ALGEBRA 1 HONORS

1200320 or 1209810 (Pre-AICE) or 1200390 (IB MYP)

Instructional Resource: McGraw-Hill: *Florida Algebra 1*, ©2015

Course Pacing

Unit of Instruction	# of Days	Dates of Instruction
Unit 1: Summarize, represent, and interpret data on a single count or measurement variable.	8	8/19 – 8/28
Unit 2: Interpret linear models.	7	8/29 – 9/9
Unit 3: Use properties of rational and irrational numbers.	3	9/10 – 9/12
Unit 4: Extend the properties of exponents to rational exponents.	5	9/16 – 9/20
Unit 5: Understand the concept of a function and use function notation. Interpret functions that arise in applications in terms of the context.	10	9/23 – 10/4
Cycle 1 Assessment (Units 1 -5)	**1**	**10/7** (9/30 – 10/11)
Unit 6: Interpret the structure of expressions	3	10/8 – 10/10
Unit 7: Create and solve equations and inequalities	11	10/11 – 10/28
Unit 8: Represent and solve equations and inequalities graphically.	11	10/29 – 11/12
Unit 9: Solve systems of equations and inequalities	8	11/13 – 11/22
Unit 10: Perform arithmetic operations on polynomials. (Split across both semesters)	7	12/2 – 12/10
Midterm Exam (& Review) (Units 6-9)	**1**	**12/11 – 12/20**
Unit 10: Perform arithmetic operations on polynomials. (Split across both semesters)	5	1/8 – 1/14
Unit 11: Polynomial relationships and identities.	13	1/15 – 2/3
Unit 12: Solve quadratic expressions	12	2/4 – 2/20
Unit 13: Construct and compare linear, quadratic, and exponential models and solve problems.	15	2/24 – 3/13
Unit 14: Interpreting and analyzing functions.	8	3/24 – 4/2
Unit 15: Build a function that models a relationship between two quantities.	10	4/3 – 4/17
Unit 16: Building new functions from existing functions.	5	4/20 – 4/24
Unit 17: Summarize, represent, and interpret data on two categorical and quantitative variables.	4	4/27 – 4/30
Algebra 1 EOC	**2**	**5/4 – 5/29**

Pinellas County Schools

ALGEBRA 1 HONORS

2019-2020

Building Community in the Math Classroom

Unit 1: Summarize, represent, and interpret data on a single count or measurement variable.

MAFS.912.S-ID.1.1 MAFS.912.S-ID.1.3
MAFS.912.S-ID.1.2 *MAFS.912.S-ID.1.4

Unit 2: Interpret linear models.

MAFS.912.S-ID.3.7 MAFS.912.S-ID.3.9
MAFS.912.S-ID.3.8

Unit 3: Use properties of rational and irrational numbers.

MAFS.912.N-RN.2.3

Unit 4: Extend the properties of exponents to rational exponents.

MAFS.912.N-RN.1.1 MAFS.912.N-RN.1.2

Unit 5: Understand the concept of a function and use function notation. Interpret functions that arise in applications in terms of the context.

MAFS.912.F-IF.1.1 MAFS.912.F-IF.1.3
MAFS.912.F-IF.1.2 MAFS.912.F-IF.2.4

Cycle 1 Assessment

Standards from Units 1-5

Unit 6: Interpret the structure of expressions.

MAFS.912.A-SSE.1.1

Unit 7: Create and solve equations and inequalities.

MAFS.912.A-CED.1.1 MAFS.912.A-REI.1.1
MAFS.912.A-CED.1.2 *MAFS.912.A-REI.1.2
MAFS.912.A-CED.1.4 MAFS.912.A-REI.2.3

Unit 8: Represent and solve equations and inequalities graphically.

MAFS.912.A-CED.1.3 MAFS.912.A-REI.4.11
MAFS.912.A-REI.4.10 MAFS.912.A-REI.4.12

Unit 9: Solve systems of equations and inequalities.

MAFS.912.A-REI.3.5 MAFS.912.A-REI.3.6
MAFS.912.A-REI.4.12

Unit 10: Perform arithmetic operations on polynomials.

MAFS.912.A-APR.1.1

Semester 1 Review and Exam

All standards from Units 6-9

Re-Building Community in the Math Classroom

Unit 10: Perform arithmetic operations on polynomials.

MAFS.912.A-APR.1.1

Unit 11: Polynomial relationships and identities.

*MAFS.912.A-APR.2.2 *MAFS.912.A-APR.4.6
MAFS.912.A-APR.2.3 MAFS.912.A-SSE.1.2
*MAFS.912.A-APR.3.4

Unit 12: Solve quadratic equations.

MAFS.912.A-REI.2.4 MAFS.912.A-SSE.2.3
*MAFS.912.A-REI.3.7

Unit 13: Construct and compare linear, quadratic, and exponential models and solve problems.

MAFS.912.F-LE.1.1 MAFS.912.F-LE.1.3
MAFS.912.F-LE.1.2 MAFS.912.F-LE.2.5

Unit 14: Interpreting and analyzing functions.

MAFS.912.F-IF.2.5 MAFS.912.F-IF.3.8
MAFS.912.F-IF.2.6 MAFS.912.F-IF.3.9
MAFS.912.F-IF.3.7

Unit 15: Build a function that models a relationship between two quantities.

MAFS.912.F-BF.1.1 *MAFS.912.A-SSE.2.4
*MAFS.912.F-BF.1.2

Unit 16: Building new functions from existing functions.

MAFS.912.F-BF.2.3 *MAFS.912.F-BF.2.4

Unit 17: Summarize, represent, and interpret data on two categorical and quantitative variables.

MAFS.912.S-ID.2.5 MAFS.912.S-ID.2.6

FSA Algebra 1 EOC

May 4-28, 2018

UNIVERSAL STANDARDS

MAFS.912.N-Q-1.1 MAFS.912.N-Q.1.3
MAFS.912.N-Q.1.2

Calendars

August 2019

				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

September 2019

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

October 2019

		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

November 2019

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

December 2019

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

January 2020

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

February 2020

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

March 2020

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April 2020

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May 2020

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June 2020

1	2	3	4	5	6

Semester 1	**Unit 1: Summarize, represent, and interpret data on a single count or measurement variable.**	8 days: 8/19-8/28

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.S-ID.1.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).	• None Calculator: **NEUTRAL** • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
MAFS.912.S-ID.1.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	• Items may require the student to calculate mean, median, and interquartile range for the purpose of identifying similarities and differences. • Items should not require the student to calculate the standard deviation. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.S-ID.1.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	• Items should not require the student to fit normal curves to data. • Data distributions should be approximately normal. • Data sets should be real-world and quantitative. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.S-ID.1.4 (Algebra 2 standard not tested) 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	• Students will calculate the z-score and use it to compare a data point to the population. • Students will calculate the z-score and use it to compare two data points. Calculator: **NEUTRAL** • Equation Editor • GRID • Matching Item • Multiple Choice • Multiselect • Open Response • Table item

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- Chapter 12: Statistics and Probability
  - Lesson 1: Samples and Studies
  - Algebra Lab: Evaluating Published Data
  - Lesson 2: Statistics and Parameters
  - Lesson 3: Distributions of Data
  - Lesson 4: Comparing Sets of Data

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

Algebra Nation
• Data Plots • Histograms • Box Plots – Part 1 • Box Plots – Part 2 • Measures of Center and Shapes of Distributions • Measures of Spread – Part 1 • Measures of Spread – Part 2 • The Empirical Rule • Outliers in Data Sets

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 2, Topic A, Lesson 1 • Algebra 1 Module 2, Topic A, Lesson 2 • Algebra 1 Module 2, Topic A, Lesson 3 • Algebra 1 Module 2, Topic B, Lesson 4 • Algebra 1 Module 2, Topic B, Lesson 5 • Algebra 1 Module 2, Topic B, Lesson 6 • Algebra 1 Module 2, Topic B, Lesson 7 • Algebra 1 Module 2, Topic B, Lesson 8

Decoded Standard	
MAFS.912.S-ID.1.1 Students use dot plots, histograms, and box plots to represent quantitative data collected from their world or through purposely given data sets. Though these graphs are separate, graphing them simultaneously on one number line builds a strong foundation and understanding of each. Students describe features that each data representation possesses for the description of a particular distribution. Histograms are useful to represent distributional shape but limit the ability to determine exact measures of center and spread. The shape of histograms may change based on the chosen bin widths. Dot plots allow for the calculation of summary statistics but are tedious to draw and, if represented by numbers that are not integers, may be difficult to summarize. Box plots can emphasize the spread of a distribution by comparing the size of quartiles and can help with the understanding of skewness of a data set while being plotted simultaneously with histograms and dot plots. (*Common Core Mathematics Companion*, Pg. 351)	
Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources
A Tomato Garden Students are asked to construct a dot plot corresponding to a given set of data Flowering Trees Students are asked to determine whether each of two given dot plots are consistent with a given histogram. Winning Season Students are asked to construct a histogram corresponding to a given set of data. Trees in the Park Students are asked to construct a box plot corresponding to a given set of data. Illustrative Mathematics Assessment Tasks	

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Speed Trap The purpose of this task is to allow students to demonstrate an ability to construct boxplots and to use boxplots as the basis for comparing distributions.	

