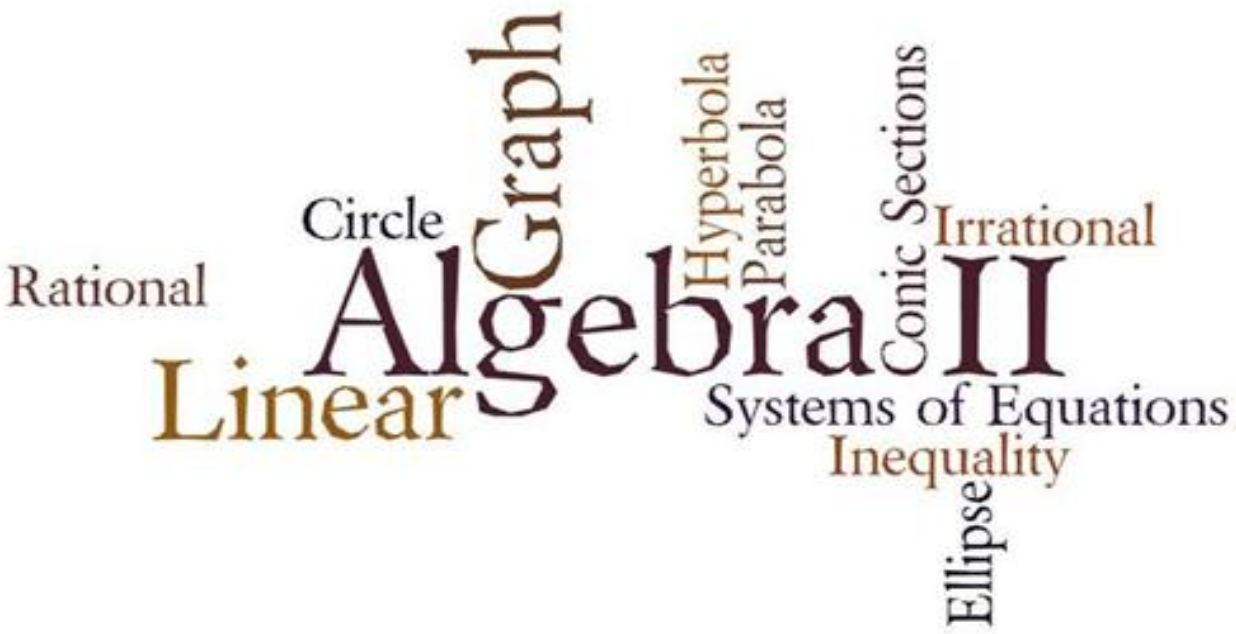
Algebra II Toolkit



A. Algebra II Course Description, Instructional Resources and Standards

I. Algebra II

II. Algebra II Honors

B. Course Maps and Sample Course Pacing Guides

I. Algebra II Sample Course Pacing Guides

C. Algebra II Assessment Assistance

I. Test Item Specifications
(The Specifications are a resource that defines the content and format of the Algebra II EOC.)

II. Diagnostic and Assessment Development Tool – Item Bank Test Platform (IBTP)
(Note: Single Sign On log in information is required.)

III. Accommodations for Florida's Statewide Student Assessments
(FDOE Bureau of Exceptional Education and Student Services)

Suggested Teacher Supplies	Suggested Student Supplies & Materials
Two-Pan Algebra Balance Hands-on Algebra kit with tiles Scientific or graphing calculator Number cubes Electronic spreadsheets Geogebra https://www.geogebra.org/ (free download) and/or other geometry cad software National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/vlibrary.html (use Internet Explorer) Free virtual calculators http://www.meta-calculator.com/online/?panel-201-calculator http://www.calculator.org/jcalc98.aspx http://www.alcula.com/simplecalc.php	Electronic spreadsheets Geogebra https://www.geogebra.org/ (free download) and/or other geometry cad software (classroom & home use) National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/vlibrary.html (use Internet Explorer) Pencils/pens/colored pencils Folder with prongs or three-ring binder with dividers Erasers/cap erasers Composition notebooks/notebook paper/spiral notebooks Graph paper/ notebooks with graph paper Ruler Scientific or graphing calculator Free virtual calculators (classroom & home use)

★ Denotes Math Florida Standards for Modeling

Modeling standards are marked with a star/asterisk at the end of the standard. This denotes that it is a modeling standard from the ***Modeling*** conceptual category. Modeling is best interpreted not as a collection of isolated topics but in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★). It is important to note that there are 61 specific modeling standards throughout the high school standards. Look for a star/asterisk in the course descriptions to delineate. For more information regarding modeling standards please click on the star.

Standard: MAFS.912.A-APR.1.1. Also Assesses: MAFS.912.A-APR.3.4

MAFS.912.A-APR.1.1: Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
MAFS.912.A-APR.3.4: Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Special Products of Binomials MAFS.912.A-APR.1.1	In this video, students will learn about two typical polynomial multiplications. First, squaring a binomial and second, product of a sum and difference.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Analyzing Polynomials Identities MAFS.912.A-APR.1.1	In this video, students will learn how to critically analyze polynomial identities and their proofs.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Apply the Closure Property to Set of Elements MAFS.912.A-APR.1.1	In this video, students will learn how to apply the closure property to sets of elements by reviewing sets that are closed and not closed.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Prove Polynomials Identities MAFS.912.A-APR.3.4	In this tasks students will determine whether given polynomial identities are true, and whether given proofs of such identities are valid.	• Internet connection • Computer • Scientific calculator (if necessary)
Trina's Triangles MAFS.912.A-APR.3.4	In this task, students will investigate and ultimately prove the validity of the method of generating Pythagorean Triples that involves the polynomial identity $(x^2+y^2)^2= (x^2–y^2)^2+ (2xy)^2$.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.A-APR.4.6. Also Assesses: MAFS.912.A-APR.2.2

