

Algebra 1A/1B

Course Description:

This course lays the foundation for high school level mathematics, demonstrating that each concept builds on previous knowledge. Throughout this course, students are challenged to make connections between computation with numbers (concrete) and computation with variables (abstract.) With an emphasis on critical thinking and analysis skills, students will learn about equations, inequalities, functions, and statistical analysis. As a result, students will learn the foundations of mathematical thinking and computation that is necessary to continue to upper-level math courses.

Assignments and Assessments:

Guided Learning Units - Each semester, students will be assigned a Guided Learning Unit that is divided into 4 parts. Each part will be due on specific dates throughout the semester and will be worth 25 points. The project will be worth a total of 100 point and will count as one test grade.

All other units will be completed following this process:

1. Students will attend live and interactive classes or view recorded (At My Pace - AMP) instruction video and participate by answering questions in the live setting or by pausing the AMP instruction video to solve a given problem. Students will have immediate feedback on their current level of comprehension, thus reinforcing learning and providing the opportunity to improve their skills within each lesson.
2. Students will complete one homework assignment before attending or viewing the next instruction session. Students are provided with answers to homework assignments and are expected to self-check their answers. Classes begin with time for students to ask the instructor about homework questions they were not able to complete correctly. Students using AMP recorded instruction can set up time with an instructor, up to 5 hours per course, for individual tutoring.
3. After approximately every two assignments, students complete a quiz (using paper and pencil) that is proctored by an adult and returned to the instructor for grading and feedback. Instructors look at both work and answers to ensure that students are using sound mathematical processes to demonstrate mastery. After each unit, students complete a test in the same manner. The instructor creates an online personal grading notebook for each student where the student's work, the instructor's feedback, and the grade can be viewed. Access to the notebook is granted to the student and parents, as well as any education advisors.
4. At the end of each semester, students complete a cumulative final exam.
5. Course grades are assigned based on a weighted average of 40% quiz / 60% test. The final exam is weighted the same as the other tests.

Unit 1: Data Analysis [Guided Learning Unit – fall semester]

Description: Unit 1 will focus on statistical models, multi-variable categorical data, one variable distributions and regression curves with linear, quadratic and exponential models. Students will understand measures of central tendency, spread and how outliers can affect these. Displays of statistical data will be incorporated such as histograms, line graphs, dot plots, and box-plots. Students will find and use regression curves to make predictions and understand if their predictions are reasonable.

Skills to be demonstrated:

- Analyze statistical data to find measures of central tendency and spread.
- Use various graphs to display statistical data (histograms, line graphs, dot plots, box plots).
- Interpret data to compare its qualitative and quantitative characteristics and draw conclusions both with a single variable and two variables.
- Recognize possible associations and trends in data.
- Summarize categorical data for two categories using two-way frequency tables focusing on joint, marginal and conditional relative frequencies.
- Use statistical data appropriate to its shape to compare/identify measures of central tendency, spread, and standard deviation of two or more different data sets.
- Interpret possible effects of extreme data points (outliers).
- Find regression models of linear, quadratic and exponential data.
- Using regression modeling, interpret its real-world meaning.
- Using regression modeling, make predictions and understand if these predictions are reasonable.
- Identify the correlation coefficient and understand its meaning.
- Analyze residuals by comparing the correlation coefficient and plotting of the data.
- Distinguish between correlation and causation.

Unit 2: Functions [Guided Learning Unit – spring semester]

Description: Unit 2 will focus on functions and their interconnectedness in mathematics. Functions discussed and analyzed will be linear, absolute value, quadratic, radical, piecewise, and exponential functions. Graphs, increasing/decreasing intervals, relative extrema, end behavior, domain/range, intercepts will be incorporated in the lessons as well as recognizing parent functions and graphing transformations that have been shifted or affected by a scale factor. Students will exhibit an understanding of the interconnected properties of functions and state answers using correct terminology. Students will also use their knowledge of functions to solve real world applications.

Skills to be demonstrated for each function (linear, absolute value, quadratic, radical, piecewise, and exponential functions):

- Determine if a graph is a function or not.
- Identify increasing/decreasing intervals and relative extrema.
- Identify intercepts and asymptotes if applicable.
- Identify positive and negative intervals.
- Identify end behavior.
- Identify domain/range including in real-world applications.
- Identify additional key features of quadratics (axis of symmetry and vertex).
- For exponential functions, identify the difference between exponential growth/decay.
- Use function notation to evaluate and interpret statements in terms of a context.
- Use parent functions to graph functions that incorporate transformations/scale factor.
- Recognize and use parent functions to write the equation of a function that has been transformed.
- Explain the relationship between intersections and solutions to an equation/system.
- Compare and observe properties of two functions represented in algebraic, graphical, numerical forms or with verbal descriptions.
- Model and solve real-world problems involving exponential functions.
- Understand the relationship between a quadratic function and its inverse.

Unit 3: Expressions, Equations and Solving Linear Equations

Description: Unit 3 will focus on solving increasingly complex equations for both numerical values and for selected variables; writing and solving equations based on given information; solving problems using proportions, scale drawings, and dimensional analysis. Students will demonstrate algebraic reasoning skills and develop their ability to model and solve real world problems using linear equations.

Skills to be demonstrated within this unit:

- Use variables to model expressions based on given information.
- Solve 1-step, 2-step, and multi-step equations where the variable is on one or both sides of the equal sign.
- Manipulate and solve 1-variable equations, including equations with coefficients represented by letters.
- Create and solve equations based on given information.
- Model and solve real world problems involving equations in linear equations.
- Use proportions, scale drawings, and dimensional analysis to solve real world problems.