Decoded Standard	
MAFS.912.S-ID.1.2 The overarching purpose of statistics is to use data to summarize, compare, and predict. This particular standard focuses on the issue of comparison between different data sets. Students are required to understand the difference between centers and spreads of two distributions. In some cases, summary information may be similar or different based on the context of the data set; thus, students are required to use and justify appropriate measure of center and spread. (*Common Core Mathematics Companion*, Pg. 353)	
Instructional Resources	
Mathematics Formative Assessments (MFAS) How Many Jeans Students are asked to select a measure of center to compare data displayed in dot plots and to justify their choice. Texting During Lunch Students are asked to select a measure of center to compare data displayed in frequency tables and to justify their choice. Texting During Lunch Histograms Students are asked to select measures of center and spread to compare data displayed in histograms and to justify their choices. Illustrative Mathematics Assessment Tasks Hair Cut Costs This problem could be used as an introductory lesson to introduce group comparisons and to engage students in a question they may find amusing and interesting.	Lesson Resources

Decoded Standard	
MAFS.912.S-ID.1.3 We often describe distributions by their center. We may identify one or multiple peaks or modes of the data set, which may or may not relate to the distribution's measure of center. Generally, the mean is best used for the measure of center if there are no extreme values or there is no skewness in the distribution. When distributions are skewed to the right or the left, the mean tends to be more towards the skew than the center of the distribution. In cases of skewed data sets or cases with extreme values, it is more appropriate to use the median as a center because it is considered robust, or less subjective to extreme values or skewness. The uniform distribution or uniform probability model may also be useful for students because it is a good model for introduction of probability models for continuous data. Students should use summaries of quantitative spread that use the relationship of dispersion and center. The interquartile range (IQR), which represents the width of the box plot, or Quartile 3 minus Quartile 1, does not use a measure of center in its calculation. For this reason, students should use the IQR as a preferred description measure when in the presence of skewness or outliers (that is, when the median is the more appropriate measure of center). Students use the standard deviation when the mean of a data set is appropriate, such as when the distribution is symmetric or when a sample is intended to measure the population mean. (*Common Core Mathematics Companion*, Pg. 354)	
Instructional Resources	
Mathematics Formative Assessments (MFAS) Using Centers to Compare Tree Heights Students are asked to compare the centers of two data distributions displayed using box plots.	Lesson Resources

Using Spread to Compare Tree Heights Students are asked to compare the spread of two data distributions displayed using box plots. Comparing Distributions Students are given two histograms and are asked to describe the differences in shape, center, and spread. Total Points Scored Students are given a set of data and are asked to determine how the mean is affected when an outlier is removed.	

Decoded Standard

MAFS.912.S-ID.1.4

This particular standard emphasizes the use of the normal distribution to obtain the probability or likelihood of certain events. Though the empirical rule is not explicitly stated, it can form a basis for the relationship understanding of area under the distribution and likelihood of occurrence. The empirical rule states that 68% of the data in a normal distribution is between 1 standard deviation below the mean and 1 standard deviation above the mean; 95% of data is between 2 standard deviations below the mean and 2 standard deviations above the mean; 99.7% of the data from a normal distribution is between 3 standard deviations below the mean and 3 standards deviations above the mean, shown below.

See the images on page 355.

The standards emphasizes the use of calculators, spreadsheets, and tables to estimate the area under the curve. Students can use functions within advanced calculators to identify boundaries of interest. For example, a problem may require finding the probability of an event being between -1 standard deviation and 1.5 standard deviations of the mean. This is an interval contained within two bounds. Intervals may be upward-bound restricted, lower-bound restricted, or both lower- and upward-bound restricted. When using tables or spreadsheets to identify areas or probability of interest, it is important to identify the table or spreadsheet design. Some tables may provide areas below or above a value of interest.

If students use tables, they will need to learn how to standardize data using data transformations. Teachers should devote attention and time to ensuring students understand the impact of operations on data sets. Addition and subtraction of a data set by the same number relates to translation. This keeps the data set shape and spread equal; however, the center shifts. Multiplication and division of the data set relates to dilation. The center and spread are numerically changed; however, the shape is equivalent. To students, the shape of the graph of the data set may appear to change during experimentation, but the shapes of the original and the transformed data are equivalent. Students can verify this when changing the scale of the transformed graph or the bin width of the histogram by the scale of the multiplier. Standardization uses these properties to transform a data set by shifting it to a center of zero and making it standard deviation 1.

(*Common Core Mathematics Companion*, Pgs. 355-356)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Range of testing Thread Students are asked to find the probability that an outcome of a normally distributed variable is between two given values. Label a Normal Curve Students are asked to scale and label a normal curve given the mean and standard deviation of a data set with a normal distribution. Area Under the Normal Curve Students are asked to find the probability that an outcome of a normally distributed variable is between two given values using both a Standard Normal Distribution Table and technology. Algebra Test Scores Students are asked to select a histogram for which it would be appropriate to apply the 68-95-99.7 rule.	•

Probability of your Next Texting Thread Students are asked to find the probability that an outcome of a normally distributed variable is greater than a given value. Illustrative Mathematics Assessment Tasks SAT Scores This problem solving task challenges students to answer probability questions about SAT scores, using distribution and mean to solve the problem. Do You Fit in This Car? This task requires students to use the normal distribution as a model for a data distribution. Students must use given means and standard deviations to approximate population percentages	

Semester 1	**Unit 2: Interpret linear models.**	7 days: 8/29-9/9

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.S-ID.3.7 In items that require the student to interpret or use the correlation coefficient, the value of the correlation coefficient must be given in the stem.	• Items assessing S-ID.3.7 should include data sets. Data sets must contain at least six data pairs. The linear function given in the item should be the regression equation. • For items assessing S-ID.3.7, the rate of change and the y-intercept should have a value with at least a hundredths place value. Calculator: **NEUTRAL** • Equation Editor • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.S-ID.3.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. Assessed with MAFS.912.S-ID.2.6	• In items that require the student to interpret or use the correlation coefficient, the value of the correlation coefficient must be given in the stem. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.S-ID.3.9 Distinguish between correlation and causation. Assessed with MAFS.912.S-ID.2.6	• In items that require the students to interpret or use the correlation coefficient, the value of the correlation must be given in the stem. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- Chapter 4: Equations of Linear Functions
    - Algebra Lab: Correlation and Causation

Algebra Nation

- Rate of Change of Linear Functions
- Interpreting Rate of Change and Y-Intercpet in a Real-World Context – Part 1
- Interpreting Rate of Change and Y-Intercept in a Real-World Context – Part 2
- Examining Correlation

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Algebra 1 Module 2, Topic C, Lesson 11
- Algebra 1 Module 2, Topic C, Lesson 12

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- Algebra 1 Module 2, Topic C, Lesson 13
- Algebra 1 Module 2, Topic D, Lesson 14
- Algebra 1 Module 2, Topic D, Lesson 15
- Algebra 1 Module 2, Topic D, Lesson 19
- Algebra 1 Module 2, Topic D, Lesson 20

Decoded Standard

MAFS.912.S-ID.3.7

Students interpret slope from a given linear model in terms of units of increase of the *x* variable and the associated increase or decrease on the *y* variable. For a positive slope, students describe how a specific increase in the *x* variable contributes to a certain increase in the *y* variable (in context). For a negative slope, students relate the increase in the *x* variable (in context of the situation) with a decrease in the *y* variable. For every 1 unit of increase in the *x* variable, the *y* variable will increase of decrease the amount and direction of the slope.

The intercept of a linear model cannot always be interpreted within a context. A correct interpretation discusses the *y* variable in context when the *x* variable in context is zero. If the *x* variable cannot contextually be zero or close to zero, students should address the inappropriateness of interpretation. In addition, the *y* intercept may be far from the points in the data set and be useless for prediction (and is considered a case of unwarranted extrapolation). (*Common Core Mathematics Companion*, Pg. 369)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Intercept for Life Expectancy Students are asked to interpret the intercept of a linear model of life expectancy data. Slope for Foot Length model Students are asked to interpret the meaning of the slope of the graph of a linear model. Slope For Life Expectancy Students are asked to interpret the meaning of the slope of the graph of a linear model. Bungee Cord Model Students are asked to interpret the meaning of the constant term in a linear model.	

Decoded Standard

MAFS.912.S-ID.3.8

Students use technology to compute the correlation coefficient of a linear fit. This is a measure of the strength and direction of the linear relationship between two variables, or the correlation coefficient (*r*). A model is said to be perfectly positively related when the *r* value is 1 and perfectly negatively related when the *r* value is -1. No linear association would be represented with an *r* value of 0. Some common interpretations for specific *r* values are in the table below but are not a gold standard. Tables such as this should not be used alone but in conjunction with the scatter and residual plots to determine appropriate fit.

|*r* value|	Description
.0-.19	Very weak
.2-.39	Weak
.4-.59	Moderate
.6-.79	Strong
.8-1.0	Very Strong

Students can model correlation coefficient by visually displaying points' relationships to both their independent and dependent variables' mean using vertical and horizontal lines. Though not a part of this standard, the calculation of the correlation coefficient is the slope of the line when the *x* and *y* have been standardized or shifted to an intercept of (0, 0) with both *x* and *y* having standard deviation 1.