MAFS.912.A-APR.4.6 Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.
MAFS.912.A-APR.2.2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Combined Fuel Efficiency MAFS.912.A-APR.4.6	In this example, fuel efficiency of a car can be analyzed by using rational expressions and operations with rational expressions.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Rewrite Division of Polynomials using Inspection MAFS.912.A-APR.4.6	In this video, students will learn how to rewrite the division of two polynomials by using inspection.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Polynomial Remainder Theorem MAFS.912.A-APR.2.2	In this video, students will use the Polynomial Remainder Theorem to determine whether a linear expression is a factor of a polynomial expression.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Dividing Polynomials MAFS.912.A-APR.2.2	This tutorial can be used to help students practice division of polynomials. Students will recognize that dividing polynomials is similar to simplifying fractions.	• Flash Player • Scientific calculator (if necessary)
Zeroes and Factorization of a General Polynomial MAFS.912.A-APR.2.2	In this task, students are asked to show or verify four theorems related to roots, zeroes and factors of polynomial functions. The Fundamental Theorem of Arithmetic is also mentioned. This task builds on zeroes and factorization of a quadratic function parts I and II.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Zeroes and Factorization of a Non-Polynomial Function MAFS.912.A-APR.2.2	The goal of this task is to show via a concrete example that this property of polynomials is not shared by all functions. The non-polynomial function F given by F(x) =|x| is a familiar function for which property	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

	does not hold. The graph is broken into two parts which do not connect at x=0.	
Zeroes and Factorization of a Quadratic Polynomial I MAFS.912.A-APR.2.2	For a polynomial function *p*, a real number *r* is a root of *p* if and only if *p*(*x*) is evenly divisible by *x*-*r*. This fact leads to one of the important properties of polynomial functions: a polynomial of degree *d* can have at most *d* roots. This is the first of a sequence of problems aiming at showing this fact. Teachers should pay close attention to the logic used in the solution to part (c) where the divisibility of ax^2+bx+c by *x*-*r* is obtained not by performing long division but by using the result of long division of these polynomials; namely, that said division will result in an expression of the following form: $ax^2+bx+c=(x-r)$ l(*x*) +*k* where l is a linear polynomial and *k* is a number.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Zeroes and Factorization of a Quadratic Polynomial II MAFS.912.A-APR.2.2	This task continues zeroes and factorization of a quadratic polynomial I. The argument here generalizes, as shown in zeroes and factorization of a general polynomial to show that a polynomial of degree *d* can have at most *d* roots. In the quadratic case, an alternative argument for why there can be at most two roots can be given using the quadratic formula. This task will help students see more clearly the link between factorization of polynomials and zeroes of polynomial functions. Students who are familiar with the quadratic formula should be encouraged to think about the first solution which extends to polynomials of higher degree where formulas for the roots are either very complex or not possible to find.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

The Missing Coefficient MAFS.912.A-APR.2.2	The purpose of this task is to emphasize the use of the Remainder Theorem (a discussion of which should be considered as a prerequisite for the task) as a method for determining structure in polynomial in equations, and in this particular instance, as a replacement for division of polynomials.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: ★ MAFS.912.A-CED.1.1. Also Assesses: ★MAFS.912.A-REI.1.2 and ★MAFS.912.A-CED.1.4

MAFS.912.A-CED.1.1★ Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions.
MAFS.912.A-REI.1.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MAFS.912.A-CED.1.4★ Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Write and Solve a Quadratic Equation MAFS.912.A-CED.1.1★	In this lesson, students will learn how to write and solve a quadratic equation by examining a scenario with a quadratic relationship.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Write and Solve a Quadratic Inequality MAFS.912.A-CED.1.1★	In this lesson, students will learn how to write and solve quadratic inequalities by examining a scenario with a quadratic relationship.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Write and Solve a Simple Rational Equation MAFS.912.A-CED.1.1★	In this lesson, students will learn how to write and solve a simple rational equation by examining a scenario with a uniform motion.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Equations & Inequalities Word Problems MAFS.912.A-CED.1.1★	Using this resource, students will construct equations or inequalities that models a given context. Modeling expressions can be quadratic, rational, or exponential.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Solving Mixture Problems with Linear Equations MAFS.912.A-CED.1.1★	Mixture problems can involve mixtures of things other than liquids. This video shows how algebra can be used to solve problems involving mixtures of different types of items.	• Internet connection • Speakers/headphones • Compute • Scientific calculator (if necessary)
Solving a Literal Equation MAFS.912.A-CED.1.4	At the conclusion of this video, students will have learned how to solve a literal equation.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Standard: ★MAFS.912.A-CED.1.2. Also Assesses: ★MAFS.912.A-CED.1.3, MAFS.912.A-REI.3.6 and MAFS.912.A-REI.3.7

