

Honors Algebra 2 Curriculum

Chambersburg Area School District

Course Map Timeline (40 min classes) 2016

Units	Suggested Days
*Note: unit numbers are for reference only and do not indicate the order in which concepts need to be taught	
Unit 1: Applications of Linear Functions The concepts within this unit are a review of algebra 1. Teachers should give a pre-test to determine how much time to take on each concept.	15 Days
Unit 2: Quadratic Functions	25 Days
Unit 3: Polynomial Functions	25 Days
Unit 4: Exponential and Logarithmic Function	20 Days
Unit 5: Rational and Radical Functions	25 Days
Unit 6: Properties and Attributes of Functions	15 Days
Unit 7: Probability	10 Days
Unit 8: Data Analysis & Statistics	10 Days
Unit 9: Sequences & Series	25 Days

Topic: Unit 1 Applications of Linear Functions

Subject(s): Math

Days: 15

Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- **Review and extend the concepts of linear functions, inequalities and systems from Algebra 1.**

Unit Essential Question(s):

- **How can linear functions be used to interpret data and find solutions?**
- **How do we create and solve systems of linear equations and inequalities?**

Concept:	Concept:	Concept:
Linear Functions and Inequalities	Rewriting Formulas	Systems of Equations and Inequalities
CC.2.4.HS.B.2, CC.2.4.HS.B.3, CC.2.2.HS.D.8, CC.2.2.HS.D.10	CC.2.2.HS.D.8	CC.2.4.HS.D.8, CC.2.4.HS.D.10
Lesson Essential Question(s): How do we solve linear equations and inequalities? (ET) How do we distinguish a function from a relation? (ET) How do we graph equations and inequalities? (ET) How do we derive the equation of a line? (ET) How can we fit scatter plot data using linear functions with and without technology? (ET) How do we use linear models to make predictions? (ET)	Lesson Essential Question(s): How can we use the algebraic process to solve a formula for a given variable? (ET) How do we write the equation of a line in slope-intercept, point-slope and standard form? (A) How can we rewrite the equation of a line in standard form? (A)	Lesson Essential Question(s): How are the techniques of substitution, linear combination and graphing used to solve a system of linear equations? (ET) How do we determine the best method to use when solving a linear system? How do we solve a system of linear inequalities? (A)
Vocabulary: Relation, function, domain, range, mapping diagram, vertical line test, independent variable, dependent variable, function notation, x-intercept, y-intercept, standard form, point-slope form, slope-intercept form, Regression, no correlation, linear model, scatterplot, line of best fit, correlation	Vocabulary: Variable, formula	Vocabulary: Equivalent systems, linear combination, substitution, elimination, parallel lines, coinciding lines, linear programming, feasible region, vertices, constraints, objective function, optimization, boundary line

Topic: Unit 2 Quadratic Functions
Subject(s): Math

Days: 25
Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- **Extend the factoring concepts learned in Algebra 1 to analyze, graph and solve quadratic functions.**

Unit Essential Question(s):

- **How can we use quadratic functions to represent, analyze and solve real-life problems?**
- **How are complex numbers reflected in quadratic functions?**

Concept:	Concept:	Concept:
Graphing Quadratic Functions	Methods of Factoring	Solving Quadratic Equations
CC.2.2.HS.C.1, CC.2.2.HS.C.2, CC.2.2.HS.C.4, CC.2.2.HS.D.7	CC.2.2.HS.D.2, CC.2.2.HS.D.3, CC.2.2.HS.D.5	CC.2.2.HS.C.2, CC.2.2.HS.D.2, CC.2.2.HS.D.5, CC.2.2.HS.D.7, CC.2.2.HS.D.8, CC.2.2.HS.D.9, CC.2.2.HS.D.10, CC.2.1.HS.F.6
Lesson Essential Question(s): How do we transform a quadratic function? (A) How do we describe the effects of changes in the coefficients of a quadratic function in vertex form? (A) How do we define, identify and graph quadratic functions? (A) How can we use maximums and minimums to solve problems? (A) How can we find the domain and range of quadratic functions? (A)	Lesson Essential Question(s): How do we factor a quadratic when it has a greatest common factor? (ET) How do we factor special forms of a quadratic (difference of squares, difference of cubes, sum of cubes)? (A) How do we factor a trinomial when a = 1? When a > 1? (A) What strategies can we use to factor a polynomial that has more than three terms? (A)	Lesson Essential Question(s): What methods can be used to solve a quadratic equation? (A) How do the solutions of quadratic equations relate to the graph of a quadratic functions? (A) How can we determine a quadratic function from its roots? (A) How can we solve quadratic equations by completing the square? (A) How do we write quadratic equation in vertex form? (ET) How do we use the Quadratic Formula to solve quadratic equations? (ET) How do we classify roots using the discriminant? (A)
Vocabulary: Quadratic function, parabola, vertex of a parabola, vertex form, axis of symmetry, standard form, minimum value, maximum value	Vocabulary: Term, standard form, coefficient, GCF, binomial, trinomial, polynomial, perfect square, perfect cube, grouping, degree	Vocabulary: Zero of a function, root of an equation, binomial, trinomial, completing the square, discriminant