See Pgs. 371-372 for more information.

(*Common Core Mathematics Companion*, Pgs. 371-372)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
July December Correlation Students are asked to compute and interpret the correlation coefficient for a given set of data. How Big are Feet Students are asked to compute and interpret the correlation coefficient for a given set of data. Correlation Order Students are asked to estimate a correlation coefficient for each of four data sets and then order the coefficients from least to greatest in terms of the strength of relationship. Correlation for Life Expectancy Students are asked to compute and interpret the correlation coefficient for a given set of data.	

Decoded Standard

MAFS.912.S-ID.3.9

Data alone cannot be used to determine causation; thus, experimentation and science is involved to help deduce causation. Students and the teacher should pay careful attention to terminology used when describing bivariate relationships (both quantitative versus quantitative, quantitative versus categorical, and categorical versus categorical), even when causal effects seem evident. In order to determine causation to a population or from a treatment, at the least, researchers must complete a random sampling from the population and a random assignment to the treatment group. In many situations, this is impossible and unethical.

Teachers can exemplify this standard with the use of two variables that are associated but obviously not causal. An example may entail having students plot their arm length and height. Though the two variables will be associated, having a large arm length does not cause you to be tall. And using a stretching regimen designed to increase your arm length will likely have no impact on your height.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Sleep and Reading Students are asked to interpret a correlation coefficient in context and describe a possible causal relationship. Does Studying Pay? Students are given a scenario describing an association between two variables and are asked to determine if one variable is a cause of the other. Listing All Possible Causal Relationships Students are asked to identify all possible causal relationships between two correlated variables. Illustrative Mathematics Assessment Tasks Coffee and Crime This problem solving task asks students to examine the relationship between shops and crimes by using a correlation coefficient. Golf and Divorce This is a simple task addressing the distinction between correlation and causation. Students are given information indicating a correlation between two variables, and are asked to reason out whether or not a causation can be inferred.	

Semester 1	**Unit 3: Use properties of rational and irrational numbers.**	3 days: 9/10-9/12

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.N-RN.2.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	• Expressions should contain no more than three variables. Calculator: **NO** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• Chapter 10: Radical Functions and Geometry   ○ Algebra Lab: Rational and Irrational Numbers

Algebra Nation
• Operations with Rational and Irrational Numbers

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
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Decoded Standard
MAFS.912.N-RN.2.3 Students work with symbolic forms of rational and irrational numbers to make conjectures about closure for addition and multiplication and to be able to explain why their conjectures work. The key word is *explain*. It is not sufficient for students to apply an algorithm to complete a calculation; they must understand what that calculation means. (*Common Core Mathematics Companion*, Pg. 18)

Instructional Resources	
Mathematics Formative Assessments (MFAS) Sum of Rational and Irrational Numbers Students are asked to describe the difference between rational and irrational numbers and then explain why the sum of a rational and an irrational number is irrational. Product of Rational Numbers Students are asked to define a rational number and then explain why the product of two rational numbers is rational. Sum of Rational Numbers Students are asked to define a rational number and then explain why the sum of two rational numbers is rational. Product of Non-Rational Zero Numbers Students are asked to describe the difference between rational and irrational numbers, and then explain why the product of a non-zero rational and an irrational number is irrational. Illustrative Mathematics Assessment Tasks Calculating the Square root of 2 This task is intended for instructional purposes so that students can become familiar and confident	Lesson Resources

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with using a calculator and understanding what it can and cannot do. Operations with Rational and Irrational Numbers This task has students experiment with the operations of addition and multiplication, as they relate to the notions of rationality and irrationality.	

Semester 1	**Unit 4: Extend the properties of exponents to rational exponents.**	5 days: 9/16-9/20

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
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.*	• Expressions should contain no more than three variables. Calculator: **NO** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.N-RN.1.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.	• Expressions should contain no more than three variables. • For N-RN.1.2, items should not require the student to do more than two operations Calculator: **NO** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

• Chapter 7: Exponents and Exponential Functions
  ○ Lesson 1: Multiplication Properties of Exponents *(not part of either standard, but probably needed)*
  ○ Lesson 2: Division Properties of Exponents *(not part of either standard, but probably needed)*
  ○ Lesson 3: Rational Exponents

Algebra Nation
• Properties of Exponents • Radical Expressions and Expressions with Rational Exponents • Adding Expressions with Radicals and Rational Exponents • More Operations with Radical and Rational Exponents

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
•

Decoded Standard
MAFS.912.N-RN.1.1 Students use the exponent property $(a^b)^c = a^{bc}$ from earlier grades to derive the meaning of rational exponents. The connection between inverse operations (such as multiplication undoes division) is expanded to radicals and exponents. For example, $(\sqrt{25})^2 = 5^2 = 25$ is a good starting point for considering how a square root and squaring undo each other. Exploring similar problems by hand and with technology resources leads students to

discover what exponents must stand for a given radical (that $\frac{1}{2}$ is the exponent that means the same thing as $\sqrt{}$).

Problems such as $\left(\sqrt{25}\right)^3 = 5^{\frac{3}{2}} = \left(5^{\frac{1}{2}}\right)^3 = 5^3 = 125$ further extend the meaning of fractional exponents beyond fractions with a numerator of one. Students must also connect the meaning of functions with the restricted range of operations such as the square root – that is, students must be able to explain that $\sqrt{9} = 3$ and not $\sqrt{9} = \pm 3$ in order to satisfy the demand that a square root be a function. (*Common Core Mathematics Companion*, Pg. 14)

Instructional Resources	
Illustrative Mathematics Assessment Tasks Evaluating a Special Exponential Expression Three students disagree about what value to assign to the expression 00. In each case, critically analyze the student's argument. Evaluating Exponential Expressions This task is to use properties of exponents for whole numbers in order to explain how expressions with fractional exponents are defined. Checking a Calculation of a Decimal Exponent This task is to connect properties of fractional exponents with ordering of real numbers. Extending the Definitions of Exponents, Variation 2 Students will develop an understanding of why rational exponents are defined as they are.	Lesson Resources • MARS/Shell ○ Manipulating Radicals Students will use the properties of exponents, including rational exponents and manipulate algebraic statements involving radicals. Discriminate between equations and identities.

Decoded Standard	
MAFS.912.N-RN.1.2 Students are able to use both radical and exponential forms to write expressions and can translate flexibility between them. Students use symbolic examples, such as $a^2\sqrt{a} = a^2 \cdot a^{\frac{1}{2}} = a^{\frac{5}{2}}$, and contextual examples, like solving $V = \frac{4}{3}\pi r^3$ for *r*.	
Instructional Resources	
Illustrative Mathematics Assessment Tasks	Lesson Resources

Semester 1	**Unit 5: Understand the concept of a function and use function notation. Interpret functions that arise in applications in terms of the context.**	10 days: 9/23-10/4

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.F-IF.1.1 (Assessed under F-IF.1.2) Understand that a function from one set (called a domain) to another set (called the range assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x),* denotes the output of *f* corresponding to the input *x*. The graph of, *f* is the graph of the equation *y=f(x).*	• Items that require the student to determine the domain using equations within a context are limited to exponential functions with one translation, linear functions, or quadratic functions. • Items may present relations in a variety of formats, including sets of ordered pairs, mapping diagrams, graphs, and input/output models. • In items requiring the student to find the domain from the graphs, relationships may be on a closed or open interval. • In items requiring the student to find the domain from graphs, relationships may be discontinuous. • Items may not require students to know or use interval notation Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.F-IF.1.2 (Also assesses F-IF.1.1 and F-IF.2.5) Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	• In items that require the student to find a value given a function, the following function types are allowed: quadratic, polynomials whose degrees are no higher than 6, square root, cube root, absolute value, exponential except for base e, and simple rational. Calculator: **Neutral** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.F-IF.1.3 Recognize that sequences are functions, sometimes defined recursively whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0)=f(1)-1, f(n+1)=f(n)+f(n-1) for $n \geq 1$	• In items where the student constructs an exponential function, a geometric sequence in a recursive definition from input-output pairs, at least two sets of pairs must have consecutive inputs. Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item

MAFS.912.F-IF.2.4 (Also assesses F-IF.3.9) 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; symmetric; and behavior; and periodicity.	• Functions can be linear, quadratic or exponential • Functions can be represented using tables or graphs. Functions represented using these representations are not limited to linear, quadratic or exponential. • Functions may have closed domains • Functions may be discontinuous • Items may not require students to use or know interval notation.
	Calculator: **NO**
	• Equation Editor • GRID • Hot Text • Multiple Choice • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- Chapter 1: Expressions, Equations, and Functions
    - Lesson 6: Relations
    - Lesson 7: Functions
    - Lesson 8: Interpreting Graphs of Functions