MAFS.912.A-CED.1.2 ★ Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MAFS.912.A-CED.1.3★ Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
MAFS.912.A-REI.3.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
MAFS.912.A-REI.3.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Two-Point Form MAFS.912.A-CED.1.2 ★	The two-point form of the equation for a line can describe any non-vertical line in the Cartesian plane, given the coordinates of two points which lie on the line.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Basic Linear Function MAFS.912.A-CED.1.3★	Using this video, students will learn how to write a function that represents a real-life scenario.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
The Substitution Method MAFS.912.A-REI.3.6	This video shows how to solve a system of equations using the substitution method.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Substitution Method Example 2 MAFS.912.A-REI.3.6	This video can be used to demonstrate a system of equations with no solution.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Example 3: Solving Systems by Substitution MAFS.912.A-REI.3.6	This example can be used to demonstrate solving a system of equations algebraically and graphically.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Graphing Systems of Equations MAFS.912.A-REI.3.6	Using this video, students will learn how to solve and graph a system of equations.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving System of Equations by Graphing MAFS.912.A-REI.3.6	Using this video, students will learn how to solve and graph a system of equations. Students will see how to sketch their solution after solving the system of equations.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving a System of Equations by Graphing MAFS.912.A-REI.3.6	Using this video, students will learn how to solve a system of equations by graphing. Students will see what a **NO** solution system of equations looks like in a graph.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving Basic Systems Using the Elimination Method MAFS.912.A-REI.3.6	Using this video, students will learn step-by-step directions for using the elimination method to solve a system of linear equations.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Using Systems of Equations Versus One Equation MAFS.912.A-REI.3.6	Using this video, students will learn how to solve a system of equations with multiple variables.	• Internet connection • Speakers/headphones • Computer • Scientific calculator • (if necessary)
Systems of Linear Equations in Two Variables MAFS.912.A-REI.3.6	The points of intersection of two graphs represent common solutions to both equations. Finding these intersection points is an important tool in analyzing physical and mathematical systems.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Why the Elimination Method Works MAFS.912.A-REI.3.6	This video presents a new look at the logic behind adding equations, the essential technique used when solving systems of equations by elimination.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving Inconsistent or Dependent Systems MAFS.912.A-REI.3.6	When solving a system of linear equations in *x* and *y* with a single solution, we get a unique pair of values for *x* and *y*. What happens when trying to solve a system with no solutions or an infinite number of solutions?	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Inconsistent, Dependent, and Independent Systems MAFS.912.A-REI.3.6	Systems of two linear equations in two variables can have a single solution, no solutions, or an infinite number of solutions. This video provides a great description of inconsistent, dependent, and independent systems. This video also provides information on how to distinguish a given system of linear equations as inconsistent, independent, or dependent system by looking at the slope and intercept.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving Systems of Equations by Elimination MAFS.912.A-REI.3.6	Systems of two equations in *x* and *y* can be solved by adding the equations to create a new equation with one variable eliminated. This new equation can then be solved to find the value of the remaining variable. That value is then substituted into either equation to find the value of the other variable.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving Systems of Equations by Substitution MAFS.912.A-REI.3.6	A system of two equations in *x* and *y* can be solved by rearranging one equation to represent *x* in terms of *y*, and substituting this expression for *x* in the other equation. This creates an equation with only *y* which can then be solved to find *y*'s value. This value can then be substituted into either equation to find the value of *x*.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

The Circle and The Line MAFS.912.A-REI.3.7	Although this task is fairly straightforward, it is worth noticing that it does not explicitly tell students to look for intersection points when they graph the circle and the line. Thus, in addition to assessing whether they can solve the system of equations, it is assessing a simple but important piece of conceptual understanding, namely the correspondence between intersection points of the two graphs and solutions of the system.	• Microsoft Office or Adobe Acrobat Reader • Scientific calculator (if necessary)
A Linear and Quadratic System MAFS.912.A-REI.3.7	This task asks students to consider the linear and quadratic functions shown on a graph, and use quadratic functions to find the coordinates.	• Microsoft Office or Adobe Acrobat Reader • Scientific calculator (if necessary)
Simultaneous Equations 1 Linear 1 Quadratic Example 1 MAFS.912.A-REI.3.7	In this tutorial, students will learn how to solve simultaneous equations.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Simultaneous Equations 1 Linear 1 Quadratic Example 2 MAFS.912.A-REI.3.7	In this tutorial, students will learn how to solve simultaneous equations.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Standard: MAFS.912.A-REI.1.1
Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Justifiable Steps MAFS.912.A-REI.1.1	By the end of this tutorial, students should be able to explain the steps used to solve a simple equation and provide reasons to support those steps. Being able to explain and justify steps indicate that the student has mastered solving simple equations.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Algebra: Reasoning with Equations and Inequalities MAFS.912.A-REI.1.1	Using this tutorial, students will learn how to reason with equations and inequalities.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Same Solutions? MAFS.912.A-REI.1	The purpose of this task is to provide an opportunity for students to reason about equivalence of equations. The instruction to give reasons that do not depend on solving the equation is intended to focus attention on the transformation of equations as a deductive step.	• Microsoft Office • Adobe Acrobat Reader • Scientific calculator (if necessary)

Standard: ★MAFS.912.A-REI.4.11
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); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Solving an Equation Using a Graph MAFS.912.A-REI.4.11★	Students will explain why the *x*-coordinate of the point of intersection of two functions is the solution of the equation f(x) = g(x).	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Population and Food Supply MAFS.912.A-REI.4.11★	In this task, students will use verbal descriptions to construct and compare linear and exponential functions and to find where the two functions intersect.	• Microsoft Office • Adobe Acrobat Reader Scientific calculator (if necessary)
Two Squares are Equal MAFS.912.A-REI.4.11★	This task is designed to elicit a variety of different methods of solving a quadratic equation.	• Microsoft Office • Adobe Acrobat Reader • Scientific calculator (if necessary)
Equation Grapher MAFS.912.A-REI.4.11★	This interactive simulation investigates graphing linear and quadratic equations. Users are given the ability to define and change the coefficients and constants in order to observe resulting changes in the graph(s).	• Internet connection • Speakers/headphones • Computer • LCD Projector • Java Plugin • Scientific calculator (if necessary)

Standard: ★MAFS.912.A-SSE.2.3. Also Assesses ★MAFS.912.A-SSE.1.1 and MAFS.912.A-SSE.1.2

MAFS.912.A-SSE.2.3 ★ Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

a. Factor a quadratic expression to reveal the zeros of the function it defines.
b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