Concept:	Concept:
Operations with Complex Numbers and Roots	Curve Fitting with Quadratic Models
CC.2.2.HS.D.8, CC.2.1.HS.F.6	CC.2.2.HS.C.1, CC.2.2.HS.C.2, CC.2.2.HS.C.3, CC.2.2.HS.C.6, CC.2.2.HS.D.7, CC.2.2.HS.D.9, CC.2.2.HS.D.10, CC.2.1.HS.F.3, CC.2.1.HS.F.4, CC.2.1.HS.F.5, CC.2.1.HS.F.7
Lesson Essential Question(s): How are complex and imaginary numbers defined and used? (A) How do we solve quadratic equations with complex roots? (ET) What do complex solutions tell us about the graph of a quadratic function? (A) How do we perform operations with complex numbers? (A)	Lesson Essential Question(s): How do we use quadratic functions to model real-world data? (A) How can we use quadratic models to analyze and predict real-world data? (A)
Vocabulary: Imaginary unit, imaginary number, complex number, real part, imaginary part, complex conjugate, complex plane, absolute value of a complex number	Vocabulary: Quadratic model, quadratic regression

Topic: Unit 3 Polynomial Functions
Subject(s): Math

Days: 25
Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- **Write, solve, and graph polynomial functions and equations and use them to model relationships between quantities.**

Unit Essential Question(s):

- **How do we analyze, evaluate, and graph polynomial functions?**

Concept:	Concept:	Concept:
Polynomials and Polynomial Operations	Factoring Polynomials	Roots of Polynomial Functions
CC.2.2.HS.C.2, CC.2.2.HS.D.2, CC.2.2.HS.D.3, CC.2.2.HS.D.5	CC.2.2.HS.D.2, CC.2.2.HS.D.3, CC.2.2.HS.D.5	CC.2.2.HS.D.4, CC.2.2.HS.D.5, CC.2.2.HS.D.8, CC.2.2.HS.D.9, CC.2.2.HS.D.10
Lesson Essential Question(s): How do we identify, evaluate, add and subtract polynomials? (A) How do we classify and graph polynomials? (A) How do we multiply polynomials? (A) How do we use binomial expansion? (A) How do we use long division and synthetic division to divide polynomials? (A)	Lesson Essential Question(s): What methods can be used to factor a polynomial? (A) How can we use special patterns of polynomials to factor? (A) How can we solve a polynomial by factoring? (A)	Lesson Essential Question(s): How do we identify the multiplicity of roots? (A) How can we use to Rational Root Thm. And the Irrational Root Thm. to solve polynomial equations? (A) What is the Fundamental Thm. of Algebra and how use it to write polynomial equations? (A) How do we identify all the roots of a polynomial equation? (A)
Vocabulary: Synthetic division	Vocabulary:	Vocabulary: multiplicity

Concept:	Concept:
Investigating Graphs of Polynomial Functions	Curve Fitting with Polynomial Models
CC.2.2.HS.C.1, CC.2.2.HS.C.2, CC.2.2.HS.C.3, CC.2.2.HS.C.4, CC.2.2.HS.C.6, CC.2.2.HS.D. 4, CC.2.2.HS.D.7, CC.2.1.HS.F.3, CC.2.1.HS.F.7	CC.2.2.HS.C.3, CC.2.2.HS.C.6, CC.2.2.HS.D.7, CC.2.1.HS.F.3
Lesson Essential Question(s): How can we use properties of end behavior to analyze, describe and graph polynomial functions? (A) How can we use maxima and minima of polynomial functions to solve problems? (A) How can we transform polynomial functions? (A)	Lesson Essential Question(s): How can we use finite differences to determine the degree of a polynomial that will best fit data? (A) How can we use technology to find polynomial models for given sets of data? (A)
Vocabulary: End behavior, turning point, local maximum, local minimum	Vocabulary:

Topic: Unit 4 Exponential and Logarithmic Functions
 Subject(s): Math

Days: 20
 Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- **Graph exponential functions and their applications to growth and decay. Logarithmic functions are the inverses of exponential functions.**

Unit Essential Question(s):

- **What are the relationships between exponents, logarithms, exponential functions and logarithmic functions?**
- **How are these relationships useful?**

Concept:	Concept:	Concept:
Exponential Functions: Growth & Decay	Inverses of Relations & Functions	Logarithmic Functions
CC.2.2.HS.C.2, CC.2.2.HS.C.3, CC.2.2.HS.C.6, CC.2.1.HS.D.2, CC.2.2.HS.D.7, CC.2.1.HS.F.1, CC.2.2.HS.F.3	CC.2.2.HS.C.4, CC.2.2.HS.D.8, CC.2.2.HS.D.9, CC.2.2.HS.D.10	CC.2.2.HS.C.2, CC.2.2.HS.C.6, CC.2.1.HS.D.2, CC.2.2.HS.D.7, CC.2.2.HS.D.8 CC.2.1.HS.F.1, CC.2.1.HS.F.3
Lesson Essential Question(s): How can we write, evaluate, and graph exponential expressions to model growth and decay situations? (A) What are the similarities and differences between exponential growth and decay functions? (A) How do we model real-world data using growth and decay functions? (A)	Lesson Essential Question(s): How can we recognize inverses of relations and functions? (A) How do we find the inverse of a functions? (A) How do the graphs of functions and their inverses compare? (A)	Lesson Essential Question(s): How do we write equivalent forms of exponential and logarithmic functions? (A) How can we evaluate logarithmic functions? (A) What are the characteristics of the graph of a logarithmic function? (A) How can we simplify logarithmic expressions? (A) How do we translate between logarithms in any base? (A)
Vocabulary: Exponential function, base, asymptote, exponential growth, exponential decay	Vocabulary: Inverse relation, inverse function	Vocabulary: Logarithm, common logarithm, logarithmic function

Concept:	Concept:	Concept:
Exponential & Logarithmic Equations	The Natural Base, e	Exponential & Logarithmic Functions/Models
CC.2.2.HS.D.2, CC.2.2.HS.D.8, CC.2.2.HS.D.9, CC.2.2.HS.D.10, CC.2.1.HS.F.1	CC.2.2.HS.C.2, CC.2.2.HS.C.6, CC.2.1.HS.D.2, CC.2.1.HS.D.7, CC.2.1.HS.F.1, CC.2.1.HS.F.3	CC.2.2.HS.C.4, CC.2.2.HS.C.5, CC.2.2.HS.C.6, CC.2.1.HS.D.2, CC.2.2.HS.D.7, CC.2.2.HS.D.9, CC.2.2.HS.D.10, CC.2.1.HS.F.1, CC.2.1.HS.F.3, CC.2.1.HS.F.4, CC.2.1.HS.F.5.
Lesson Essential Question(s): How do we solve exponential equations? (A) How do we solve logarithmic equations? (A) What relationship do exponential and logarithmic equations have? (A)	Lesson Essential Question(s): What is the number e ? (A) How do we use the number e to write and graph exponential functions in real-world scenarios? (A) How can we solve problems involving e or natural logarithms? (A)	Lesson Essential Question(s): How can we transform exponential and logarithmic functions by changing parameters? (A) How can we describe the effect of changes to exponential and logarithmic functions? (A) How can we model real-world data using exponential and logarithmic functions? (A) How can we use exponential and logarithmic models of analyze and predict? (A)
Vocabulary: Exponential equation, logarithmic equation	Vocabulary: Natural logarithm, natural logarithmic function	Vocabulary: Exponential regression, logarithmic regression

Topic: Unit 5 Rational and Radical Functions
Subject(s): Math

Days: 25
Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- Operations with rational expressions follow the same rules as operations with fractions. Graphs of rational functions and solutions of rational equations have some unique features that relate to the denominator.**

