Morgan Co. High School

Mathematics Department

Algebra II – Instructional Unit Plan

Unit #	Unit Topic	Length (Days)
1	Introduction to Algebra II: Purpose and Predictability of Patterns	10
2	Linear Equations and Inequalities: Poetry and Prose of Algebra	10
3	What is a Matrix – Really?	10
4	Functions, Relations, and Conics	15
5	Quadratic Equations, Inequalities, and Functions	15
6	Polynomials	15
7	Rational and Radical Expressions and Equations	15
8	Exponential and Logarithmic Functions	15
9	Trigonometry	15
10	Probability and Data Analysis	15

Unit 1
Introduction to Algebra II: The Purpose and Predictability of Patterns

ACT Course Standards

Unit 1 Introduction to Algebra II: The Purpose and Predictability of Patterns	
A.1. Skills Acquired by Students . . .	a. Identify properties of real numbers and use them and the correct order of operations to simplify expressions
	j. Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions
B.1. Mathematical Processes	a. Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
	b. Use a variety of strategies to set up and solve increasingly complex problems
	c. Represent data, real-world situations, and solutions in increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
	d. Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
	e. Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
	f. Make mathematical connections among concepts, across disciplines, and in everyday experiences
	g. Demonstrate the appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
	h. Apply previously learned algebraic and geometric concepts to more advanced problems
H.2. Sequences and Series	a. Find the *n*th term of an arithmetic or geometric sequence
	b. Find the position of a given term of an arithmetic or geometric sequence
	c. Find sums of a finite arithmetic or geometric series
	d. Use sequences and series to solve real-world problems
	e. Use sigma notation to express sums

F-BF-2

Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*(Modeling standard)

A-SSE-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.

Day	Flash Back	CCSSI	ACT	Formative Assessment/Activity	Deconstructed Standard
1	Order of Operations	F-BF-2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*(Modeling standard)	H.2.A H.2.B		**K:** Combine two functions using the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. **R:** Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities • determine which arithmetic operation should be performed to build the appropriate combined function • relate the combined function to the context of the problem
2	Simplify Expression	F-BF-2	H.2.A		**K:** Combine two functions using

		Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*(Modeling standard)	H.2.B		the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. **R:** Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities • determine which arithmetic operation should be performed to build the appropriate combined function relate the combined function to the context of the problem
3	Identify Real Numbers	A-SSE-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.	H.2.C		**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1).
4	Evaluate Expressions	A-SSE-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.	H.2.C H.2.E		**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1).
5	Multiplying Fractions	A-SSE-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	H.2.C H.2.E		**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms.

		problems. For example, calculate mortgage payments.			Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1).
6	Adding Fractions	A-SSE-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.			**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1).
7	Dividing Fractions	A-SSE-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.	H.2.D		**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1).
8	Subtracting Fractions	A-SSE-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.	H.2.D		**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the

					common ratio is not 1).
9	Greatest Common Factor	A-SSE-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.			**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1).
10	Least Common Multiple	A-SSE-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.			**K:** Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ to solve problems. **R:** Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1).

K=Knowledge Target
R=Reasoning Target
PS=Performance Skills Target
P=Product Target

Unit 2
Linear Equations and Inequalities: The Poetry and Prose of Algebra

ACT Course Standards

Unit 2 Linear Equations and Inequalities: The Poetry and Prose of Algebra		
B.1. Mathematical Processes	a.	Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
	b.	Use a variety of strategies to set up and solve increasingly complex problems
	c.	Represent data, real-world situations, and solutions in increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
	d.	Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
	e.	Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
	f.	Make mathematical connections among concepts, across disciplines, and in everyday experiences
	g.	Demonstrate the appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
	h.	Apply previously learned algebraic and geometric concepts to more advanced problems
D.1. Expressions, Equations, and Inequalities	a.	Solve linear inequalities containing absolute value
	b.	Solve compound inequalities containing "and" and "or" and graph the solution set
	c.	Solve algebraically a system containing three variables
D.2. Graphs, Relations, and Functions	a.	Graph a system of linear inequalities in two variables with and without technology to find the solution set to the system
	b.	Solve linear programming problems by finding maximum and minimum values of a function over a region defined by linear inequalities

A-CED

Create equations that describe numbers or relationships

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 and exponential functions.*

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

F-IF

Interpret functions that arise in applications in terms of the context

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.

Analyze functions using different representations

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.

A-REI-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.