MAFS.912.A-SSE.1.1★ Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*

MAFS.912.A-SSE.1.2 Use the structure of an expression to identify ways to rewrite it. *For 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* $(x^2 - y^2)(x^2 + y^2)$.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Finding the Maximum or Minimum of a Quadratic Function MAFS.912.A-SSE.2.3★	By the end of this tutorial, students should be able to complete the square of a quadratic expression to reveal the maximum or minimum value of the function it defines, as well as identify the maximum or minimum value of a quadratic function and interpret its meaning in a real world context.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Power of a Power Property MAFS.912.A-SSE.2.3★	This tutorial demonstrates how to use the power of a power property with both numerals and variables.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Forms of Exponential Expressions MAFS.912.A-SSE.2.3★	This task contrasts the usefulness of four equivalent expressions. Students first have to confirm that the given expressions for the radioactive substance are equivalent. Then they have to explain the significance of each expression in the context of the situation.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Building a General Quadratic Function MAFS.912.A-SSE.2.3★	In this resource, a method of deriving the quadratic formula from a theoretical standpoint is demonstrated. This task is for instructional purposes only and builds on building an explicit quadratic function.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Graphs of Quadratic Functions MAFS.912.A-SSE.2.3★	This exploration can be completed in class near the beginning of a unit on graphing parabolas. Students need to be familiar with intercepts and need to know what the vertex is. It is effective after students have graphed parabolas in vertex form ($y=a(x–h)^2+k$) but have not yet explored graphing other forms.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Increasing or Decreasing? Variation 2 MAFS.912.A-SSE.2.3★	The purpose of this task is to help students see manipulation of expressions as an activity undertaken for a purpose.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Quadrupling Leads to Halving MAFS.912.A-SSE.1.1★	Variation 1 of this task presents a related more complex expression already in the correct form to answer the question.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Radius of a Cylinder MAFS.912.A-SSE.1.1★	The expression arises in physics as the reciprocal of the combined resistance of two resistors in parallel. However, the context is not explicitly considered here.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Kitchen Floor Tiles MAFS.912.A-SSE.1.1★	Students will explore the structure of the operation $s/(vn)$. This question provides students with an opportunity to see expressions as constructed out of a sequence of operations: first taking the square root of n, then dividing the result of that operation into s.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Animal Populations MAFS.912.A-SSE.1.1★	In this task, students interpret the relative size of variable expressions involving two variables in the context of a real world situation. All given expressions can be interpreted as quantities that one might study when looking at two animal populations.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Computations with Complex Numbers MAFS.912.A-SSE.1.2	This resource involves simplifying algebraic expressions that involve complex numbers and various algebraic operations.	• Adobe Acrobat Reader or Microsoft Office Scientific calculator (if necessary)

Standard: MAFS.912.N-CN.3.7. Also Assesses MAFS.912.A-REI.2.4

MAFS.912.N-CN.3.7 Solve quadratic equations with real coefficients that have complex solutions.
MAFS.912.A-REI.2.4 Solve quadratic equations in one variable.

a. 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. Derive the quadratic formula from this form.
b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Quadratic Equations and Robots MAFS.912.N-CN.3.7	Get in gear with robotics as this engineer explains how quadratic equations are used in programming robotic navigation.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Find Imaginary Roots of Quadratic Equations MAFS.912.N-CN.3.7	In this lesson, students will learn how to find imaginary roots of a quadratic equation by using the square root property.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Find Complex Solutions of a Quadratic Equation MAFS.912.N-CN.3.7	In this lesson, students will learn how to find complex solutions of a quadratic equation by completing the square.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Finding Complex Roots using the Quadratic Formula MAFS.912.N-CN.3.7	In this lesson, students will learn how to solve quadratic equations with complex solutions by using the quadratic formula.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Identify Real and Complex Roots using the Discriminant MAFS.912.N-CN.3.7	In this lesson, students will learn how to identify real or complex roots by evaluating the discriminant of a quadratic equation.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving Quadratic Equations Using the Quadratic Formula MAFS.912.A-REI.2.4	In this video tutorial, students will learn how to solve quadratic equations using the quadratic formula.	• Internet connection • Speakers/headphones • Computer • Graphing calculator
Learning How to Complete the Square MAFS.912.A-REI.2.4	In this video tutorial, students will learn how to solve quadratic equations by square roots.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Solving Quadratics By Taking The Square Root MAFS.912.A-REI.2.4	This resource can be used to assess students' understanding of solving quadratic equations by taking the square root. A great resource to view prior to this is Solving Quadratic Equations by Square Root.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Standard: MAFS.912.G-GPE.1.2
Derive the equation of a parabola given a focus and directrix.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Definition of a Parabola MAFS.912.G-GPE.1.2	Students will learn how to determine an algebraic representation of a parabola, given its focus and its directrix.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Discovering Properties of Parabolas by Comparing and Contrasting Parabolic Equations MAFS.912.G-GPE.1.2	Teachers can use this resource to teach students how to *derive the equation of a parabola* in vertex form $y = a(x - h)^2 + k$, when given the (x, y) coordinates of the focus and the linear equation of the directrix. An additional interactive graphing spreadsheet can be used as a resource to aid teachers in providing examples.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: ★MAFS.912.F-BF.1.2. Also Assesses ★MAFS.912.F-BF.1.1, and ★MAFS.912.A-SSE.2.4

MAFS.912.F-BF.1.2★Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

MAFS.912.F-BF.1.1★ Write a function that describes a relationship between two quantities.