Algebra Nation

- Input and Output Values
- Representing, Naming, and Evaluating Functions
- Real-World Combinations and Compositions of Functions
- Arithmetic Sequences
- Geometric Sequences
- Comparing Arithmetic and Geometric Sequences
- Exploring non-Arithmetic, non-Geometric Sequences

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Algebra 1 Module 3, Topic A, Lesson 1
- Algebra 1 Module 3, Topic A, Lesson 2
- Algebra 1 Module 3, Topic A, Lesson 3
- Algebra 1 Module 3, Topic B, Lesson 8
- Algebra 1 Module 3, Topic B, Lesson 9
- Algebra 1 Module 3, Topic B, Lesson 10
- Algebra 1 Module 3, Topic B, Lesson 11
- Algebra 1 Module 3, Topic B, Lesson 12

Decoded Standard

MAFS.912.F-IF.1.1
Students will understand that a function is a special relationship between two sets (the domain, or the input or dependent values, and the range, or output or independent values) in which each domain value corresponds to one and only one range value. Students can determine if a relation is a function by looking at the sets of pairs of

elements, a rule, a graph, or a table of values. The vertical line test is not referenced in the Standards because it requires students to understand the underlying concept of function and to have the knowledge of when it may not apply (such as functions that are not graphed or some parametrically defined functions). Students understand that the graph of *f* is the same as using *y*= symbols, but that the function notation allows us the flexibility of seeing both the input and output in one statement. Students can then make the connection between the statements "the graph of *f*" and "the graph of *y*=*f*(*x*)". (*Common Core Mathematics Companion*, Pg. 146)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Identifying Functions Students identify functions from tables and maps. Identifying the Graphs of a Function Students identify graphs as functions or not functions Writing Functions Students write functions in tables and maps Cafeteria Function Students are asked to decide if one variable is a function of the other in the context of a real-world problem. What is a Function? Students are asked to define the term function and describe any important properties of functions.	• MARS/Shell A culminating lesson task using a coherent approach to this unit ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Decoded Standard

MAFS.912.F-IF.1.2

Students practice with function notation so they acquire fluency with it. Using a context, such as having *d* stand for a distance function relating to miles and time in hours lets students view *d*(5)=105 as the distance traveled at time 5 hours is 105 miles. Students read this as "*d* of 5" and interpret *d*(5) to stand for the output value of the function, whether it is evaluated or not.

Students can use graphing technology to explore expressions for functions such as *g*(*x*)+4 or *h*(*x*-1) to gain facility with function notation. This is especially helpful to build students' understanding that function notation is not an arithmetic operation – that is, does not indicate multiplication or the possibility of the distributive property. (*Common Core Mathematics Companion*, Pg. 148)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
What is the Function Notation? Explores what function notation represents for students. What is the Value? Students evaluate corresponding input values in a function table. Graphs and Functions Students determine a given function at an input by inspecting its graph. Illustrative Mathematics Assessment Tasks The Random Walk This task requires interpreting functions. Yam in the Oven Students practice interpreting statements using function notation. The Parking Lot Students investigate the meaning of the definition of a function based on a situation.	• MARS/Shell *A culminating lesson task using a coherent approach to this unit* ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Decoded Standard

MAFS.912.F-IF.1.3

Students will understand there can be special types of function notation used for sequences and recursive functions. For a geometric sequence that is defined recursively, students may see $a_n = a_{n-1}r$, where *n* is the index or term number, and a_{n-1} stands for the previous term of the function, as well as more standard notation such as $g(n) = g(n-1)r$. It is helpful to provide examples to help students see sequences as a set of range values with an index from the integers – a first term, second term, third term, and so forth. For example, a sequences can be written as $a_n = n + 1$, so that $a_1 = 2$, $a_2 = 3$, … , $a_6 = 7$, and so on. Tables are frequently used to investigate sequences. (*Common Core Mathematics Companion*, Pg. 150)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Recursive Sequences Students are asked to find the first five terms of a sequence recursively, explain why the sequence is a function, and describe its domain. Which Sequences are Functions? Students are asked to determine if each of two sequences is a function and to describe its domain, if it is a function.	

Decoded Standard

MAFS.912.F-IF.2.4

Students attain conceptual understanding of the key features of a function by focusing on graphs and tables of the related quantities. (*Common Core Mathematics Companion*, Pg. 152)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Elevation Along a Trail Students interpret key features of a graph (symmetry) in the context of a problem situation. Uphill and Downhill Students interpret key features of a graph (intercepts and intervals over which the graph is increasing) in the context of a problem situation. Taxi Ride Students sketch a graph from a verbal description. Bike Race Students evaluate three verbal descriptions and to state why each does or does not match a given graph. Surf's Up Students are given a table of functional values and asked to describe and interpret key features of the graph in the context of the problem. Illustrative Mathematics Assessment Tasks Snake on a Plane This task has students approach a function via both a recursive and an algebraic definition, in the context of a famous game. Warming and Cooling Straightforward interpretation to read and interpret a graph. Telling a story with graphs Students examine graphs and interpret them giving a verbal description of what they see.	• MARS/Shell *A culminating lesson task using a coherent approach to this unit* ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Semester 1	**Unit 6: Interpret the structure of expressions.**	3 days: 10/8-10/10

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
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 as the product of P and a factor not depending on P.	• For A-SSE.1.1, items should not ask the student to interpret zeros, the vertex, or axis of symmetry when the quadratic expression is in the form ax2 + bx + c (see F-IF.3.8). Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- Chapter 1: Expressions, Equations, and Functions
  - Lesson 1: Variables and Expressions
  - Lesson 2: Order of Operations (requires complex expressions)
  - Lesson 3: Properties of Numbers

Algebra Nation

- Using Expressions to Represent Real-World Situations
- Understanding Polynomial Expressions
- Algebraic Expressions Using the Distributive Property
- Algebraic Expressions Using the Commutative and Associative Properties.

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Algebra 1 Module 1, Topic B, Lesson 6
- Algebra 1 Module 1, Topic B, Lesson 7
- Algebra 1 Module 4, Topic B, Lesson 12
- Algebra 1 Module 4, Topic B, Lesson 16

Decoded Standard

MAFS.912.A-SSE.1.1
Students see that complicated expressions are built up out of simpler ones. Part of this understanding means students know what a factor is, know how factors and coefficients are related, and know how constants, factors, and/or coefficients relate to terms in an expression. Students work with the structure of a complicated expression, identify the parts to help understand what the expression means. Complex formulas in science or other disciplines are a rich source of applications for these standards. The Doppler Effect formula, $f = \left(\frac{c+v_r}{c+v_s}\right) f_0$, can be seen as the product but also as including a part that is quotient in which both the numerator and denominator have a similar format in which the velocity of the waves in a medium, *c*, are affected by the velocity of the receiver or source to the medium. Students can determine the relative values of each and make estimates about the size of the Doppler Effect. Students may also recognize that the computational rules they have learned mean that the expression $\left(\frac{c+v_r}{c+v_s}\right) f_0$ is not equivalent to $\left(\frac{1+v_r}{1+v_s}\right) f_0$. (*Common Core Mathematics Companion*, Pg. 81)

Instructional Resources

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Dot Expressions Students are asked to explain how parts of an algebraic expression relate to the number and type of symbols in a sequence of diagrams. Interpreting Basic Tax Students interpret the parts of an equation used to calculate the total purchase price including tax of a set of items. What Happens? Students are asked to determine how the volume of a cone will change when its dimensions are changed. Illustrative Mathematics Assessment Tasks Animal Populations Students interpret the relative size of variable expressions involving two variables in the context of a real world situation. Mixing Fertilizer Students generalize the problem and verify conclusions using algebraic rather than numerical expressions. The Bank Account Students explore an expression that calculates the balance of a bank account with compounding interest. Cubic Identity This task presents a challenging exercise in both algebraic manipulations and seeing structure in algebraic expressions. Seeing Dots The purpose of this task is to identify the structure in the two algebraic expressions by interpreting them in terms of a geometric context.	• MARS/Shell: ○ Sorting Equations and identities Students will be able to: Recognize the differences between equations and identities. Substitute numbers into algebraic statements in order to test their validity in special cases. Resist common errors when manipulating expressions such as $2(x – 3) = 2x – 3$; $(x + 3)^2 = x^2 + 3^2$. Carry out correct algebraic manipulations.