Day	**Flash Back**	**CCSSI**	**ACT**	**Formative Assessment/Activity**	**Deconstructed Standard**
1	Solve Equations	A-CED-1 **Create equations that describe numbers or relationships** 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 and exponential functions.* 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*	D.1.A		K: Solve all available types of equations & inequalities, including root equations & inequalities, in one variable. Describe the relationships between the quantities in the problem (for example, how the quantities are changing or growing with respect to each other); express these relationships using mathematical operations to create an appropriate equation or inequality to solve. **R:** Create equations and inequalities in one variable and use them to solve problems. Create equations and inequalities in one variable to model real-world situations. Compare and contrast problems that can be solved by different types of equations
2	Solve Abs. Value Equation	A-CED-1 **Create equations that describe numbers or relationships** 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 and exponential functions.*	D.1.B		K: Solve all available types of equations & inequalities, including root equations & inequalities, in one variable. Describe the relationships between the quantities in the problem (for example, how the quantities are changing or growing with respect to each other); express these relationships using mathematical operations to create an appropriate equation or inequality to solve. **R:** Create equations and inequalities in one variable

					and use them to solve problems. Create equations and inequalities in one variable to model real-world situations. Compare and contrast problems that can be solved by different types of equations
3	Graph a Linear Equation	A-CED-2 **Create equations that describe numbers or relationships** 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED-3 **Create equations that describe numbers or relationships** 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*			**K:** Identify the quantities in a mathematical problem or real-world situation that should be represented by distinct variables and describe what quantities the variables represent. Graph one or more created equation on a coordinate axes with appropriate labels and scales. **R:** Create at least two equations in two or more variables to represent relationships between quantities Justify which quantities in a mathematical problem or real-world situation are dependent and independent of one another and which operations represent those relationships. Determine appropriate units for the labels and scale of a graph depicting the relationship between equations created in two or more variables **K:** Recognize when a modeling context involves constraints. **R:** Interpret solutions as viable or nonviable options in a modeling context. Determine when a problem should be represented by equations, inequalities, systems of equations and/ or inequalities. Represent constraints by equations or inequalities, and by systems of equations and/or

		F-IF-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.			inequalities. **K:** Recognize slope as an average rate of change. Calculate 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. **R:** Interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.
		F-IF-7 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,			**K:** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions, by hand in simple cases or using technology for more complicated cases, and show/label key features of the graph. Graph polynomial functions, by hand in simple cases or using technology for more complicated cases, and show/label maxima and minima of the graph, identify zeros when suitable factorizations are available, and show end behavior. Graph exponential, logarithmic, and trigonometric functions, by hand in simple cases or using technology for more complicated cases, and show intercepts and end behavior for exponential and logarithmic functions, and for trigonometric functions, show period, midline, and amplitude. **R:** Analyze the difference between simple and complicated linear, quadratic, square root, cube root, and piecewise-defined functions,

		showing period, midline, and amplitude.			including step functions and absolute value functions and know when the use of technology is appropriate. Compare and contrast the domain and range of absolute value, step and piece-wise defined functions with linear, quadratic, and exponential. Select the appropriate type of function, taking into consideration the key features, domain, and range, to model a real-world situation. Determine the difference between simple and complicated polynomial functions, and know when the use of technology is appropriate. Relate the relationship between zeros of quadratic functions and their factored forms to the relationship between polynomial functions of degrees greater than two. Analyze the difference between simple and complicated linear, quadratic, square root, cube root, piecewise-defined, exponential, logarithmic, and trigonometric functions, including step functions and absolute value functions and know when the use of technology is appropriate. Compare and contrast the domain and range of exponential, logarithmic, and trigonometric functions with linear, quadratic, absolute value, step and piece-wise defined functions.
4	Solve a System of Equations	A-CED-2 **Create equations that describe numbers or relationships**	D.2.A		**K:** Identify the quantities in a mathematical problem or real-world situation that should be represented by distinct variables and describe what

		2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			quantities the variables represent. Graph one or more created equation on a coordinate axes with appropriate labels and scales. **R:** Create at least two equations in two or more variables to represent relationships between quantities Justify which quantities in a mathematical problem or real-world situation are dependent and independent of one another and which operations represent those relationships. Determine appropriate units for the labels and scale of a graph depicting the relationship between equations created in two or more variables
5	Geometric Sequence(nth term)	A-CED-2 **Create equations that describe numbers or relationships** 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED-3	D.2.A		**K:** Identify the quantities in a mathematical problem or real-world situation that should be represented by distinct variables and describe what quantities the variables represent. Graph one or more created equation on a coordinate axes with appropriate labels and scales. **R:** Create at least two equations in two or more variables to represent relationships between quantities Justify which quantities in a mathematical problem or real-world situation are dependent and independent of one another and which operations represent those relationships. Determine appropriate units for the labels and scale of a graph depicting the relationship between equations created in two or more variables **K:** Recognize when a