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

MAFS.912.A-SSE.2.4★ Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Geometric Sequence or Progression MAFS.912.F-BF.1.2★	In this tutorial, students will learn how to write a geometric sequence.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Geometric Series MAFS.912.F-BF.1.2★	In this tutorial, students will learn how to write a geometric series.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Finding the nth Term in a Recursively Defined Sequence MAFS.912.F-BF.1.2★	In this tutorial, students will learn how to find the 5^{th} term in a recursively defined sequence.	• Document camera • Teacher laptop • Internet connection • LCD projector • Speakers/headphones • Scientific calculator (if necessary)
Temperatures in Degrees Fahrenheit and Celsius MAFS.912.F-BF.1.2★	The first part of this task provides an opportunity to construct a linear function given two input-output pairs. The second part investigates the inverse of a linear function while the third part requires reasoning about quantities and/or solving a linear equation.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Geometric and Harmonic Series- Limits MAFS.912.F-BF.1.2★	This applet allows students to set up various geometric series with a visual representation of the successive terms and the	• Internet connection • LCD projector • Computer

	corresponding sum of those terms.	• Scientific calculator (if necessary)
Graphs of Compositions MAFS.912.F-BF.1.1★	In this task, students will explore an important issue about inverse functions. In this case, the function *f* is the inverse of the function *g*, but *g* is not the inverse of *f* unless the domain of *f* is restricted.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
A Sum of Functions MAFS.912.F-BF.1.1★	In this example, students are given the graph of two functions and are asked to sketch the graph of the function that is their sum. The intent is that students develop a conceptual understanding of function addition.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Summer Intern MAFS.912.F-BF.1.1★	In this task, students are asked to use proportions of mass and volume to create an ideal brine for saltwater fish tanks. Students are also asked to compare graphs.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Triangle Series MAFS.912.A-SSE.2.4★	The purpose of this task is to emphasize the adjective geometric in the geometric series, namely, that the algebraic notion of a common ratio between terms corresponds to the geometric notion of a repeated similarity transformation.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Cantor Set MAFS.912.A-SSE.2.4★	The purpose of this task is to lead to the generation of finite geometric series with a common ratio less than one as a means to explore properties of the Cantor Set.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Course of Antibiotics MAFS.912.A-SSE.2.4★	In this task, students will consider a real-world problem involving the decay of a drug in a patient's body. This task presents a real world application of finite geometric series.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.F-BF.2.3
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); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Building an Explicit Quadratic Function by Composition MAFS.912.F-BF.2.3	This task is intended for instruction and to motivate building a general quadratic function. This task assumes that the students are familiar with the process of completing the square.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Building a Quadratic Function from $f(x) = x^2$ MAFS.912.F-BF.2.3	The objective of this task is for students to understand the quadratic formula in a geometric way in terms of the graph of a quadratic function.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Transforming the Graph of a Function MAFS.912.F-BF.2.3	This problem-solving task examines, in a graphical setting, the impact of adding a scalar, multiplying by a scalar, and making a linear substitution of variables on the graph of the function *f*. This resource also includes standards alignment commentary and annotated solutions.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Building a General Quadratic Function MAFS.912.F-BF.2.3	In this resource, a method of deriving the quadratic formula from a theoretical standpoint is demonstrated. This task is for instructional purposes only and builds on "building an explicit quadratic function."	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Identifying Even and Odd Functions MAFS.912.F-BF.2.3	In this task, students will be asked to determine whether the set of given functions is odd, even, or neither.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.F-BF.2.4

Find inverse functions.

a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.*

b. Verify by composition that one function is the inverse of another.

c. Read values of an inverse function from a graph or a table, given that the function has an inverse.

d. Produce an invertible function from a non-invertible function by restricting the domain.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Exponentials and Logarithms II MAFS.912.F-BF.2.4	In this task, students will explore the inverse relationship between an exponential function and a logarithmic function. The task is to determine the relevant composite functions, their graphs, and the domain and range of each.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Temperature Conversions MAFS.912.F-BF.2.4	Unit conversion problems provide a rich source of examples both for composition of functions (when several successive conversions are required) and inverses (units can always be converted in either of two directions).	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Rainfall MAFS.912.F-BF.2.4	In this task, students are asked to analyze a function and its inverse when the function is given as a table of values. In addition to finding values of the inverse function from the table, they also have to explain why the given function is invertible.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Invertible or Not? MAFS.912.F-BF.2.4	This task illustrates several components of standard MAFS.912.F-BF.2.4.c: Find inverse functions. Here, instead of presenting two functions and asking the students to decide which on is invertible, students are asked to complete a table of input-output pairs for the functions in such a way that one of the functions is invertible and the other one is not.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: ★MAFS.912.F-IF.2.4. Also Assesses MAFS.912.F-IF.3.9, ★MAFS.912.F-IF.2.5 and ★MAFS.912.F-LE.2.5

MAFS.912.F-IF.2.4★ 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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

