



# ALGEBRA II A

## CURRICULUM OUTLINE

2013 - 2014

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### **OVERVIEW:**

1. Linear Equations and Inequalities
  2. Polynomial Expressions and Equations
  3. Rational Expressions and Equations
  4. Radical Expressions and Equations
  5. Introduction to Functions – Notation and Terminology, Graphs, and Applications
  6. Linear Functions and Applications
  7. Quadratic Functions and Applications
  8. Functions Part II – Transformations, Compositions, Inverses
  9. Exponential and Logarithmic Functions
  10. Univariate Statistics and the Normal Distribution
  11. Unit Circle Trigonometry
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### **OUTLINE:**

Notes: Each class is 50 minutes and meets 4 times per week.  
Time frames are approximate and include assessments.  
Asterisks (\*) indicate optional topics.

### **Quarter 1**

#### **UNIT 1: LINEAR EQUATIONS AND INEQUALITIES**

Approx. 9 classes

1. Solve linear equations (with an emphasis on equations that involve clearing fractions and decimals) including equations that have no solution or are consistent.
2. Solve for a specified variable given a formula (literal equations) including equations that require factoring out desired variable.
3. Know and use properties of real numbers, including associative, commutative, distributive, inverse, identity and closure properties.
4. State all number systems to which a real number belongs.



## Quarter 2

### **UNIT 4: RADICAL EXPRESSIONS AND EQUATIONS**

Approx. 8 classes

1. Simplify radical expressions with both numeric and variable radicands.
2. Add, subtract, multiply and divide radical expressions with both numeric and variable radicands.
3. Simplify algebraic expressions with rational exponents.
4. Solve radical equations.
5. Simplify algebraic expressions with complex numbers.
6. Add, subtract, multiply and divide complex numbers.

### **UNIT 5: INTRODUCTION TO FUNCTIONS**

Approx. 10 classes

1. Determine whether a relation (expressed verbally, as a list of ordered pairs, as a mapping, or as a graph) is a function or a one-to-one function.
2. Find the domain and range of a function expressed as a list of ordered pairs or as a graph.
3. Given the equation of a function,  $f(x)$  and a real number  $k$ , find  $f(k)$ , the zeros of the function, or all  $x$  such that  $f(x) = k$ .
4. Given the graph of a function, find,  $f(x)$  and a real number  $k$ , find  $f(k)$ , the zeros of the function, or all  $x$  such that  $f(x) = k$ , intervals on which the functions is positive or negative, and relative extrema.
5. Find the domain of a function given its equation or graph.
6. Graph a function using a table of values given its equation.
7. Graph common parent graphs (by hand) including  $f(x) = k$ ,  $f(x) = x$ ,  $f(x) = x^2$ ,  $f(x) = x^3$ ,  $f(x) = \sqrt{x}$ ,  $f(x) = |x|$ , and  $f(x) = \lfloor x \rfloor$ . Given graphs of common parent graphs, state the equation for the function.
8. Use a graphing calculator to perform basic operations, graph functions, set windows appropriately, use table functions to determine values, find extrema, zeros and values.
9. Given the equation of a function that models an application, identify independent and dependent variables, answer questions about the function (find values), graph the function with the assistance of a graphing calculator, find domain, range, local extrema, zeros and intercepts and relate them to the context of the problem.

## UNIT 6: LINEAR FUNCTIONS AND APPLICATIONS

Approx. 15 classes

1. Find the distance, midpoint, and slope using the correct formulas of a line segment given its endpoints.
2. Determine the slope of a line from its graph and give an interpretation of slope as a rate of change between the independent and dependent variables given the equation, situation, or graph of the linear relationship.
3. Graph a line given its equation in any form and find the equation of a line given its graph.
4. Write the equation of a line given two points or point and slope. Express the equation in point-slope form, slope-intercept form, double-intercept form and standard form.
5. Find the  $x$ - and  $y$ - intercepts of a line.
6. Determine if two lines are parallel or perpendicular.
7. Find the equation of line that is parallel or perpendicular to another line given the line and the point it passes through.
8. Given a verbal description of a linear application, model the situation with a linear function and answer questions about the function, including an interpretation of slope in the context of the problem. Graph the function over an appropriate domain.
9. Solve a system of equations, in two or three variables, using graphs, substitution or elimination.
10. Solve applications of linear systems problems by modeling the situation with and solving an appropriate linear system.
11. Graph linear inequalities and systems of linear inequalities.
12. Given a set of linearly related bi-variate data:
  - a. construct a scatterplot both manually and with a graphing calculator,
  - b. interpret a scatterplot for shape, strength, direction, clusters and outliers,
  - c. find the line of best fit (both a manual estimation and using a graphing calculator),
  - d. interpret slope in the context of the problem,
  - e. find and interpret the correlation coefficient using a graphing calculator,
  - f. use the calculator to make predictions, and
  - g. distinguish between interpolative and extrapolative predictions.

### Quarter 3

#### **UNIT 7: QUADRATIC FUNCTIONS AND APPLICATIONS**

Approx. 8 classes

1. Solve quadratic equations using factoring, completing the square and quadratic formula.
2. Given a quadratic function in either standard form or vertex form, find the axis-of-symmetry, vertex, zeros, and y-intercept and graph using an appropriate table-of-values.
3. State the effect of the leading coefficient on the shape of the parabola.
4. Calculate the discriminant of a quadratic function or quadratic equation and use it to determine the number and nature of the zeros or roots.
5. Write a quadratic equation for a given pair of roots using their sum and product.
6. Write a quadratic function in standard form given its equation in vertex form and vice versa, using the completing the square method.
7. Write the equation of a quadratic function in vertex form or standard form given its vertex and a point, its zeros and a point, or three points.
8. Solve quadratic inequalities.
9. Graph quadratic inequalities and systems of quadratic inequalities.
10. Solve quadratic-linear systems both algebraically and graphically.
11. Solve applied maximum/minimum problems that can be modeled with a quadratic function.
12. Model and solve vertical motion problems.
13. Find the best fit model of a set of quadratically related bi-variate data using a graphing calculator.