Semester 1	Unit 7: Create and solve equations and inequalities	11 days: 10/11-10/28
Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**	
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.	• In items that require students to write an equation, equations are limited to linear, quadratic, and exponential. • Items may include equations or inequalities that contain variables on both sides. Calculator: Neutral • Equation Response • Graphic Response • Hot Spot Response • Movable Text Response • Multiple Choice Response • Multi-select Response • Natural Language Response • Selectable Text Response	
MAFS.912.A-CED.1.2 Create equations in two or more variable s to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	• Items that require the student to write a system of equations using a real-world context are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form Ax+By=C. • Items that require the student to solve a system of equations are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form Ax+By=C. • Items that require the student to graph a system of equations or inequalities to find the solution are limited to a 2x2 system. • Items that require the student to write a system of inequalities using a real-world context are limited to integer coefficients. Calculator: Neutral • Editing Task Choice • Equations Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response	
MAFS.912.A-CED.1.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning a in solving equations. For example, rearrange Ohm's law V=IR to highlight resistance R	• Items that involve formulas should not include overused contexts such as Fahrenheit/Celsius or three-dimensional geometry formulas. • In items that require students to solve literal equations and formulas, a linear term should be the term of interest. • Items should not require more than three procedural steps to isolate the variable of interest. • Items may require the student to recognize equivalent expressions but may not require a student to perform an algebraic operation outside the context of Algebra 1. Calculator: Neutral • Drag and drop response • Equation Response • Hot Spot Response • Multiple Choice Response • Natural Language Response	

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

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.	• Items will not require students to recall names of properties from memory Calculator: No • Drag and drop response • Equation Response • Movable Text Response • Multiple Choice Response • Natural Language Response • Selectable Text Response
MAFS.912.A-REI.1.2 (Algebra 2 standard not tested) Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	• Calculator: •
MAFS.912.A-REI.2.3 (Assessed with MAFS.912.A-CED.1.1) Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	• In items that require students to write an equation, equations are limited to linear, quadratic, and exponential. • Items may include equations or inequalities that contain variables on both sides. Calculator: Neutral • Equation Response • Graphic Response • Hot Spot Response • Movable Text Response • Multiple Choice Response • Multi-select Response • Natural Language Response • Selectable Text Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- Chapter 2: Linear Equations
  - Lesson 4: Solving Equations with Variables on Each side
  - Lesson 5: Solving Equations Involving Absolute Value
  - Lesson 6: Ratios and Proportions
  - Lesson 8: Literal Equations and Dimensional Analysis
- Chapter 5: Linear Inequalities
  - Algebra Lab: Reading Compound Statements
  - Lesson 4: Solving Compound Inequalities
  - Lesson 5: Inequalities Involving Absolute Value
- Chapter 10
  - Lesson 2: Simplifying Radical Expressions
  - Algebra Lab: Rational and Irrational Numbers
  - Lesson 3: Operations with Radical Expressions
  - Lesson 4: Radical Equations
- Chapter 11
  - Lesson 2: Rational Functions
  - Lesson 3: Simplifying Rational Expressions
  - Lesson 4: Multiplying and Dividing Rational Expressions

Algebra Nation

- Equations: True or False?
- Identifying Properties When Solving Equations.
- Solving Equations

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

- Solving Equations Using the Zero Product Property
- Solving Inequalities – Part 1
- Solving Inequalities – Part 2
- Solving Compound Inequalities
- Rearranging Formulas
- Solution Sets to Inequalities with Two Variables *(also part of Unit 8)*

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Algebra 1 Module 1, Topic C, Lesson 10
- Algebra 1 Module 1, Topic C, Lesson 11
- Algebra 1 Module 1, Topic C, Lesson 12
- Algebra 1 Module 1, Topic C, Lesson 13
- Algebra 1 Module 1, Topic C, Lesson 14
- Algebra 1 Module 1, Topic C, Lesson 15
- Algebra 1 Module 1, Topic C, Lesson 16
- Algebra 1 Module 1, Topic C, Lesson 17
- Algebra 1 Module 1, Topic C, Lesson 18
- Algebra 1 Module 1, Topic C, Lesson 19
- Algebra 1 Module 1, Topic C, Lesson 20
- Algebra 1 Module 1, Topic C, Lesson 21
- Algebra 1 Module 1, Topic D, Lesson 25
- Algebra 1 Module 1, Topic D, Lesson 28

Decoded Standard

MAFS.912.A-CED.1.1
Students look for patterns in one variable in data, contextual situations, and other numeric patterns and create equations or inequalities for them. Then, the equations or inequalities are used to solve contextual problems. The equations can arise from many situations, depending on the material the students have studied, including linear (started in younger grades), quadratics, exponentials, and rational situations.
(*Common Core Mathematics Companion*, Pg. 107)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
State Fair Students will model a real world equation based on a scenario and they will solve to find the cost of tickets Music Club In this exercise students will create an inequality in one variable that models a real world situation Quilts Students are asked to write and solve an equation that models a given problem. Follow Me Students are asked to write and solve an equation that models an exponential relationship between two variables Illustrative Mathematics Assessment Tasks Planes and wheat identifying the correct value and substituting the value in for the variable to create equations. Paying the Rent Students solve problems tracking the balance of a checking account Basketball Students set up rational equations in a real world context	• Algebra Nation ○ Solving Equations ○ Solving Equations Using the Zero Product Property

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

Decoded Standard	
MAFS.912.A-CED.1.2 Students look for patterns in bivariate (two-variable matched) data, contextual situations, and other numeric patters and create equations or inequalities for them. The equations, inequalities, or systems of equations or inequalities are used to solve contextual problems. (*Common Core Mathematics Companion*, Pg. 109)	
Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Hotel Swimming Pool Students are asked to write an equation in two variables given a verbal description of the relationship among the variables. Loss of Fir Trees Students are asked to sketch a graph that depicts the exponential decline in the population of fir trees in a forest. Model Rocket Students are asked to graph a function in two variables given in context. Tech Repairs Students are asked to write an equation in two variables from a verbal description. Tech Repairs Graph Students are asked to graph an equation in two variables given in context. Tee It Up Students are asked to write an equation in three variables from a verbal description. Trees in Trouble Students are asked to write a function that represents an annual loss of 3% per year.	• Algebra Nation ○ Rearranging Formulas ○ Solution Sets to Equations with Two Variables

Decoded Standard	
MAFS.912.A-CED.1.4 Students solve literal equations for a variable of interest. The process of solving should be closely related to solving equations for unknown numerical quantities. (*Common Core Mathematics Companion*, Pg. 111)	
Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additioanl Lesson Resources
Solving Formulas for a Variable Students are asked to solve for a specific variable from the slope equation and slope intercept equation. Solving Literal Equations Students are given 3 variable problems and asked to solve for a specific variable. Literal Equations Students are given three variable equations and asked to solve using inverse of multiplication and division Rewriting Equations Students are asked to solve a four variable equation.	• Algebra Nation ○ Rearranging Formulas

Decoded Standard
MAFS.912.A-REI.1.1 Students explain the steps for solving an equation. In addition, students apply SMP 3 by constructing viable rationales for their solution processes. Students who simply memorize steps to solve an equation without justifying their reasoning will fall short of what this standard is asking. Students need to use the basic principle of equivalency in equations to create methods for solving equations that make mathematical sense. These solution methods may be an alternative to traditional methods, such as "performing the order of operations in reverse order" for an equation such as $\sqrt{3x+1} = 4$; we first square to undo the square root to get 16, then we subtract the 1 to get 15, and finally we divide by 3 to get 5. (*Common Core Mathematics Companion*, Pg. 116)

Instructional Resources	
Mathematics Formative Assessments (MFAS) Justify the Process 1 Students are asked to justify each step in the process of solving equations. Justify the Process 2 Students are asked to justify each step in the process of solving equations. Equation Logic Students are given linear equations and asked to justify each step in the process of solving. Does it Follow? Students are asked to compare two equations and determine if they are equivalent Illustrative Mathematics Assessment Tasks 1-2 Same Solutions? Students reason about equivalence of equations How Does the Solution Change? Students reason about their solutions.	Additional Lesson Resources • Algebra Nation ○ Identifying Properties When Solving Equations ○ Solving Equations

Decoded Standard
MAFS.912.A-REI.1.2 *(Algebra 2 Standard)* This standard builds on the framework provided in standard A-REI.1.1 and the concept of retaining equivalency when performing the same operation to both sides of an equation. In particular, this standard focuses on solving equations in which unknown values may be in the denominator or beneath a radical, causing restrictions in the possible solutions for an equation. Solutions that are found when performing the same operation to both sides of an equation may be erroneous (called extraneous roots) based on mathematical definitions of dividing by zero or the principle square root. For example, the two equations below have both valid and extraneous solutions: See examples on Pg. 118 (*Common Core Mathematics Companion*, Pg. 118)

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources ○

Decoded Standard
MAFS.912.A-REI.2.3 Students solve linear equations and inequalities with one variable. Students use methods such as manipulatives, tables, graphs, technology such as graphing calculators or spreadsheets, and symbols. The problems explored include undoing an operation, using the distributive property, and solving literal equations, such as $Ax + By = C$, solved for *y*. (*Common Core Mathematics Companion*, Pg. 121)

Instructional Resources	
Mathematics Formative Assessments (MFAS) Solve for M Students are asked to solve a linear equation in one variable. Solve for N Students are asked to solve a linear equation in one variable with fractional coefficients. Solve for X Students are asked to solve a linear equation in one variable. Solve for Y Students are asked to solve a linear inequality in one variable. Solving a Literal Linear Equation Students are given a literal linear equation and asked to solve for a specific variable. Solving a Multistep Inequality Students are asked to solve a multistep inequality.	Additional Lesson Resources • Algebra Nation ○ Equations: True or False? ○ Identifying Properties When Solving Equations ○ Solving Equations ○ Solving Inequalities – Part 1 ○ Solving Inequalities – Part 2 ○ Solving Compound Inequalities ○ Rearranging Formulas