MAFS.912.F-IF.3.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

MAFS.912.F-IF.2.5★ Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.*

MAFS.912.F-LE.2.5★ Interpret the parameters in a linear or exponential function in terms of a context.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Logistic Growth Model, Explicit Version MAFS.912.F-IF.2.4★	This problem will introduce students to a logistic growth model in the concrete settings of estimating the population of the U.S. The model gives a surprisingly accurate estimate, and this should be contrasted with linear and exponential models.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Logistic Growth Model, Abstract Version MAFS.912.F-IF.2.4★	This task is for instructional purposes only, and students should already be familiar with some specific examples of logistic growth functions. The goal of this task is to have students appreciate how different constants influence the shape of a graph.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Telling a Story with Graphs MAFS.912.F-IF.2.4★	In this task, students are given graphs of quantities related to weather. The purpose of the task is to show that graphs are more than a collection of coordinate points; they can tell a story about the variables that are involved, and together they can paint a very complete picture of a situation, in this case the weather.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Throwing Baseballs MAFS.912.F-IF.2.4★	This task could be used for assessment or for practice. It allows students to compare characteristics of two quadratic functions that are each represented differently, one as the graph of a quadratic function and one written out algebraically. Specifically, students are asked to determine which function has the greatest maximum and the greatest non-negative root.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Function Flyer MAFS.912.F-IF.2.4★	In this online tool, students input a function to create a graph where the constants, coefficients, and exponents can be adjusted by slider bars. This tool allows students to explore graphs of functions and how adjusting the numbers in the function affect the graph.	• Internet connection • Speakers/headphones • Computer • Java plugin • Scientific calculator (if necessary)
Equation Grapher MAFS.912.F-IF.3.9	This interactive simulation will allow students to investigate graphing linear and quadratic equations. Users are given the ability to define and change the coefficients and constants in order to observe resulting changes in the graph(s).	• Internet connection • Speakers/headphones • Computer • Java plugin • LCD projector • Scientific calculator (if necessary)
The Canoe Trip, Variation 1 MAFS.912.F-IF.2.5★	The purpose of this task is to give students practice constructing functions that represent a quantity of interest in a context, and then interpreting features of the function in the light of the context. It can be used as either an assessment or a teaching task.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
The Canoe Trip, Variation 2 MAFS.912.F-IF.2.5★	The primary purpose of this task is to lead students to a numerical and graphical understanding of the behavior of a rational function near a vertical asymptote, in terms of the expression defining the function.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Newton's Law of Cooling MAFS.912.F-LE.2.5★	The coffee-cooling experiment is a popular example of an exponential model with immediate appeal. The model is realistic and provides a good context for students to practice work with exponential equations.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
A Saturating Exponential MAFS.912.F-LE.2.5★	This task provides an interesting context to ask students to estimate values in an exponential function using a graph.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Carbon 14 Dating in Practice I MAFS.912.F-LE.2.5★	In the task, Carbon 14 Dating, the amount of Carbon 14 in a preserved plant is studied as time passes after the plant has died. In practice, however, scientists wish to determine when the plant died, and as this task shows, that is not possible with a simple measurement of the amount of Carbon 14 remaining in the preserved plant.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.F-IF.3.8. Also Assesses MAFS.912.A-APR.2.3, ★MAFS.912.F-IF.2.6 and ★MAFS.912.F-IF.3.7

MAFS.912.F-IF.3.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.*

MAFS.912.A-APR.2.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

MAFS.912.F-IF.2.6★ Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

MAFS.912.F-IF.3.7★ Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Solving Quadratic Equations using Square Roots MAFS.912.F-IF.3.8	In this video, students will receive a demonstration on how to solve a quadratic equation using square roots.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Graphs of Second Degree Polynomials MAFS.912.A-APR.2.3	In this tutorial, students will look at input and output values of quadratic functions to help them understand why the graph of a second degree polynomial curves.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Dividing Polynomials MAFS.912.A-APR.2.3	This tutorial will help students practice division of polynomials. Students will recognize that dividing polynomials is similar to simplifying fractions.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Changing Rates MAFS.912.F-IF.2.6★	This tutorial will assist students with calculating and interpreting average rate of change over a specific interval on a graph.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
The High School Gym MAFS.912.F-IF.2.6★	Using this task, students will be asked to consider functions in regard to temperatures in a high school gym.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Graphing Quadratic Functions MAFS.912.F-IF.3.7★	The focus of this tutorial are the vertex (a maximum or minimum extreme) and the direction of its opening. Students will learn how to examine a quadratic equation written in vertex form in order to distinguish each of these key features.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Mathematically Exploring the Wakulla Caves MAFS.912.F-IF.3.7★	The tide is high! How can we statistically prove there is a relationship between the tides on the Gulf Coast and in a fresh water spring 20 miles from each other? (informative video)	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Finding Parabolas through Two Points MAFS.912.F-IF.3.7★	This problem-solving task challenges students to find all quadratic functions described by given equation and coordinates, and describe how the graphs of those functions are related to one another.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: ★ MAFS.912.F-LE.1.4 Also Assesses MAFS.912.F-BF.2.a

MAFS.912.F-LE.1.4★ For exponential models, express as a logarithm the solution to ab^{ct} = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
MAFS.912.F-BF.2.a Use the change of base formula.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Bacteria Populations MAFS.912.F-LE.1.4★	In this task, students will be provided with a real world context for interpreting and solving exponential equations.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Snail Invasion MAFS.912.F-LE.1.4★	The purpose of this task is to give students experience modeling a real-world example of exponential growth in a context that provides a vivid illustration of the power of exponential growth; for example, the cost of inaction for a year.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Evaluating Logarithms: Change of Base Rule MAFS.912.F-BF.2.a	In this tutorial, students will learn how to approximate $\log_5(100)$ by rewriting it as log(100)/log(5) using the change of base rule, then evaluate with a calculator.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Proof of the Logarithm Change of Base Rule MAFS.912.F-BF.2.a	In this tutorial, students will learn how to prove the logarithmic change of base rule, $\log_a(b)=\log_x(b)/\log_x(a)$.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Standard: MAFS.912.F-TF.1.2 Also Assesses MAFS.912.F-TF.1.1 and MAFS.912.F-TF.3.8

MAFS.912.F-TF.1.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
MAFS.912.F-TF.1.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle; Convert between degrees and radians.
MAFS.912.F-TF.3.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Introduction to the Unit Circle MAFS.912.F-TF.1.2	Using this tutorial, students will be given an introduction to the unit circle. It also extends the students' knowledge of SOH CAH TOA so that they can define trigonometric functions for a broader class of angles.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Ferris Wheel Measures MAFS.912.F-TF.1.1	By the end of this tutorial, students should be able to understand the radian measures of an angle, find an angle measure in radians given the arc length and length of the radius, and convert between degree measures and radian measures.	• Adobe Acrobat Reader • Scientific calculator (if necessary)
Using Trigonometric Identities MAFS.912.F-TF.3.8	At the conclusion of this video, students will learn how to write various trigonometric expressions using the Pythagorean Identity and other trigonometric identities.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Proof of the Pythagorean Trig. Identity MAFS.912.F-TF.3.8	Using this tutorial, students will examine a proof that proves the Pythagorean identity $(\sin\theta)^2+(\cos\theta)^2=1$ for all real numbers.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Use the Pythagorean Identity MAFS.912.F-TF.3.8	Given the sine (or cosine) of an angle, students will find its cosine (or sine) using the Pythagorean Identity.	• Internet connection • Computer • Scientific calculator (if necessary)
Prove the Pythagorean Identity using the Unit Circle MAFS.912.F-TF.3.8	In this lesson, students will prove the Pythagorean Identity by using the equation of the unit circle.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Standard: ★MAFS.912.F-TF.2.5
Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Foxes and Rabbits 2 MAFS.912.F-TF.2.5★	This problem-solving task can be used to challenge students to use trigonometric functions to model the populations of rabbits and foxes over time, and then graph the functions.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Foxes and Rabbits 3 MAFS.912.F-TF.2.5★	This problem-solving task can be used to challenge students to use trigonometric functions to model the number of rabbits and foxes as a function of time.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
As the Wheel Turns MAFS.912.F-TF.2.5★	In this task, students will use trigonometric functions to model the movement of a point around a wheel and through space. Students also interpret features of graphs in terms of the given real-world context.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.N-CN.1.2 Also Assesses MAFS.912.N-CN.1.1

