, as the product of P and a factor depending on time t.<br><br>Example: See $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.<br><br>Rewrite trinomials as the product of two binomials.<br><br>Solve the equations to find the x-intercepts of the graph. | |

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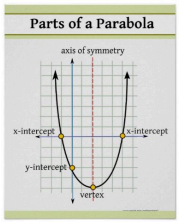
| | | Use the vertex form of a quadratic expression to reveal the maximum or minimum value and the axis of symmetry of the function it defines.<br><br>Complete the square to find the vertex form of quadratics with a leading coefficient of one.<br><br>Use the properties of exponents to transform expressions for exponential functions.<br><br>Add, subtract, and multiply polynomials, showing that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication.<br><br>Analyze the relationship (increasing or decreasing, linear or non-linear) between two quantities represented in a graph. | $y=a(x-h)2+k$<br>  <br><br>Turn the quadratic form into the vertex form of the parabola.<br><br>Example: Identify percent rate of change in functions such as $y = (1.02)^t$ , $y = (0.97)^t$ , $y = (1.01)12^{t,}$ or $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.<br><br>Add, subtract, and multiply polynomials - using the box method of multiplication and by grouping and combining like terms. | |

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| | Analyze and solve linear equations and systems of two linear equations.<br><br>Solve equations involving absolute values. | Solve systems of two linear equations in two variables by graphing and substitution.<br><br>Explain that the solution(s) of systems of two linear equations in two variables corresponds to points of intersection on their graphs because points of intersection satisfy both equations simultaneously.<br><br>Interpret and justify the results of systems of two linear equations in two variables (one solution, no solution, or infinitely many solutions) when applied to real-world and mathematical problems.<br><br>Explain why extraneous solutions to an equation involving absolute values may arise and how to check to be sure that a candidate solution satisfies an equation. | What happens when there are two equations on the grid?<br><br>What does it mean to “solve the system of equations?”<br><br>What methods can we use to solve for the solution (the intersection) of these two equations?<br><br>What does it mean if the system of equations has no solution? Or one solution? Or an infinite number of solutions?<br><br>Why do absolute value equations or square root equations have “extraneous” solutions? | |
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| | Determine an efficient strategy to find a solution to a system of equations, if one exists, and then justify the solution. | Select an appropriate method to solve a quadratic equation in one variable.<br><br>Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions.<br><br>Explain how the quadratic formula is derived from this form.<br><br>Solve quadratic equations by inspection (such as $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring.<br><br>Recognize that some solutions may not be real.<br><br>Select an appropriate method to solve a system of two linear equations in two variables. | | |

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| | | Solve a system of two equations in two variables by using linear combinations and contrast situations in which use of linear combinations is more efficient with those in which substitution is more efficient.<br><br>Contrast solutions to a system of two linear equations in two variables produced by algebraic methods with graphical and tabular methods. | | |
| | Functions | Define a function as a mapping from one set (called the domain) to another set (called the range) that assigns to each element of the domain exactly one element of the range.<br><br>Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. | What is a function?<br><br>How do we use function notation?<br><br>What is a domain? A range? | |

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| | | **Note**: If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x.<br><br>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (linear, quadratic, exponential, and absolute value functions only).<br><br>Given a relation defined by an equation in two variables, identify the graph of the relation as the set of all its solutions plotted in the coordinate plane.<br><br>**Note**: The graph of a relation often forms a curve (which could be a line). | Different functions have different domains and ranges (possible inputs and outputs).<br><br>How do these differences define the relationships? | |

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| | | Compare and contrast relations and functions represented by equations, graphs, or tables that show related values.<br><br>Determine whether a relation is a function.<br><br>Identify that a function f is a special kind of relation defined by the equation y = f(x).<br><br>Combine different types of standard functions to write, evaluate, and interpret functions in context. Limit to linear, quadratic, exponential, and absolute value functions.<br>Use arithmetic operations to combine different types of standard functions to write and evaluate functions.<br><br>Use function composition to combine different types of standard functions to write and evaluate functions. | How do we represent a function with a table? A graph? A map? An equation?<br><br>What happens when we combine functions? When we add them? Multiple them by a number?<br><br>Science std: What happens when we add waves to one another? How do they add and how do they subtract?<br><br>Example: Given two functions, one representing flow rate of water and the other representing evaporation of that water, combine the two functions to determine the amount of water in the container at a given time. | |