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

Semester 1	Unit 8: Represent and solve equations and inequalities graphically.	11 days: 10/29-11/12

Standards/Learning Goals:	Content Limits, Assessment Types, Calculator
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.	• In items that require the student to write an equation as a constraint, the equation can be a linear function. • In items that require the student to write a system of equations to represent a constraint, the system is limited to a 2x2 with integral coefficients Calculator: **Neutral** • Equation Response • Graphic Response • Hot Spot Response • Movable Text Response • Multiple Choice Response • Natural Language Response • Selectable Text Response
MAFS.912.A-REI.4.10 **(Assessed under REI.4.11)** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	• In items where a function is represented by an equation, the function may be an exponential function with no more than one translation, a linear function, or a quadratic function. • In items where a function is represented by a graph or table, the function may be any continuous function. Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
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 equations 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.	• In items where a function is represented by a graph or table, the function may be any continuous function. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Item • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.A-REI.4.12 Graph the solution to a linear inequality in two variables as a half-plane(excluding the boundary in the case of a strict inequality), ~~and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes~~.	• Items that require the student to graph a system of equations or inequalities to find the solution are limited to a 2x2 system. • Items that require the student to write a system of inequalities using a real world context are limited to integral coefficients. Calculator: **Neutral** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

• Chapter 3: Linear Functions
    ○ Lesson 1: Graphing Linear Equations
    ○ Lesson 2: Solving Linear Equations
    ○ Algebra Lab: Rate of Change of a Linear Function
    ○ Lesson 3: Rate of Change and Slope
    ○ Lesson 4: Direct Variation
• Chapter 4: Equations of Linear Functions
    ○ Lesson 1: Graphing Equations in Slope-Intercept Form
    ○ Lesson 2: Writing Equations in Slope-Intercept Form
    ○ Lesson 3: Writing Equations in Point-Slope Form
    ○ Lesson 4: Parallel and Perpendicular Lines
• Chapter 5: Linear Inequalities
    ○ Lesson 6: Graphing Inequalities in Two Variables

Algebra Nation
• Key Features of Graphs of Functions – Part 1 • Key Features of Graphs of Functions – Part 2 • Modeling with Functions • Solution Sets to Equations with Two Variables • Solution Sets to Inequalities with Two Variables *(also part of Unit 7)* • Understanding Piecewise-Defined Functions • Absolute Value Functions • Graphing Power Functions – Part 1 • Graphing Power Functions – Part 2

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 1, Topic A, Lesson 2 • Algebra 1 Module 1, Topic A, Lesson 3 • Algebra 1 Module 1, Topic A, Lesson 4 • Algebra 1 Module 1, Topic A, Lesson 5

Decoded Standard
MAFS.912.A-CED.1.3 Students consider an equation in terms of what makes sense for its solution within a given context. If a student is trying to make an equation to find the lengths of the sides for a box with a volume of 20 cubic inches and made by cutting squares from the corners of a piece of cardboard that is 6 inches by 10 inches, he or she may create an equation $x(6-2x)(10-2x)=20$ for the volume. The student needs to understand that the largest side of any square cut from the cardboard can be is 3 inches and why that is the case. The student also needs to recognize that *x* cannot be less than or equal to 0. The student represents constraints for the equation using the inequality, $0<x<3$. The student may use a graph to see that there are 3 values for *x* that satisfy the equation; however, one solution will be greater than 3 and so must be excluded. When students find solutions to equations or inequalities, they need to check the solutions to ensure they make sense in the context of the problem. If students find the average number of students that can be put on each of three buses for a field trip is $33\frac{1}{3}$ students, they need to see it is not a viable answer, since the number of

students must be a whole number, and then determine how to handle that discrepancy. Students should have opportunities to contextually, analytically, and graphically check a solution set of inequalities to determine the viability of a solution. (*Common Core Mathematics Companion*, Pg. 110)

Instructional Resources	
Mathematics Formative Assessments (MFAS) Sugar and Protein Students are asked to model a problem involving constraints using inequalities. The New School Students are asked to recognize constraints in a real world context. Constraints on Equations Students are asked to analyze constraints on equations in context and interpret the solutions as viable or not viable. Illustrative Mathematics Assessment Tasks Fishing Adventures 3: Students write and solve inequalities, and represent the solutions graphically.	Additional Lesson Resources

Decoded Standard

MAFS.912.A-REI.4.10
Students look at two variables in terms of their covariation. Students may make tables or create sets of ordered pairs that are true for a given equation. Then, students graph their ordered pairs and consider if the set of points represents all possible solutions for the two-variable equation. Students are thus connecting to their understanding of domain and range, as well as to the concepts of discrete and continuous functions. The concept of covariation follows from the middle grades, using the idea that one variable is conditioned on another. Teachers use scaffolding questions such as, “If *x* were a given number, could you determine the corresponding value for *y*? What if *x* takes another value? How could you organize these results?”
(*Common Core Mathematics Companion*, Pg. 134)

Instructional Resources	
Mathematics Formative Assessments (MFAS) What is the Point Students are asked to explain the relationship between a point on the graph and a point not on the graph. Finding Solutions Students are asked to explain the relationship between a given linear equation and both a point on its graph and a point not on its graph Case In Point – (explain the relationship between the set of solutions and the graph of an exponential equation, 3 problems) Illustrative Mathematics Assessment Tasks Taxi Students are asked to justify given solutions as reasonable for the situation. Collinear points—4 part task that ask students to conceptually think about nonlinear functions	Additional Lesson Resources

Decoded Standard

MAFS.912.A-REI.4.11
In this standard, the focus is on students recognizing what the solution $y = f(x)$ and $y = g(x)$ means on a graph. The equation, $f(x) = g(x)$, is converted into $y = f(x)$ and $y = g(x)$. Now a solution to the original equation is the *x*-coordinate for the new set of equations, $y = f(x)$ and $y = g(x)$. That is, if the original equations are equal at the value of *x*, then (*x*,*y*) is a solution of $y = f(x)$ and $y = g(x)$. In the previous standards, students built a

foundational understanding that the graph of an equation is the set of all points that make the equation true. Now, students consider what that standard means when they look for the solution of $y = f(x)$ and $y = g(x)$ – that is, they are looking for every point that is on both graphs. Using graphs and tables, students can see where common values of $f(x)$ and $g(x)$ occur. When students consider the ordered pairs, they can see the *x*-coordinates are the same, as are the *y*-coordinates that are also named $f(x)$ and $g(x)$. When using tables or some forms of graphs for functions, students may identify approximate solutions by noting when the *x*-values are very close to each other, and the *y*-values ae similar as well. Students can make a smaller interval near such values and use a smaller increment when evaluating different *x*-values to find a closer approximation. (*Common Core Mathematics Companion*, Pg. 135)

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources
Graphs and Solutions: Students are given a graph and asked to explain why the x-coordinate of the intersection of two functions , f and g, is a solution of the equation f(x) = g(x). f(x) is linear and g(x) is cubic. Graphs and Solutions 2: Students are asked to find the solution(s) of the equation f(x) = g(x) given the graphs of f and g and explain their reasoning. F(x) is linear and g(x) is a parabola. Using Tables: Students are asked to find solutions of the equation f(x) = g(x) for two given functions, f and g, by constructing a table of values. Using Technology: Students are asked to use technology (e.g., spreadsheet, graphing calculator, or dynamic geometry software) to estimate the solutions of the equation f(x) = g(x) for given functions f and g. f(x) is linear and g(x) is exponential.	

Decoded Standard
MAFS.912.A-REI.4.12 Students compare the graphs of linear inequalities to those of linear equations. For an inequality such as $y > x + 1$, students explore to see which points make this a true statement, resulting in a half-plane – the values that are bordered by but not including $y = x + 1$ and the ordered pairs that make the statement $y > x + 1$ true. ~~Students find solutions of systems of inequalities are not just points of intersection of the lines but are instead regions of the coordinate plane. When students graph a single linear inequality on the coordinate plane, it creates a boundary (which may or may not be included as part of the solution) and a half-plane. The solution sets that make all of the inequalities in a set of inequalities are actually where the half-planes of the inequalities overlap – that is, the intersection of the corresponding half-planes.~~ (*Common Core Mathematics Companion*, Pg. 137)

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
	• MARS/Shell ○ Defining Regions Using Inequalities: students are able to use linear inequalities to create a set of solutions. Assist students who have difficulties in representing a constraint by shading the correct side of the inequality line and understanding how combining inequalities affects a solution space.