MAFS.912.N-CN.1.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
MAFS.912.N-CN.1.1 Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with *a* and *b* real.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Introduction to i and imaginary numbers MAFS.912.N-CN.1.1	Using this video, students will be introduced to "i" and imaginary numbers. From this tutorial, students will learn the rules of imaginary numbers.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Multiplying Complex Numbers MAFS.912.N-CN.1.2	Using this video, students will receive a demonstration on how to multiply complex numbers using distributive property and FOIL method.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

How to Subtract Complex Numbers MAFS.912.N-CN.1.2	Using this video, students will receive a demonstration on how to subtract complex numbers	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Adding Complex Numbers MAFS.912.N-CN.1.2	Using this video, students will receive a demonstration on how to add complex numbers.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
MIT BLOSSOMS - Fabulous Fractals and Difference Equations MAFS.912.N-CN.1.2	This learning video introduces students to the world of Fractal Geometry through the use of difference equations.	• Internet connection • Speakers/headphones • Computer • LCD projector • Scientific calculator (if necessary)
Computations with Complex Numbers MAFS.912.N-CN.1.1	This resource involves simplifying algebraic expressions that involve complex numbers and various algebraic operations.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.N-RN.1.2 Also Assesses MAFS.912.N-RN.1.1

MAFS.912.N-RN.1.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MAFS.912.N-RN.1.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{1/3}$ *to be the cube root of 5 because we want* $(5^{1/3})^3 = 5^{(1/3)3}$ *to hold, so* $(5^{1/3})^3$ *must equal 5.*

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Power of a Power Property MAFS.912.N-RN.1.2	Using this video, students will receive a demonstration on how to use the power of a power property with both numerals and variables.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Rational Exponents MAFS.912.N-RN.1.2 MAFS.912.N-RN.1.1	Exponents are not only integers and unit fractions. An exponent can be any rational number expressed as the quotient of two integers.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Simplifying Radical Expressions MAFS.912.N-RN.1.2	Radical expressions can often be simplified by moving factors which are perfect roots out from under the radical sign.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)
Checking a Calculation of a Decimal Exponent MAFS.912.N-RN.1.2	In this example, students will use properties of rational exponents and other algebraic concepts to compare and verify the relative size of two real numbers that involve decimal exponents.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Roots and Unit Fraction Exponents MAFS.912.N-RN.1.1	Exponents are not only integers. They can also be fractions. Using the rules of exponents, we can see why a number raised to the power "one over n" is equivalent to the nth root of that number.	• Internet connection • Speakers/headphones • Computer • Scientific calculator (if necessary)

Standard: MAFS.912.S-CP.1.1★
Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

Lesson/Activity/Tool	Lesson/Activity/Tool Description	Suggested Technology
Venn Diagrams for Set Operations MAFS.912.S-CP.1.1★	This manipulative can be used to explore the set operations of unions, intersections, complements, and differences.	• Java plugin • Scientific calculator (if necessary)
Return to Fred's Fun Factory (with 50 cents) MAFS.912.S-CP.1.1★	The task is intended to address sample space, independence, probability distributions and permutations/combinations.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
The Titanic 1 MAFS.912.S-CP.1.1★	Using this task, students will calculate probabilities using information presented in a two-way frequency table.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.S-CP.1.5. Also Assesses ★MAFS.912.S-CP.1.4, ★MAFS.912.S-CP.1.2, ★MAFS.912.S-CP.1.3 and ★MAFS.912.S-CP.2.6

MAFS.912.S-CP.1.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*

MAFS.912.S-CP.1.4★ Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

MAFS.912.S-CP.1.2★ Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

MAFS.912.S-CP.1.3★ Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

MAFS.912.S-CP.2.6★ Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Rain and Lightning MAFS.912.S-CP.1.5 MAFS.912.S-CP.1.3★	This problem-solving task challenges students to determine if two weather events are independent and use that conclusion to find the probability of having similar weather events under certain conditions.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Breakfast Before School MAFS.912.S-CP.1.5	The purpose of this task is to assess a student's ability to explain the meaning of independence in a simple context.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
The Titanic 1 MAFS.912.S-CP.1.4★ MAFS.912.S-CP.2.6★	Using this task, students will calculate probabilities using information presented in a two-way frequency table.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
The Titanic 2 MAFS.912.S-CP.1.5 MAFS.912.S-CP.1.4★ MAFS.912.S-CP.1.3★	This task lets students explore the concepts of probability as a fraction of outcomes and using two-way tables of data.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