Unit Essential Question(s):

- What are the characteristics of rational functions and how do they apply to real-life problems?**

Concept:	Concept:	Concept:
Variation Functions	Operations with Rational Expressions	Rational Functions & Equations
CC.2.2.HS.D.8, CC.2.2.HS.D.10	CC.2.2.HS.D.2, CC.2.2.HS.D.3, CC.2.1.HS.F.1	CC.2.2.HS.C.4, CC.2.2.HS.C.6, CC.2.2.HS.D.8, CC.2.2.HS.C.9, CC.2.2.HS.C.10
Lesson Essential Question(s): What is direct, inverse, joint and combined variation? (A) How do we solve problems involving them? (A)	Lesson Essential Question(s): How can we simplify rational expressions? (A) How do we multiply and divide rational expressions? (A) How do we add and subtract rational expressions? (A) How do we simplify complex fractions? (A)	Lesson Essential Question(s): How do we graph rational functions? (A) How do we transform rational functions? (A) How do we solve rational equations? (A)
Vocabulary: Direct variation, constant of variation, joint variation, inverse variation, combined variation	Vocabulary: Rational expression, complex fraction	Vocabulary: Rational function, discontinuous function, continuous function, hole (in a graph), rational equation, extraneous solution

Concept:	Concept:
Radical Expressions & Rational Exponents	Radical Functions & Equations
CC.2.1.HS.D.2, CC.2.2.HS.D.6, CC.2.1.HS.F.1	CC.2.2.HS.C.4, CC.2.2.HS.C.6, CC.2.2.HS.D.7, CC.2.2.HS.D.8, CC.2.2.HS.C.9, CC.2.2.HS.C.10
Lesson Essential Question(s): How can we rewrite radical expressions using rational exponents? (A) How do we simplify radical expressions and expressions containing rational exponents? (A) How do we evaluate radical expressions and expressions containing rational exponents? (A)	Lesson Essential Question(s): How do we graph radical functions? (A) How do we transform radical functions? (A) How do we solve radical equations? (A)
Vocabulary: Index, rational exponent	Vocabulary: Radical function, square-root function, radical equation

Topic: Unit 6 Properties and Attributes of Functions
Subject(s): Math

Days: 15
Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- **Functions can be represented in a variety of ways that can be used to model real-world data.**

Unit Essential Question(s):

- **What are the different ways that functions can be represented?**

Concept:	Concept:	Concept:
Multiple Representations of Functions	Operations with Functions	Functions and Their Inverses
CC.2.2.HS.C.2, CC.2.2.HS.C.4, CC.2.2.HS.C.5, CC.2.2.HS.D.7	CC.2.2.HS.C.4, CC.2.2.HS.D.2, CC.2.2.HS.D.3, CC.2.1.HS.F.1	CC.2.2.HS.C.1, CC.2.2.HS.C.4
Lesson Essential Question(s): How do we translate between various representations of functions? (A) How can we solve problems using these representations? (A) How can we compare the properties of two functions? (A) How can we estimate and compare rates of change? (A) How can we write and graph piecewise functions? (A) How do we use piecewise functions to model real-world situations? (A)	Lesson Essential Question(s): How do we transform a function? (A) How do we recognize a transformation of a function? (A) How do we add, subtract, multiply and divide functions? (A) How do we write and evaluate composite functions? (A)	Lesson Essential Question(s): How do we determine whether the inverse of a function is a function? (A) What are the rules for inverses of functions? (A) How do we prove two functions are inverses of each other? (A)
Vocabulary: Piecewise function, step function	Vocabulary: Composition of functions	Vocabulary: One-to-one function

Concept:
Modeling Real-World Data
CC.2.2.HS.C.6, CC.2.2.HS.D.10, CC.2.1.HS.F.3, CC.2.1.HS.F.4, CC.2.1.HS.F.5
Lesson Essential Question(s): How do we apply functions to real-world situations? (A) How can we use mathematical models to make predictions? (A) Why is it important to be able to make predictions about data? (A)
Vocabulary:

Topic: Unit 7 Probability
Subject(s): Math

Days: 10
Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- **Probability can be used to calculate the likelihood of an event.**

Unit Essential Question(s):

- **How can the concepts of probability be used to solve real-world problems?**
- **How can tables and diagrams be used to find the probabilities of compound events?**