Semester 1	**Unit 9: Solve systems of equations and inequalities.**	8 days: 11/13-11/22
Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**	
MAFS.912.A-REI.3.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.	• Items that require the student to write as system of equation using a real-world context are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+By=C.* • Items that require the student to solve a system of equations are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+By=C.* Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response	
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	• Items that require the student to write as system of equation using a real-world context are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+By=C.* • Items that require the student to solve a system of equations are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+By=C.* Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response	
MAFS.912.A-REI.4.12 Graph the solution to a linear inequality in two variables as a half-plane(excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	• Items that require the student to graph a system of equations or inequalities to find the solution are limited to a 2x2 system. • Items that require the student to write a system of inequalities using a real world context are limited to integral coefficients. Calculator: **Neutral** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response	

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• Chapter 6: Systems of Linear Equations and Inequalities ○ Lesson 1: Graphing Systems of Equations (Review – 8th Grade Standard) ○ Lesson 2: Substitution (Review – 8th Grade Standard) ○ Lesson 3: Elimination Using Addition and Subtraction ○ Lesson 4: Elimination Using Multiplication ○ Lesson 5: Applying Systems of Linear Equations

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

- Algebra Lab: Using Matrices to Solve Systems of Equations (Extends beyond Algebra 1 Honors)
- Lesson 6: Systems of Inequalities

Algebra Nation

- Introduction to Systems of Equations
- Finding Solution Sets to Systems of Equations Using Substitution and Graphing
- Using Equivalent Systems of Equations
- Finding Solution Sets to Systems of Equations Using Elimination
- Finding Solution Sets to Systems of Linear Inequalities

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Algebra 1 Module 1, Topic C, Lesson 22
- Algebra 1 Module 1, Topic C, Lesson 23
- Algebra 1 Module 1, Topic C, Lesson 24

Decoded Standard

MAFS.912.A-REI.3.5
The purpose of this standard is for students to justify the addition of two equations to determine solutions in a system of equations and justify their method for solving systems of equations. Though these concepts may appear to be unintuitive, students may develop these ideas naturally using specific problem tasks.
(*Common Core Mathematics Companion*, Pg. 127)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Solution Sets of Systems Students are asked to show that, given a system of two equations in two variables, replacing one equation with the sum of that equation and a multiple of another produces a system with the same solutions. Solving Systems Students are given a system of two linear equations and asked to form a new system by replacing one equation with the sum of that equation and a multiple of the other. Then students are asked to explain why the two systems have the same solutions.	

Decoded Standard

MAFS.912.A-REI.3-6
Students solve systems of linear equations approximately by observing the intersection of two linear graphs, created either by hand or using technology. Students understand the intersection point will satisfy both equations and is the solution to the system of equations. To solve systems of equations exactly, students may use elimination or substitution. In addition to systems of equations being modeled algebraically, students may represent situations using tape diagrams and algebra tiles. Solution methods should related to and be developed from A-REI.3.5 and A-REI.1.1. (*Common Core Mathematics Companion*, Pg. 128)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Apples and Peaches: Asked to solve a system of equations with rational solutions either algebraically or by graphing and are asked to justify the choice of method. Solving a System of Equations 1: Students are asked to solve a system of equations both algebraically and graphically. One equation is in slope intercept form.	• MARS/Shell ○ Optimizing Problems: Boomerangs – Students will develop a system of equations from a linear application. ○ Solving Linear Equations in Two Variables: This lesson unit is intended to help you assess how well students are able to formulate and solve problems using

Solving a System of Equations 2: Students are asked to solve a system of equations both algebraically and graphically. Both equations will have to be re-arranged by the student. Solving a System of Equations 3: Students are asked to solve a system of equations both algebraically and graphically. One equation is in slope intercept form. Illustrative Mathematics Assessment Tasks Cash Box: This task involves the creation and solving of a system of two equations and two unknowns. A dollar is outside the cash box, the task is to decide if the dollar should go inside the box based on ticket prices. Application of Linear Systems Accurately Weighing Pennies 1: This problem involves solving a system of algebraic equations from a context: depending how the problem is interpreted, there may be one equation or two. Application of Linear Systems, this is a three part problem. Quinoa Pasta 2: Students are given all the relevant information on the nutritional labels of quinoa, but they have to figure out how to use this information. They have to come up with the idea that they can set up two equations in two unknowns to solve the problem. Pairs of Whole Numbers: Students will solve systems of linear equations exactly, and provide a simple example of a system with three equations and three unknown. Application problem using three equations. Find a System: The purpose of this task is to encourage students to think critically about both the algebraic and graphical interpretation of systems of linear equations. They are expected to take what they know about systems and reverse the process. Estimating a Solution via Graphs: The purpose of this task is to examine, via graphing, whether or not a solution to a system of two equations is accurate or not. The equations have been chosen so that finding the exact solution requires significant calculations so that it is easy to make an error.	algebra and, in particular, to identify and help students who have the following difficulties with systems of equations.

Decoded Standard
MAFS.912.A-REI.4.12 Students compare the graphs of linear inequalities to those of linear equations. For an inequality such as $y > x + 1$, students explore to see which points make this a true statement, resulting in a half-plane – the values that are bordered by but not including $y = x + 1$ and the ordered pairs that make the statement $y > x + 1$ true. Students find solutions of systems of inequalities are not just points of intersection of the lines but are instead regions of the coordinate plane. When students graph a single linear inequality on the coordinate plane, it creates a boundary (which may or may not be included as part of the solution) and a half-plane. The solution sets that make all of the inequalities in a set of inequalities are actually where the half-planes of the inequalities overlap – that is, the intersection of the corresponding half-planes. (*Common Core Mathematics Companion*, Pg. 137)

Instructional Resources	
Mathematics Formative Assessments (MFAS) **Which Graph**: Students are asked to select the correct graph of the solution region of a given system of two linear inequalities. Graph a System of Inequalities: Students are asked to graph a system of two linear inequalities.	Additional Lesson Resources • MARS/Shell ○ Defining Regions Using Inequalities: students are able to use linear inequalities to create a set of solutions. Assist students who have difficulties in representing a constraint by shading the correct side of the

	inequality line and understanding how combining inequalities affects a solution space.

Split Across Semester 1 & 2	**Unit 10: Perform arithmetic operations on polynomials.**	12 days: 12/2-12/10 & 1/8-1/14

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
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.	• Items set in a real-world context should not result in a non-real answer if the polynomial is used to solve for the unknown. • In items that require addition and subtraction, polynomials are limited to monomials, binomials, and trinomials. The simplified polynomial should contain no more than six terms. • Items requiring multiplication of polynomials are limited to a product of: two monomials, a monomial and a binomial, a monomial and a trinomial, two binomials, and a binomial and a trinomial.
	Calculator: **NO**
	• Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

• Chapter 8: Quadratic Expressions and Equations
  ○ Lesson 1: Adding and Subtracting Polynomials
  ○ Lesson 2: Multiplying a Polynomial by a Monomial
  ○ Lesson 3: Multiplying Polynomials
  ○ Lesson 4: Special Products

Algebra Nation
• Adding and Subtracting Functions • Multiplying Functions • Closure Property

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 1, Topic B, Lesson 8 • Algebra 1 Module 2, Topic B, Lesson 9 • Algebra 1 Module 4, Topic A, Lesson 1

Decoded Standard	
MAFS.912.A-APR.1.1 Students perform the operations of addition, subtraction, and multiplication with polynomials. During their work, students realize the results are always polynomials – that is, that polynomials are closed for adding, subtracting, and multiplying. Students gain fluency in their calculations with the arithmetic of polynomials. (*Common Core Mathematics Companion*, Pg. 91)	
Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources
Adding Polynomials Students find the sum of two polynomials and	

explain if the sum of polynomials always results in a polynomial. Subtracting Polynomials Students find the difference of two polynomials and explain if the difference of polynomials will always result in a polynomial. Multiplying Polynomials 1 Students multiply polynomials and explain if the product of polynomials always results in a polynomial. Multiplying Polynomials 2 Students multiply polynomials and explain if the product of two polynomials always results in a polynomial.	