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| | Graphs of Equations | Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x).<br><br>Find the approximate solutions of an equation graphically, using tables of values, or finding successive approximations, using technology where appropriate.<br><br>**Note**: Include cases where f(x) is linear, quadratic, exponential, or absolute value functions and g(x) is constant or linear.<br><br>Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality).<br><br>Graph the solution set to a system of linear inequalities in two variables | Be able to use a calculator to enable graphing of functions.<br><br>https://www.desmos.com/calculator | |

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| | | as the intersection of the corresponding half-planes, using technology where appropriate.<br><br>Solve systems consisting of linear and/or quadratic equations in two variables graphically, using technology where appropriate. | | |
| | Describe functions using: mapping diagrams, function notation, recursive definitions, tables, and graphs. | Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Include linear, quadratic, exponential, absolute value, and linear piecewise.<br><br>Distinguish between linear and non-linear functions.<br><br>Define sequences as functions, including recursive definitions, whose domain is a subset of the integers. | How do we describe the differences between two functions?<br><br>What does it mean to be linear? Non-linear?<br><br>How do we write sequences as functions? | |

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| | | Write explicit and recursive formulas for arithmetic and geometric sequences and connect them to linear and exponential functions. | | |
| | Function Families | Identify the effect on the graph of replacing f(x) by f(x) + k, k·f (x), f (kx), and f(x + k) for specific values of k (both positive and negative).<br><br>Find the value of k given the graphs. Experiment with cases and explain the effects on the graph, using technology as appropriate. Extend from linear to quadratic, exponential, absolute value, and linear piecewise functions.<br><br>Distinguish between situations that can be modeled with linear functions and those that can be modeled with exponential functions. | What happens to the parent (or simplest version of the function) when you add a number to it?<br>When you multiply it by a number?<br><br>Which real life situations are linear?<br><br>Which are exponential?<br><br>Which are parabolic? (relates to science standards for Newton's laws) | |

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| | | Show that linear functions grow by equal differences over equal intervals, while exponential functions grow by equal factors over equal intervals.<br><br>Define linear functions to represent situations in which one quantity changes at a constant rate per unit interval relative to another.<br><br>Define exponential functions to represent situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.<br><br>Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). | | |

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| | | Use graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically | | |
| | Features of functions: minimum or maximum, zeroes, rate of change and intercepts | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.<br><br>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.<br><br>Estimate the rate of change of a function from its graph.<br><br>Graph functions expressed symbolically and show key features of the graph<br><br>Graph linear and quadratic | | |

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| | | functions and show intercepts, maxima, and minima.<br><br>Graph piecewise-defined functions, including step functions and absolute value functions.<br><br>Graph exponential functions, showing intercepts and end behavior. | | |
| | Investigate patterns of association in bivariate data. | Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities, describing patterns in terms of positive, negative, or no association, linear and non-linear association, clustering, and outliers.<br><br>Given a scatter plot that suggests a linear association, informally draw a line to fit the data, and assess the model fit by judging the closeness of the data points to the line. | How do we represent data collected?<br><br>What relationships do we see in the data?<br><br>How do we describe those relationships?<br><br>What is a “line of best fit"?<br><br>How do we know if that function is a good fit to the data? | |

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| | | Use a linear model of a real-world situation to solve problems and make predictions.<br><br>(a) Describe the rate of change and y-intercept in the context of a problem using a linear model of a real-world situation.<br><br>Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects, using relative frequencies calculated for rows or columns to describe possible associations between the two variables.<br><br>Design and carry out an investigation to determine whether there appears to be an association between two categorical variables, and write a persuasive argument based on the results of the investigation.<br><br>Distinguish between quantitative and categorical | What is a 2-way table?<br><br>How do we build one from our data set?<br><br>How do we describe our results? | |

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| | | data and between the techniques that may be used for analyzing data of these two types. | | |
| | Pythagorean theorem and its converse | Informally justify the Pythagorean Theorem and its converse.<br><br>Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.<br><br>Apply the Pythagorean Theorem to determine unknown side lengths of right triangles, including real-world applications | How do we know that Pythagoras was right?<br><br>How do we use the Pythagorean theorem to find the distance between two points?<br><br>Related science standard- how are vectors related to the Pythagorean theorem? | |
| | Geometry | Calculate volumes of cylinders, cones and spheres.<br><br>Informally derive the formulas for the volume of cones and spheres by experimentally comparing the volumes of cones and spheres with the same radius and height to a cylinder with the same | Find the volume of cones, cylinders and spheres by using a formula.<br><br>Experimentally figure out the formulas for the volume of cones and spheres. | |

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| | | dimensions.<br><br>**Note**: Students must be able to demonstrate all 8th grade skills related to parallel lines and transversal, similarity, rigid transformations and dilations in the coordinate plane. | | |