		Create equations that describe numbers or relationships 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods* F-IF-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. A-REI-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			modeling context involves constraints. **R:** Interpret solutions as viable or nonviable options in a modeling context. Determine when a problem should be represented by equations, inequalities, systems of equations and/ or inequalities. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities **K:** Recognize slope as an average rate of change. Calculate 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. **R:** Interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.
6	Arithmetic Sequence(specific)	A-CED-3 **Create equations that**	D.1.C		**K:** Recognize when a modeling context involves

		describe numbers or relationships 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*			constraints. **R:** Interpret solutions as viable or nonviable options in a modeling context. Determine when a problem should be represented by equations, inequalities, systems of equations and/ or inequalities. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities
7	Geometric Sequence(specific)		D.2.B		I will solve linear programming problems.
8	Arithmetic Series				Open Responses
9	Geometric Series				Preparation for Summative Assessment
10	Sigma Notation				Exam

K=Knowledge Target
R=Reasoning Target
PS=Performance Skills Target
P=Product Target

Unit 3
What is a Matrix—Really?

ACT Course Standards

Unit 3 What is a Matrix—Really?		
B.1. Mathematical Processes	a.	Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
	b.	Use a variety of strategies to set up and solve increasingly complex problems
	c.	Represent data, real-world situations, and solutions in increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
	d.	Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
	e.	Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
	f.	Make mathematical connections among concepts, across disciplines, and in everyday experiences
	g.	Demonstrate the appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
	h.	Apply previously learned algebraic and geometric concepts to more advanced problems
D.1. Expressions, Equations, and Inequalities	c.	Solve algebraically a system containing three variables
I.1. Matrices	a.	Add, subtract, and multiply matrices
	b.	Use addition, subtraction, and multiplication of matrices to solve real-world problems
	c.	Calculate the determinant of 2 × 2 and 3 × 3 matrices
	d.	Find the inverse of a 2 × 2 matrix
	e.	Solve systems of equations by using inverses of matrices and determinants
	f.	Use technology to perform operations on matrices, find determinants, and find inverses

N-VM

6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
8. (+) Add, subtract, and multiply matrices of appropriate dimensions.
10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

A-CED-3

Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

Day	Flash Back	CCSSI	ACT	Formative Assessment/Activity	Deconstructed Standard
1	Solve Linear Inequality	N-VM-6 6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network			I will represent data using matrices.
2	Graph Inequality	N-VM-8 8. (+) Add, subtract, and multiply matrices of appropriate	I.1.A I.1.B		I will add and subtract matrices.

		dimensions			
3	Find Solution Set	N-VM-7 7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled N-VM-8 8. (+) Add, subtract, and multiply matrices of appropriate dimensions	I.1.A I.1.B		I will multiply matrices.
4	Find the nth Term	N-VM-10 10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse	I.1.C		I will find the determinant of a matrix.
5	Compound Inequality	N-VM-10 10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse	I.1.D		I will find the inverse of a matrix.
6	Position Term	N-VM-6 6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network N-VM-7 7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled	I.1.F		I will use technology to perform operations on matrices.

		N-VM-8 8. (+) Add, subtract, and multiply matrices of appropriate dimensions. N-VM-10 10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse			
7	Sigma Notation	A-CED-3 **Create equations that describe numbers or relationships** 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*	D.1.C		.**K:** Recognize when a modeling context involves constraints. **R:** Interpret solutions as viable or nonviable options in a modeling context. Determine when a problem should be represented by equations, inequalities, systems of equations and/ or inequalities. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities
8	Arithmetic Series	A-CED-3 **Create equations that describe numbers or relationships** 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*	D.1.C		**K:** Recognize when a modeling context involves constraints. **R:** Interpret solutions as viable or nonviable options in a modeling context. Determine when a problem should be represented by equations, inequalities, systems of equations and/ or inequalities. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities

9	Geometric Series				Preparation for Summative Assessment
10					Exam

K=Knowledge Target
R=Reasoning Target
PS=Performance Skills Target
P=Product Target

Unit 4 Summary
Functions, Relations, and Conics

ACT Course Standards

Unit 4 Functions, Relations, and Conics		
B.1. Mathematical Processes	a.	Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
	b.	Use a variety of strategies to set up and solve increasingly complex problems
	c.	Represent data, real-world situations, and solutions in increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
	d.	Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
	e.	Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
	f.	Make mathematical connections among concepts, across disciplines, and in everyday experiences
	g.	Demonstrate the appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
	h.	Apply previously learned algebraic and geometric concepts to more advanced problems
C.1. Foundations	d.	Perform operations on functions, including function composition, and determine domain and range for each of the given functions
E.2. Graphs, Relations, and Functions	a.	Determine the domain and range of a quadratic function; graph the function with and without technology
	b.	Use transformations (e.g., translation, reflection) to draw the graph of a relation and determine a relation that fits a graph
E.3. Conic Sections	a.	Identify conic sections (e.g., parabola, circle, ellipse, hyperbola) from their equations in standard form
	b.	Graph circles and parabolas and their translations from given equations or characteristics with and without technology
	c.	Determine characteristics of circles and parabolas from their equations and graphs
	d.	Identify and write equations for circles and parabolas from given characteristics and graphs

F-IF

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 n engines in a factory, then the positive integers would be an appropriate domain for the function.*

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.