Unit 4: Linear Functions and Relationships

Description: Unit 4 will focus on functions, including terminology, graphical and algebraic manipulation of linear functions. Additionally, arithmetic and geometric sequences will be compared to linear and exponential functions. Students will develop an integrated comprehension of linear functions and their graphs and will correlate linear functions with arithmetic sequences and exponential functions with geometric sequences.

Skills to be demonstrated:

- Use terminology such as relations and functions, domain and range, dependent and independent variable.
- Show functions in different ways, such as in a table, mapping, ordered pair, or a graph.
- Identify the domain and range of discrete functions.
- Read, write, and evaluate functions using function notation.
- Identify how changes in slope directly affect the graphed lines.
- Graph functions in various ways, such as using ordered pairs, using the equation, working with intercepts.
- Graph different forms of linear equations, such as point-slope, slope intercept, and standard form
- Graph linear functions in slope-intercept form and identify the importance of the m and b variables.
- Write linear equations given certain information, such as 2 points, or a point and a slope, or the slope and y -intercept, or based on a given graph.
- Convert equations into different forms including standard, slope-intercept, and point-slope.
- Identify the relationship between the slopes of parallel and perpendicular lines and write their equations.
- Identify arithmetic and geometric sequences.
- Write the recursive or explicit formula given specific information about the sequence and convert between the two.
- Graph sequences as discrete functions on the coordinate plane, comparing linear and exponential models.
- Find a specific term in a sequence based on a formula or other given terms of an arithmetic or geometric sequence.
- Write arithmetic and geometric sequences both recursively and with an explicit formula.

Unit 5: Inequalities and Systems of Linear Equations and Linear Inequalities

Description: Unit 5 will focus on solving one-variable inequalities, including compound inequalities, absolute value equations and inequalities, as well as linear systems of equations and inequalities. Students will demonstrate the ability to solve these both algebraically and graphically and to apply these concepts to real-world graphing of systems of equations and inequalities.

Skills to be demonstrated:

- Solve one variable inequalities using 1-step, 2-step, and multi-step processes.
- Manipulate compound inequalities with one variable and arrive at 2 distinct answers.
- Graph the solutions to a linear inequality in two variables as a half-plane and interpret whether specified combinations of variables are or are not solutions.
- Solve absolute value equations and inequalities, giving answers in graph and algebraic form.
- Solve a system of equations graphically.
- Solve a system of equations using algebraic methods including elimination and substitution.
- Explain why the x-coordinates of the points where the graphs of linear functions $f(x)$ and $g(x)$ intersect are the solutions of the equation $f(x) = g(x)$.
- Determine whether a system is dependent or independent, consistent or inconsistent.
- Solve a simple system of equations consisting of a linear equation and a quadratic equation in two variables both algebraically and graphically.
- Graph the solution set to a system of linear inequalities in two variables.
- Model and solve real-world problems involving systems of equations.

Unit 6: Polynomials

Description: Unit 6 will focus on applying computational math skills to polynomial expressions, factoring and expanding polynomials, and recognizing special forms of polynomial expressions. Students will extend their understanding of like-terms while combining and factoring polynomials and expanding factored polynomials.

Skills to be demonstrated:

- Add, subtract, multiply, divide monomials.
- Add, subtract, multiply polynomials.
- Understand rational exponents and convert between exponential and radical forms.
- Use the properties of exponents to rewrite expressions involving rational exponents.
- Recognize multiplication patterns when squaring binomials or finding the product of a sum and difference.
- Factor binomials, trinomials, and polynomials using a variety of methods.

Unit 7: Quadratic Equations and Functions

Description: Unit 7 will focus on finding the roots of quadratic functions using factoring, completing the square, and the quadratic formula. Students will solve and graph quadratic functions and identify key features of the graph of a quadratic function.

Skills to be demonstrated:

- Recognize quadratic functions and based on the equation, identify important information including vertex, axis of symmetry, and whether the function has a maximum or minimum value.
- Find the maximum or minimum value of a quadratic function.
- Solve quadratic equations by inspection, taking the square roots, completing the square, the quadratic formula, and factoring as appropriate. Recognize when the quadratic formula gives complex solutions.
- Graph a quadratic function using x-intercepts and vertex.
- Graph quadratic functions that have no real solutions or repeated solutions.
- Identify when a quadratic function has irrational roots and graph the function using estimation.
- Explain why the x-coordinates of the points where the graphs of non-linear functions $f(x)$ and $g(x)$ intersect are the solutions of the equation $f(x) = g(x)$.
- Recognize the correlation between linear factors, zeros of a function, and the intercepts on the graph of a quadratic function.
- Model and solve real-world problems involving quadratic functions (for example, maximize area and physics.)

Unit 8: Radical Expressions and Functions

Description: Unit 8 will focus on simplifying and performing computation with radical expressions, solving radical equations, and using direct and inverse variation. Students will apply previously learned skills to solving radical equations and identify extraneous solutions. Students will apply these skills to solve real world applications of radicals and variation problems.

Skills to be demonstrated:

- Add, subtract, multiply and divide radical expressions.
- Simplify radical expressions.
- Solve radical equations with variables on one or both sides, eliminating extraneous solutions.
- Solve real world problems involving radicals.
- Identify the constant of variation relating to direct and inverse variation.
- Write an equation representing direct or inverse variation that matches a given set of data.
- Solve real world problems involving direct and indirect variation.