#### **UNIT 8: FUNCTIONS – PART II**

Approx. 10 classes

1. Perform vertical and horizontal transformations of common parent graphs and general function graphs (i.e., given  $y = f(x)$ , graph  $y = f(x-h) + k$ .) Also, given a function and a translation of that function, state the equation of the translation.
2. Perform reflections of common parent graphs and general function graphs (i.e., given  $y = f(x)$ , graph  $y = -f(x)$ ,  $y = f(-x)$ , and  $y = |f(x)|$ ). Also, given a function and a reflection of that function, state the equation of the reflection.
3. Perform non-rigid transformations of common parent graphs and general function graphs (i.e., given  $y = f(x)$ , graph  $y = f(kx)$ , and  $y = kf(x)$ ).
4. Evaluate a piecewise function for a given value, find the domain of a piecewise function from its definition, and graph.

5. Perform operations on functions:  $(f + g)(x)$ ,  $(f - g)(x)$ ,  $(f \cdot g)(x)$ , and  $\left(\frac{f}{g}\right)(x)$  and state the domain of the resulting function. Given graphs of two functions, graph the sum or difference of the functions.
6. Find the composition of two or more functions at a given value and the equation of its composition, algebraically, graphically and from a table. Write a given function as a composition of multiple functions.
7. Find inverses of functions including those with restricted domains. Determine if a given function has an inverse by determining if the function is a one-to-one function using the horizontal line test. Recognize that functions and their inverses are reflections over the line  $y=x$ . Determine if two functions are inverses of each other.

**UNIT 9: EXPONENTIAL AND LOGARITHMIC FUNCTIONS**

Approx. 10 classes

1. Simplify algebraic expressions using exponent rules.
2. Graph exponential functions of the form  $f(x) = ab^x$  and transformations of exponential functions (including the natural exponential function and its transformations). State the domain and range of an exponential function or its transformation.
3. Evaluate expressions containing the number,  $e$ . Identify  $e$  as an irrational number and define  $e$ .
4. Write a logarithmic equation in exponential form, and vice versa.
5. Evaluate logarithmic expressions including common and natural logarithms.
6. Graph logarithmic functions and their transformations (including common and natural logarithmic functions).
7. Use rules of logarithms to manipulate logarithmic expressions.
8. Solve exponential equations with like and unlike bases.
9. Solve logarithmic equations and evaluate logs in different bases using change of base formula.
10. Given a verbal description of an exponential growth or decay relationship (fixed or continuous compounding):
  - a. model the relationship with an equation;
  - b. graph the function over an appropriate domain (manually and with a graphing calculator); and
  - c. use the equation to answer various questions about the problem.

11. Use a graphing calculator to find an exponential function that best fits data given a set of bi-variate data with an approximate exponential relationship. Give an interpretation of the parameters of the model in the context of the problem.
12. Solve problems involving applications of logarithms using a given model.

#### **Quarter 4**

#### **UNIT 10: UNIT CIRCLE TRIGONOMETRY**

Approx. 9 classes

1. Draw an angle in standard form given its measure in radians or degrees and convert angle from radians to degrees and vice versa.
2. Work with angles in degrees-minutes-seconds form.
3. Find an angle co-terminal with another angle given its measure in radians or degrees.
4. Use side relationships in 30-60-90 and 45-45-90 triangles to find sides of triangles or evaluate sine and cosine on the unit circle.
5. Find the value of all six trigonometric functions for any angle with a 30, 45, 60, or 90 degree reference angle.
6. Find the area and arc length of sectors of a circle and solve problems related to circle sectors.
7. Given a value for one trigonometric function, find the values of all other six functions.
8. Evaluate inverse trigonometric functions for standard angles (including knowing the restrictions for the angles for each function).
9. Use a calculator to find approximations of trigonometric functions and their inverses.
10. Solve simple trigonometric equations over a specified interval.

#### **UNIT 11: UNIVARIATE STATISTICS AND THE NORMAL DISTRIBUTION**

Approx. 12 classes

1. Define and recognize a data set, discrete variable, continuous variables, and categorical variables, and quantitative variables.
2. Define sample and population.
3. Use a calculator to generate a simple random sample.
4. Recognize that some methods of data collection can introduce bias into a study – response bias, question wording, voluntary samples.
5. Construct dot plots, stem and leaf plots, and histograms for single-variable data.

6. Interpret dot plots, stem and leaf plots, and histograms for shape, skewing, center, spread and outliers.
7. Calculate the mean, range, and standard deviation for a set of data. Give an interpretation of the standard deviation.
8. Calculate quartiles, percentiles, and construct a five-number summary and a box-plot for a set of single-variable data.
9. Use a calculator to construct histograms, box plots, and calculate single-variable statistics.
10. State the properties of a normal distribution.
11. Given the mean and standard deviation of a normally distributed variable find the proportion of data that is below, above or between specific values, using a graphing calculator.
12. Fundamental Counting Principles
13. Permutations
14. Combinations
15. Sample Space & Events with Probability