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.*

F-BF

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 coolingbody by adding a constant function to a decaying exponential, and relate these functions to the model.*

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.*

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) =2 x3 or f(x) =(x+1)/(x–1) for x* = 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.

Day	**Flash Back**	**CCSSI**	**ACT**	**Formative Assessment/Activity**	**Learning Target**
1	Graph a Linear Equation				
2	Evaluate an Expression	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 coolingbody by adding a constant function to a decaying exponential, and relate these functions to the model.*	C.1.D		**K:** Combine two functions using the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. **R:** Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities • determine which arithmetic operation should be performed to build the appropriate combined function • relate the combined function to the context of the problem
3	Add Matrices	F-IF-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 n engines in a factory, then the positive integers would be an appropriate domain for the function.*	C.1.D		**K:** Given the graph or a verbal/written description of a function, identify and describe the domain of the function. Identify an appropriate domain based on the unit, quantity, and type of function it describes. **R:** Relate the domain of the function to its graph and, where applicable, to the quantitative relationship it describes. Explain why a domain is appropriate for a given situation.
4	Combining Like Terms	F-IF-9 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*	C.1.D		**K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety

		function and an algebraic expression for another, say which has the larger maximum			of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions **K:** Combine two functions using the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. **R:** Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities • determine which arithmetic operation should be performed to build the appropriate combined function • relate the combined function to the context of the problem
5	Distributive Property	F-IF-9 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* F-BF-1	C.1.D		**K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions **K:** Combine two functions using

		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 coolingbody by adding a constant function to a decaying exponential, and relate these functions to the model*			the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. **R:** Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities • determine which arithmetic operation should be performed to build the appropriate combined function • relate the combined function to the context of the problem
6	Evaluate an Expression in the Form –b/2a	F-IF-7a 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. F-IF-9 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.*	E.2.A		**K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions
7	Graph a Set of Ordered Pairs	F-IF-5 Relate the domain of a function to its graph and, where applicable,	E.2.A E.3.C E.3.D		**K:** Given the graph or a verbal/written description of a function, identify and describe the domain of the function.

		to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function* F-IF-7a 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 F-IF-9 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.*			Identify an appropriate domain based on the unit, quantity, and type of function it describes. **R:** Relate the domain of the function to its graph and, where applicable, to the quantitative relationship it describes. Explain why a domain is appropriate for a given situation. **K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions
8	Solve a System of Equations	F-IF-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*	E.2.A E.3.C E.3.D		**K:** Given the graph or a verbal/written description of a function, identify and describe the domain of the function. Identify an appropriate domain based on the unit, quantity, and type of function it describes. **R:** Relate the domain of the

		person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function F-IF-7a 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 F-IF-9 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.*			function to its graph and, where applicable, to the quantitative relationship it describes. Explain why a domain is appropriate for a given situation. **K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions
9	Solve for a Variable	F-BF-4 Find the 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* $f(x) = (x + 1)/(x$ - *for x ≠ 1.*	C.1.D		**K:** Define inverse function. 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.
10	Describe the	F-IF-9	E.3.B		**K:** Identify types of functions

	Difference Between the Graphs of x and x+5.	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.* F-BF-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.*	E.2.B		based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions **K:** Given a single transformation on a function (symbolic or graphic) identify the effect on the graph. Using technology, identify effects of single transformations on graphs of functions. Graph a given function by 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). **R:** Describe the differences and similarities between a parent function and the transformed function. Find the value of k, given the graphs of a parent function, f(x), and the transformed function: f(x) + k, k f(x), f(kx), or f(x + k). Recognize even and odd functions from their graphs and from their equations. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
11	Graph Linear Inequalities	F-IF-9 9. Compare properties of two functions each represented in a different way (algebraically,	E.3.A E.3.B E.3.C E.3.D		I will identify the equation of a circle and graph.