MAFS.912.S-CP.2.6★		
The Titanic 3 MAFS.912.S-CP.1.5 MAFS.912.S-CP.1.4★ MAFS.912.S-CP.2.6★	Using this problem solving task, students will determine probabilities and draw conclusions regarding the survival rates on the Titanic by consulting a table of data.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Interactive Marbles MAFS.912.S-CP.1.2★	Using this online manipulative, students will simulate placing marbles into a bag and finding the probability of pulling out certain combinations of marbles. This allows exploration of probabilities of multiple events as well as probability with and without replacement.	• Internet Connection • Speakers/Headphones • Computer • Adobe Acrobat Reader • Java Plugin • Scientific calculator (if necessary)
Lucky Envelopes MAFS.912.S-CP.1.3★	Using this resource, students will answer questions about the probabilities of independent and dependent events.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.S-CP.2.7
Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
Coffee at Mom's Diner MAFS.912.S-CP.2.7	Using this task, students will use the addition rule to compute a probability and to interpret a probability in context.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Addition Rules for Probability MAFS.912.S-CP.2.7	Using this task, students will use the addition rule to compute a probability.	• Internet connection • Computer • Scientific calculator (if necessary)

Standard: MAFS.912.S-IC.1.1
Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

MicroGravity Sensors & Statistics MAFS.912.S-IC.1.1	Statistical analysis played an essential role in using microgravity sensors to determine location of caves in Wakulla County. Using this resource, students will gain a greater understanding regarding the use of statistical analysis	• Internet Connection • Speakers/Headphones • Computer • Scientific calculator (if necessary)
Population Sampling and Beekeeping MAFS.912.S-IC.1.1	This buzzworthy video features statistics, sampling, and how scientists make inferences about populations.	• Internet Connection • Speakers/Headphones • Computer • Scientific calculator (if necessary)
Musical Preferences MAFS.912.S-IC.1.1	Using this problem solving, students will be asked to make deductions about what kind of music students like by examining a table with data.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
School Advisory Panel MAFS.912.S-IC.1.1	Using this resource, students are asked to choose the best sampling method for choosing the new school advisory panel.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.S-IC.2.3 Also Assesses MAFS.912.S-IC.2.4, MAFS.912.S-IC.2.5, MAFS.912.S-IC.1.2 and MAFS.912.S-IC.2.6

MAFS.912.S-IC.2.3 ★Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MAFS.912.S-IC.2.4 ★ Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
MAFS.912.S-IC.2.5 ★Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MAFS.912.S-IC.1.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*
MAFS.912.S-IC.2.6 ★ Evaluate reports based on data

Lesson/Activity/Video	Lesson/Activity/Video Description	Suggested Technology
Words and Music II MAFS.912.S-IC.2.3★	The purpose of this task is to assess (1) ability to distinguish between an observational study and an experiment and (2) understanding of the role of random assignment to experimental groups in an experiment.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Ecological Sampling Methods and Population Density MAFS.912.S-IC.2.4★	Dr. David McNutt explains how a simple do-it-yourself quadrat and a transect can be used for ecological sampling to estimate population density in a given area.	• Internet Connection • Speakers/Headphones • Computer
MIT BLOSSOMS - Is Bigger Better? A Look at a Selection Bias that Is All Around Us MAFS.912.S-IC.2.4★	In this learning video, students will be introduced selection bias, a statistical bias in which there is an error in choosing the individuals or groups to make broader inferences.	• Internet Connection • Speakers/Headphones • Computer
Advanced Fire Simulator - Shodor MAFS.912.S-IC.2.5★ MAFS.912.S-IC.1.2	In this online activity, students burn a simulated forest and adjust the probability that the fire spreads from one tree to the other. This simulation also records data for each trial including the burn probability, where the fire started, the percent of trees burned, and how long the fire lasted. This activity allows students to explore the idea of chaos in a simulation of a realistic scenario.	• Internet Connection • Computer • Java Plugin • Scientific calculator (if necessary)

Simple Monty Hall MAFS.912.S-IC.1.2	In this activity, students select one of three doors in an attempt to find a prize that is hidden behind one of them. After their first selection, one of the doors that doesn't have the prize behind it is revealed, and the student has to decide whether to switch to the one remaining door or stay on the door of their first choice. This situation, referred to as the Monty Hall problem, was made famous on the show "Let's Make A Deal" with host Monty Hall. This activity allows students to explore the idea of conditional probability as well as unexpected probability.	• Internet Connection • Computer • Java Plugin • Adobe Acrobat Reader • Scientific calculator (if necessary)
Population Demographic Lab MAFS.912.S-IC.2.6★	Using this lab simulation, students will use real demographic data, collected by the US Census Bureau, to analyze and make predictions centered on demographic trends. Students will explore factors that impact the birth, death, and immigration rate of a population and learn how the population transitions having taken place globally.	• Internet Connection • Computer • Adobe Acrobat Reader • Microsoft Office • Scientific calculator (if necessary)

Standard: MAFS.912.S-ID.1.4 ★

Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Lesson/Activity	Lesson/Activity Description	Suggested Technology
SAT Scores MAFS.912.S-ID.1.4 ★	Using this problem-solving task, students are challenged to answer probability questions about SAT scores using	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)

	distribution and mean to solve the problem.	
Should We Send Out a Certificate? MAFS.912.S-ID.1.4 ★	The purpose of this task is to have students complete normal distribution calculations and to use properties of normal distributions to draw conclusions.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Do You Fit in This Car? MAFS.912.S-ID.1.4 ★	Using this task, students will use the normal distribution as a model for a data distribution. Students must use given means and standard deviations to approximate population percentages.	• Adobe Acrobat Reader or Microsoft Office • Scientific calculator (if necessary)
Normal Distribution Interactive Activity MAFS.912.S-ID.1.4 ★	Using this online tool, students adjust the standard deviation and sample size of a normal distribution to see how it will affect a histogram of that distribution. This activity allows students to explore the effect of changing the sample size in an experiment and the effect of changing the standard deviation of a normal distribution.	• Internet Connection • Computer • Java Plugin • Adobe Acrobat Reader • Scientific calculator (if necessary)

Number and Quantity MAFS.912.N-Q.1.2 is assessed throughout

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