Concept:	Concept:	Concept:
Permutations & Combinations	Theoretical & Experimental Probability	Independent, Dependent and Compound Events
CC.2.4.HS.B.6	CC.2.4.HS.B.6	CC.2.4.HS.B.6, CC.2.4.HS.B.7
Lesson Essential Question(s): How do we solve problems using the Fundamental Counting Principle? (A) How do we decide when to use a permutation versus a combination? (A) How do we solve problems involving permutations and combinations? (A)	Lesson Essential Question(s): How do we find the theoretical probability of an event? (A) How do we find the experimental probability of an event? (A) What is the difference between theoretical and experimental probability? (A)	Lesson Essential Question(s): How do we determine whether an event is dependent or independent? (A) How do we find the probability of dependent and independent events? (A) How do we find the probability of mutually exclusive events? (A) How do we find the probability of inclusive events? (A)
Vocabulary: Fundamental Counting Principle, permutation, combination, factorial	Vocabulary: Probability, outcome, sample space, event, equally likely outcomes, favorable outcomes, theoretical probability, complement, geometric probability, experiment, trial, experimental probability	Vocabulary: Independent events, dependent events, conditional probability, simple event, compound event, mutually exclusive events, inclusive events

Topic: Unit 8 Data Analysis and Statistics
 Subject(s): Math

Days: 10
 Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- **Statistical methods can give meaning to real-world data.**

Unit Essential Question(s):

- **How can statistics be used to solve real-world problems?**

Concept:	Concept:	Concept:
Measures of Central Tendency & Variation	Data Gathering	Surveys, Experiments, and Observational Studies
CC.2.4.HS.B.2	CC.2.4.HS.B.2, CC.2.4.HS.B.3, CC.2.4.HS.B.4, CC.2.4.HS.B.5	CC.2.4.HS.B.2, CC.2.4.HS.B.3, CC.2.4.HS.B.4, CC.2.4.HS.B.5
Lesson Essential Question(s): What are the measures of central tendency? (ET) How can we find measures of central tendency and measures of variation for statistical data? (A) How do outliers effect statistical data? (A)	Lesson Essential Question(s): How can random samples be used to make inferences about a population? (A) How do we use probability to analyze decisions and strategies? (A)	Lesson Essential Question(s): What are the commonalities and differences between surveys, experiments, and observational studies? (A) How can we use simulations and hypothesis testing to compare treatments from a randomized experiment? (A)
Vocabulary: Expected value, probability distribution, variance, standard deviation, outlier	Vocabulary: Population, census, sample, random sample, biased sample, statistic, parameter	Vocabulary: Experiment, observational study, controlled experiment, control group, treatment group, randomized comparative, experiment, hypothesis testing, null hypothesis

Topic: Unit 9 Sequences and Series
Subject(s): Math

Days: 25
Grade(s): 9th, 10th, 11th, 12th

Key Learning:

- Explore basic concepts of arithmetic and geometric sequences and series.

Unit Essential Question(s):

- How can sequences and series be used to model real-life situations?

Concept:	Concept:	Concept:
Sequences, Series and Summation Notation	Arithmetic Sequences and Series	Geometric Sequences and Series
CC.2.2.HS.C.1	CC.2.2.HS.C.1	CC.2.2.HS.C.1, CC.2.1.HS.F.1
Lesson Essential Question(s): How do we find the n th term of a sequence? (A) How can we develop rules for sequences? (A) What is sigma notation? (A) How do we evaluate the sum of a series expressed in sigma notation? (A)	Lesson Essential Question(s): How can we find the terms of an arithmetic sequence? (A) How do we find the sums of arithmetic sequences? (A) How do we determine if a sequence or series is arithmetic? (A) What is the difference between a sequence and a series? (A)	Lesson Essential Question(s): How do we find the terms of a geometric sequence? (A) How do we find the sum of a geometric series? (A) How do we find the sum of an infinite geometric series? (A) How can we use mathematical induction to prove statements? (A)
Vocabulary: Sequence, term of a sequence, infinite sequence, finite sequence, recursive formula, explicit formula, iteration, series, partial sum, summation notation	Vocabulary: Arithmetic sequence, arithmetic series	Vocabulary: Geometric sequence, geometric mean, geometric series, infinite geometric series, converge, limit, diverge, mathematical induction