		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.*			
12	Solve Absolute Value Equations	F-IF-9 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.*	E.3.A		**K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions
13	Graph a Quadratic Equation	F-IF-9 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.*	E.3.A		**K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions
14	Composition of Two Functions	F-IF-9 9. Compare properties of two functions each represented in a different way (algebraically, graphically,	E.2.A E.3.C E.3.D		**K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end

		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.*			behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions
15	Transformations	F-IF-9 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.*			**K:** Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) **R:** Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions
16					Exam

K=Knowledge Target
R=Reasoning Target
PS=Performance Skills Target
P=Product Target

Unit 5
Quadratic Equations, Inequalities, and Functions

ACT Course Standards

Unit 5 Quadratic Equations, Inequalities, and Functions	
B.1. Mathematical Processes	a. Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
	b. Use a variety of strategies to set up and solve increasingly complex problems
	c. Represent data, real-world situations, and solutions in increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
	d. Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
	e. Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
	f. Make mathematical connections among concepts, across disciplines, and in everyday experiences
	g. Demonstrate the appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
	h. Apply previously learned algebraic and geometric concepts to more advanced problems
C.1. Foundations	a. Identify complex numbers and write their conjugates
	b. Add, subtract, and multiply complex numbers
	c. Simplify quotients of complex numbers
E.1. Equations and Inequalities	a. Solve quadratic equations and inequalities using various techniques, including completing the square and using the quadratic formula
	b. Use the discriminant to determine the number and type of roots for a given quadratic equation
	c. Solve quadratic equations with complex number solutions
	d. Solve quadratic systems graphically and algebraically with and without technology
E.2. Graphs, Relations, and Functions	b. Use transformations (e.g., translation, reflection) to draw the graph of a relation and determine a relation that fits a graph
	c. Graph a system of quadratic inequalities with and without technology to find the solution set to the system

N-CN
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.
2. Use the relation *i*2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
7. Solve quadratic equations with real coefficients that have complex solutions.

A-REI-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.

F-IF-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.

Day	Flash Back	CCSSI	ACT	Formative Assessment/Activity	Deconstructed Standard
1	Identifying Real Numbers	N-CN-1 Know there is a complex number *i* such that *i*2 = –1,	C.1.A		**K:** Define *i* as √-1 or i^2 = -1. Define complex

		and every complex number has the form *a* + *bi* with *a* and *b* real.			numbers. Write complex numbers in the form a + b*i* with a and b being real numbers
2	Adding Like Terms	N-CN-2 Use the relation *i*2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	C.1.B		**K:** Know that the commutative, associative, and distributive properties extend to the set of complex numbers over the operations of addition and multiplication.
3	Foil Method	N-CN-2 Use the relation *i*2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	C.1.C		**K:** Know that the commutative, associative, and distributive properties extend to the set of complex numbers over the operations of addition and multiplication.
4	Solve a Linear Equation	F-IF-8a 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.	E.1.A		**K:** Identify how key features of a quadratic function relate to characteristics of in a real-world context. **R:** Given the expression of a quadratic function, interpret zeros, extreme values, and symmetry of the graph in terms of a real-world context. Write a quadratic function defined by an expression in different but equivalent forms to reveal and explain different properties of the function and determine which form of the quadratic (i.e. expanded, perfect square form) is the most appropriate for showing zeros, extrema and symmetry of a graph in terms of a real-world context.
5	Factor an Expression	F-IF-8a Write a function defined by an	E.1.A		**K:** Identify how key features of a quadratic function relate to characteristics of in a real-

		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.			world context. **R:** Given the expression of a quadratic function, interpret zeros, extreme values, and symmetry of the graph in terms of a real-world context. Write a quadratic function defined by an expression in different but equivalent forms to reveal and explain different properties of the function and determine which form of the quadratic (i.e. expanded, perfect square form) is the most appropriate for showing zeros, extrema and symmetry of a graph in terms of a real-world context.
6	Solve $x^2=4$	F-IF-8a 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.	E.1.A		**K:** Identify how key features of a quadratic function relate to characteristics of in a real-world context. **R:** Given the expression of a quadratic function, interpret zeros, extreme values, and symmetry of the graph in terms of a real-world context. Write a quadratic function defined by an expression in different but equivalent forms to reveal and explain different properties of the function and determine which form of the quadratic (i.e. expanded, perfect square form) is the most appropriate for showing zeros, extrema and symmetry of a graph in terms of a real-world context.
7	Evaluate an Expression in the Form of b^2-4ac	F-IF-8a 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	E.1.B		**K:** Identify how key features of a quadratic function relate to characteristics of in a real-world context. **R:** Given the expression of a quadratic function, interpret zeros, extreme values, and symmetry of the graph in terms of a real-world context. Write a quadratic function

		square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.			defined by an expression in different but equivalent forms to reveal and explain different properties of the function and determine which form of the quadratic (i.e. expanded, perfect square form) is the most appropriate for showing zeros, extrema and symmetry of a graph in terms of a real-world context.
8	Evaluate an Expression	F-IF-8a 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.	E.1.A		**K:** Identify how key features of a quadratic function relate to characteristics of in a real-world context. **R:** Given the expression of a quadratic function, interpret zeros, extreme values, and symmetry of the graph in terms of a real-world context. Write a quadratic function defined by an expression in different but equivalent forms to reveal and explain different properties of the function and determine which form of the quadratic (i.e. expanded, perfect square form) is the most appropriate for showing zeros, extrema and symmetry of a graph in terms of a real-world context.
9	Simplifying Complex Numbers	N.CN.7 Solve quadratic equations with real coefficients that have complex solutions	E.1.C		**K:** Solve quadratic equations with real coefficients that have complex solutions.
10	Solve a Linear Inequality	F-IF-8a 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.	E.1.A		I will solve a quadratic inequality algebraically.

11	Graph a Linear Inequality	F-IF-8a 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.	E.1.A		**K:** Identify how key features of a quadratic function relate to characteristics of in a real-world context. **R:** Given the expression of a quadratic function, interpret zeros, extreme values, and symmetry of the graph in terms of a real-world context. Write a quadratic function defined by an expression in different but equivalent forms to reveal and explain different properties of the function and determine which form of the quadratic (i.e. expanded, perfect square form) is the most appropriate for showing zeros, extrema and symmetry of a graph in terms of a real-world context.
12	Sigma Notation	A-REI-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.	E.1.D		**K:** Recognize and use function notation to represent linear, polynomial, rational, absolute value, exponential, and radical equations. **R:** Explain why the x-coordinates of the points where the graph of the equations y=f(x) and y=g(x) intersect are the solutions of the equations f(x)=g(x). Approximate/find the solution(s) using an appropriate method for example, using technology to graph the functions, make tables of values or find successive approximations.
13	Identify the Equation of a Circle	A-REI-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	E.1.D		**K:** Recognize and use function notation to represent linear, polynomial, rational, absolute value, exponential, and radical equations. **R:** Explain why the x-coordinates of the points where the graph of the equations y=f(x) and y=g(x) intersect are the solutions of the equations f(x)=g(x). Approximate/find the

		values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.			solution(s) using an appropriate method for example, using technology to graph the functions, make tables of values or find successive approximations.
14	Determine the Domain and Range	A-REI-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.	E.2.C E.2.B		**K:** Recognize and use function notation to represent linear, polynomial, rational, absolute value, exponential, and radical equations. **R:** Explain why the x-coordinates of the points where the graph of the equations y=f(x) and y=g(x) intersect are the solutions of the equations f(x)=g(x). Approximate/find the solution(s) using an appropriate method for example, using technology to graph the functions, make tables of values or find successive approximations.
15	Composition of Two Functions				Open Response
16	Complete the Square				Preparation for Assessment
17					Exam

K=Knowledge Target
R=Reasoning Target
PS=Performance Skills Target
P=Product Target

Unit 6
Polynomials

ACT Course Standards

Unit 6 Polynomials		
B.1. Mathematical Processes	a.	Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
	b.	Use a variety of strategies to set up and solve increasingly complex problems
	c.	Represent data, real-world situations, and solutions in increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
	d.	Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
	e.	Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
	f.	Make mathematical connections among concepts, across disciplines, and in everyday experiences
	g.	Demonstrate the appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
	h.	Apply previously learned algebraic and geometric concepts to more advanced problems
F.1. Expressions and Equations	a.	Evaluate and simplify polynomial expressions and equations
	b.	Factor polynomials using a variety of methods (e.g., factor theorem, synthetic division, long division, sums and differences of cubes, grouping)
F.2. Functions	a.	Determine the number and type of rational zeros for a polynomial function
	b.	Find all rational zeros of a polynomial function
	c.	Recognize the connection among zeros of a polynomial function, x-intercepts, factors of polynomials, and solutions of polynomial equations
	d.	Use technology to graph a polynomial function and approximate the zeros, minimum, and maximum; determine domain and range of the polynomial function

A-SSE

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.*
2. Use the structure of an expression to identify ways to rewrite it. *For example, see* $x4 - y4$ *as* $(x2)2 - (y2)2$, *thus recognizing it as a difference of squares that can be factored as* $(x2 - y2)(x2 + y2)$.

A-APR

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.
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 $p(x)$.
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.
4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x2 + y2)2 = (x2 - y2)2 + (2xy)2$ *can be used to generate Pythagorean triples.*
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.

F-IF

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.
7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

Day	**Flash Back**	**CCSSI**	**ACT**	**Formative Assessment/Activity**	**Deconstructed Standard**
1	Multiply Exponents	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.*	F.1.A		**K:** For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. **K:** The underpinning knowledge for this standard is addressed in **A.SSE.1a:** For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. **R:** For expressions that represent a contextual quantity, interpret parts of an expression, such as terms, factors, and coefficients in terms of the context. **R:** For expressions that represent a contextual quantity, interpret complicated expressions, in terms of the context, by viewing one or more of their parts as a single entity.
2	Evaluate an Expression	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.*	F.1.A		**K:** For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. **K:** The underpinning knowledge for this standard is addressed in **A.SSE.1a:** For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. **R:** For expressions that represent a contextual

					quantity, interpret parts of an expression, such as terms, factors, and coefficients in terms of the context. **R:** For expressions that represent a contextual quantity, interpret complicated expressions, in terms of the context, by viewing one or more of their parts as a single entity.
3	Combine Like Terms	A-APR-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.	F.1.A		**K:** Identify that the sum, difference, or product of two polynomials will always be a polynomial, which means that polynomials are closed under the operations of addition, subtraction, and multiplication. Define "closure". Apply arithmetic operations of addition, subtraction, and multiplication to polynomials.
4	Long Division of Real Numbers	A-APR-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.	F.1.B		**K:** Use inspection to 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 $b(x)$. Use long division to 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 $b(x)$. Use a computer algebra system to rewrite complicated 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 $b(x)$.
5	Factor a Quadratic	A-APR-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	F.1.B		**K:** Use inspection to 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

		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.			degree of $b(x)$. Use long division to 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 $b(x)$. Use a computer algebra system to rewrite complicated 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 $b(x)$.
6	Difference of Two Squares	A-APR-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 $p(x)$. A-APR-3	F.1.B		**K:** Define the remainder theorem for polynomial division and divide polynomials. **R:** Given a polynomial p(x) and a number a, divide p(x) by (x – a) to find p(a) then apply the remainder theorem and conclude that p(x) is divisible by x – a if and only if p(a) = 0.
7	Completely Factor a Trinomial	A-APR-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 $p(x)$. A-APR-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.	F.2.A F.2.B		**K:** Define the remainder theorem for polynomial division and divide polynomials. **R:** Given a polynomial p(x) and a number a, divide p(x) by (x – a) to find p(a) then apply the remainder theorem and conclude that p(x) is divisible by x – a if and only if p(a) = 0. **K:** When suitable factorizations are available, factor polynomials using any available methods. Create a sign chart for a polynomial f(x) using the polynomial's x-intercepts and testing the domain intervals for which f(x) greater than and less than zero. Use the *x*-intercepts of a polynomial function and the sign chart to construct a rough graph of the function

8	Foil Method	A-APR-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.*	F.2.C		**K:** Explain that an identity shows a relationship between two quantities, or expressions, that is true for all values of the variables, over a specified set. **R:** Prove polynomial identities. Use polynomial identities to describe numerical relationships.
9	Multiply Complex Numbers	F-IF-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.*	F.2.D		**K:** Define and recognize the key features in tables and graphs of linear, exponential, and quadratic functions: intercepts; intervals where the function is increasing, decreasing, positive, or negative, relative maximums and minimums, symmetries, end behavior and periodicity. Identify the type of function, given its table or graph. **R:** Interpret key features of graphs and tables of functions in the terms of the contextual quantities the function represents. Sketch graphs showing key features of a function that models a relationship between two quantities from a given verbal description of the relationship.
10	Solve Quadratic Equation	F-IF-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.*	F.2.D		**K:** Define and recognize the key features in tables and graphs of linear, exponential, and quadratic functions: intercepts; intervals where the function is increasing, decreasing, positive, or negative, relative maximums and minimums, symmetries, end behavior and periodicity. Identify the type of function, given its table or graph. **R:** Interpret key features of graphs and tables of functions in the terms of the contextual quantities the function represents. Sketch graphs showing key features of a function that models a relationship between two quantities from a given verbal description of the relationship.

		F-IF-7c Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard) c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.			**K:** Graph polynomial functions, by hand in simple cases or using technology for more complicated cases, and show/label maxima and minima of the graph, identify zeros when suitable factorizations are available, and show end behavior. **R:** Determine the difference between simple and complicated polynomial functions, and know when the use of technology is appropriate. Relate the relationship between zeros of quadratic functions and their factored forms to the relationship between polynomial functions of degrees greater than two.
11	Find the Discriminant	A-APR-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 F-IF-7c Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard) c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	F.2.D		**K:** When suitable factorizations are available, factor polynomials using any available methods. Create a sign chart for a polynomial f(x) using the polynomial's x-intercepts and testing the domain intervals for which f(x) greater than and less than zero. Use the *x*-intercepts of a polynomial function and the sign chart to construct a rough graph of the function **K:** Graph polynomial functions, by hand in simple cases or using technology for more complicated cases, and show/label maxima and minima of the graph, identify zeros when suitable factorizations are available, and show end behavior. **R:** Determine the difference between simple and complicated polynomial functions, and know when the use of technology is appropriate. Relate the relationship between zeros of quadratic functions and their factored

					forms to the relationship between polynomial functions of degrees greater than two.
12	Determine Domain and Range	F-IF-7c Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard) c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	F.2.D		**K:** Graph polynomial functions, by hand in simple cases or using technology for more complicated cases, and show/label maxima and minima of the graph, identify zeros when suitable factorizations are available, and show end behavior. **R:** Determine the difference between simple and complicated polynomial functions, and know when the use of technology is appropriate. Relate the relationship between zeros of quadratic functions and their factored forms to the relationship between polynomial functions of degrees greater than two.
13	Divide a Polynomial				Preparation for Assessment
14					Exam

K=Knowledge Target
R=Reasoning Target
PS=Performance Skills Target
P=Product Target

Unit 7
Rational and Radical Expressions and Equations

ACT Course Standards

Unit 7 Rational and Radical Expressions and Equations	
B.1. Mathematical Processes	a. Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
	b. Use a variety of strategies to set up and solve increasingly complex problems
	c. Represent data, real-world situations, and solutions in increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
	d. Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
	e. Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
	f. Make mathematical connections among concepts, across disciplines, and in everyday experiences
	g. Demonstrate the appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
	h. Apply previously learned algebraic and geometric concepts to more advanced problems
C.1. Foundations	d. Perform operations on functions, including function composition, and determine domain and range for each of the given functions
G.1. Rational and Radical Expressions, Equations, and Functions	a. Solve mathematical and real-world rational equation problems (e.g., work or rate problems)
	b. Simplify radicals that have various indices
	c. Use properties of roots and rational exponents to evaluate and simplify expressions
	d. Add, subtract, multiply, and divide expressions containing radicals
	e. Rationalize denominators containing radicals and find the simplest common denominator
	f. Evaluate expressions and solve equations containing *n*th roots or rational exponents
	g. Evaluate and solve radical equations given a formula for a real-world situation

A-REI

2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

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.

F-IF

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

Day	Flash Back	CCSSI	ACT	Formative Assessment/Activity	Deconstructed Standard
1	Find the Square Root		G.1.B		
2	Order of Operations		G.1.C		
3	Simplify Square Roots		G.1.D		
4	Distributive Property		G.1.D G.1.E		
5	Solve a Quadratic	A-REI-2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous	G.1.F		**K:** Determine the domain of a rational function. Determine the domain of a radical function. Solve radical equations in

		solutions may arise.			one variable. Solve rational equations in one variable. **R:** Give examples showing how extraneous solutions may arise when solving rational and radical equations
6	Add Complex Numbers		G.1.F		I will solve radical equations in real world scenarios.
7	Solve a Linear System by Graphing	A-REI-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.			**K:** Recognize and use function notation to represent linear, polynomial, rational, absolute value, exponential, and radical equations. **R:** Explain why the x-coordinates of the points where the graph of the equations y=f(x) and y=g(x) intersect are the solutions of the equations f(x)=g(x). Approximate/find the solution(s) using an appropriate method for example, using technology to graph the functions, make tables of values or find successive approximations.
8	Add/Subtract Fractions	F-IF-7b Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard) b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			**K:** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions, by hand in simple cases or using technology for more complicated cases, and show/label key features of the graph. Note from the Appendix A: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. **R:** Analyze the difference between simple and complicated linear, quadratic, square root, cube root, and piecewise-defined functions, including step functions and absolute value functions and know when the use of technology is appropriate.

					Compare and contrast the domain and range of absolute value, step and piece-wise defined functions with linear, quadratic, and exponential. Select the appropriate type of function, taking into consideration the key features, domain, and range, to model a real-world situation.
9	Find LCD		G.1.A		I will add and subtract rational expressions.
10	Find the x-intercepts of a Polynomial	A-REI-2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	G.1.A		**K:** Determine the domain of a rational function. Determine the domain of a radical function. Solve radical equations in one variable. Solve rational equations in one variable. **R:** Give examples showing how extraneous solutions may arise when solving rational and radical equations
11	Find the Slope of a Line	F-IF-7d d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.			I will identify vertical and horizontal asymptotes.
12	Find the Sum of a Sequence	F-IF-7d d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.			I will graph rational functions.
13	Graph a Absolute Value Function				Open Response
14	Rationalizing the Denominator				Preparation for Assessment
15					Exam

K=Knowledge Target
R=Reasoning Target
PS=Performance Skills Target
P=Product Target