Pinellas County Schools **ALGEBRA 1 HONORS** 2019-2020

Semester 2	Unit 11: Polynomial relationships and identities.	13 days: 1/15-2/3

Standards/Learning Goals:	Content Limits, Assessment Types, Calculator
MAFS.912.A-APR.2.2 **(Algebra 2 standard not tested)** 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).	• The polynomial that is the dividend should have a degree no less than 3 and no greater than 6. • The polynomial that is the divisor should have a degree of 1, 2, or 3. Calculator: **NO** • Equation Editor • Hot Text • Multiple Choice • Multiselect • Open Response
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.	• Students will find the zeros of a polynomial function when the polynomial is in factored form. • Students will create a rough graph of a polynomial function in factored form by examining the zeros of the function. • Students will use the x-intercepts of a polynomial function and end behavior to graph the function. Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-APR.3.4 **(Algebra 2 standard not tested)** 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.	• Calculator: •
MAFS.912.A-APR.4.6 **(Algebra 2 standard not tested)** 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.	• Calculator: •
MAFS.912.A-SSE.1.2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y 4 as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.	• Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- Chapter 8: Quadratic Expressions and Equations
  - Lesson 5: Using the Distributive Property
  - Lesson 6: Solving $x^2 + bx + c = 0$ (extend to include finding the Zeros once factored : A-APR.2.3)
  - Lesson 7: Solving $ax^2 + bx + c = 0$ (extend to include finding the Zeros once factored : A-APR.2.3)
  - Lesson 8 Differences of Squares

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

○ Lesson 9 Perfect Square

Algebra Nation
• Real-World Examples of Quadratics • Factoring Quadratic Expressions • Solving Quadratic Equations by Factoring • Solving Other Quadratic Equations by Factoring • Solving Quadratic Equations by Factoring – Special Cases • Solving Quadratic Equations by Raking Square Roots • Solving Quadratic Equations by Completing the Square

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 4, Topic A, Lesson 2 • Algebra 1 Module 4, Topic A, Lesson 3 • Algebra 1 Module 4, Topic A, Lesson 4 • Algebra 1 Module 4, Topic A, Lesson 5 • Algebra 1 Module 4, Topic A, Lesson 8 • Algebra 1 Module 4, Topic A, Lesson 9

Decoded Standard	
MAFS.912.A-APR.2.2 *(Algebra 2 Standard)* One specific theorem that students may use when attempting to find zeros or to make a sketch of a polynomial function, $p(x)$, is the Remainder Theorem. The connection to the Zero Factor property and to $p(a)$ being zero when $x - a$ is a factor of $p(x)$ is easily discovered. Comparison of substitutions of $x = a$ into $p(x)$ and then the remainder when dividing $p(x)$ by $x - a$ helps students make the generalization that gives the entire Remainder Theorem. The "if and only if" part of the standard means students need to see that $p(a) = 0$ implies $(x - a)$ is a factor of $p(x)$, and $(x - a)$ is a factor of $p(x)$ implies $p(a) = 0$. (*Common Core Mathematics Companion*, Pg. 93)	
Instructional Resources	
Illustrative Mathematics Assessment Tasks	Lesson Resources
Zeros and Factorizations of Quadratic Polynomials 1 Each of the questions in this task could be formulated as an if and only if statement but the other implication, namely that *f*(*x*) is divisible by *x*-*r* if and only if *r* is a root of *f*. Zeros and Factorizations of Quadratic Polynomials 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. The Missing Coefficient The purpose of this task is to emphasize the use of the Remainder Theorem Zeros and Factorizations of general Polynomials In this task, students are asked to show or verify four theorems related to roots, zeroes, and factors of polynomial functions. Zeros and Factorization of a non-polynomial function For a polynomial function f, if f(0)=0 then the polynomial f(x) is divisible by x.	

Decoded Standard
MAFS.912.A-APR.2.3

Students use factoring to rewrite polynomials and then solve for the roots by applying the Zero Factor Property. In combination with identifying multiple roots and substitutions of one or two other *x*-values, students create a rough graph of a given polynomial. One special point of study is the result of a double root (or any other multiple occurrence of a root) on the graph. To better understand this, students apply their learning about the effects of parameter changes on functions (for example, that $y = x^2$ and $y = -x^2$ have different behavior because of the negative coefficient for x^2) about the shapes of specific families of polynomials (at least quadratics and cubics). (*Common Core Mathematics Companion*, Pg. 95)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Zeros of a Quadratic Students are asked to identify the zeros of polynomials, without the use of technology, and then describe what the zeros of a polynomial indicate about its graph. Zeros of a Cubic Students are asked to identify the zeros of cubic polynomials, without the use of technology, and then describe what the zeros indicate about the graph. Use Zeros to Graph Students are given the factored form of a cubic polynomial and are asked to use the zeros to sketch the graph between two given points on the coordinate plane without the use of technology	

Decoded Standard

MAFS.912.A-APR.3.4 *(Algebra 2 Standard)*
Students work with identities to verify by examples but then as mathematical proofs. This may be as simple as proving $(x - y)(x + y) = x^2 - y^2$ using an area model or the double distributive property but can include the product of the sum and difference of binomial, the difference of two square terms, the square of a binomial, and so forth. (*Common Core Mathematics Companion*, Pg. 97)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources

Decoded Standard

MAFS.912.A-APR.4.6 *(Algebra 2 Standard)*
Students have experience with division problems when learning about the Remainder Theorem, which they connect to rational expressions as a specific form of a division expression. An expression may be written as a quotient and remainder by using inspections, such as $\frac{x^2+1}{x}$, which is rewritten by inspection as $x + \frac{1}{x}$ or by using long division to obtain the quotient and remainder, such as for $\frac{x^3-x-a}{x-1}$, or for higher degree divisors, such as $\frac{x^3-3x^2+3x-1}{x^2+1}$, by using CAS. (*Common Core Mathematics Companion*, Pg. 101)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources

Decoded Standard

MAFS.912.A-SSE.1.2
Students view expressions from a dynamic perspective – that is, there is progress or change when using expressions flexibly in different formats to find the form that is most useful in a contextual situation. In the standard, students consider $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$ and as the factored form $(x^2 - y^2)(x^2 + y^2)$. This can

help students consider zeros and graphing patterns. Recognizing different forms of an expression and being able to apply the forms is an important step mentioned in the *Progressions for the Common Core State Standards in Mathematics for Algebra* (2013). An example in that document (p. 5) concerns looking at the expression for the sum of a series of perfect squares, $\frac{n(2n+1)(n+1)}{6}$, whose structure allows students to see the expression has a degree of 3 with a leading coefficient of $\frac{1}{3}$, that is the term $\frac{1}{3}n^3$, which is helpful when studying rules for summation notation and integration, providing an underpinning of calculus. Rewriting $y = x^2 + 2x + 1$ as a trinomial square pattern $y = (x + 1)^2$ can help students consider the graph of the function as a translation of $y = x^2$ instead of having to calculate individual ordered pairs to determine the graph.
(*Common Core Mathematics Companion*, Pg. 82)

Instructional Resources	
<u>Mathematics Formative Assessments (MFAS)</u> Finding Missing Values Students rewrite quadratic expressions and identify parts of the expressions. Determine the Width Students find the width of a rectangle whose area and length are given as polynomials. Rewriting Numerical Expressions Students are asked to rewrite numerical expressions to find efficient ways to calculate. <u>Illustrative Mathematics Assessment Tasks</u> Equivalent Expressions Students must understand the need to transform the factored form of the quadratic expression (a product of sums) into a sum of products in order to easily see ***a***, the coefficient of the x2 term; *k*, the leading coefficient of the ***x*** term; and *n*, the constant term.	<u>Lesson Resources</u>

Semester 2	Unit 12: Solve quadratic equations.	12 days: 2/4-2/20

Standards/Learning Goals:	Content Limits, Assessment Types, Calculator
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 $\left(1.15^{1/12}\right)^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.	• For A-SSE.2.3, items should require the student to choose how to rewrite the expression. Calculator: **NEUTRAL** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
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 ± bi for real numbers a and b.	• In items that require the student to transform a quadratic equation to vertex form, the coefficient of the linear term must be an even factor of the coefficient of the quadratic term. • In items that require the student to solve a simple quadratic equation by inspection or by taking square roots, equations should be in the form ax2 = c or ax2 + d = c, where a, c, and d are rational numbers and where c is not an integer that is a perfect square and c –d is not an integer that is a perfect square. In items that allow the student to choose the method for solving a quadratic equation, equations should be in the form ax2 + bx + c = d, where a, b, c, and d are integers. • Items may require the student to recognize that a solution is nonreal but should not require the student to find a nonreal solution. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-REI.3.7 **(Algebra 2 standard not tested)** 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 $x^2 + y^2 = 3$.	• Items that require a student to graph a system of equations are limited to a 2 x 2 system. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response

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Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

• Chapter 9: Quadratic Functions and Equations
  ○ Lesson 1: Graphing Quadratic Functions
  ○ Lesson 2: Solving Quadratic Equations by Graphing
  ○ Lesson 3: Transformations of Quadratic Functions
  ○ Lesson 4: Solving Quadratic Equations by Completing the Square
  ○ Algebra Lab: Finding the Maximum or Minimum Value
  ○ Lesson 5: Solving Quadratic Equations by using the Quadratic Formula
  ○ Lesson 6: Analyzing Functions with Successive Differences

Algebra Nation
• Deriving the Quadratic Formula • Solving Quadratic Equations Using the Quadratic Formula • Quadratic Functions in Action

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 4, Topic A, Lesson 6 • Algebra 1 Module 4, Topic A, Lesson 7 • Algebra 1 Module 4, Topic B, Lesson 11 • Algebra 1 Module 4, Topic B, Lesson 12 • Algebra 1 Module 4, Topic B, Lesson 13 • Algebra 1 Module 4, Topic B, Lesson 14 • Algebra 1 Module 4, Topic B, Lesson 15

Decoded Standard	
MAFS.912.A-SSE.2.3 Students learn several ways to analyze quadratic expressions and their related functions. This standard focuses on factoring and completing the square. Each of these methods has its appropriate place. Students understand that factoring may be an efficient way to analyze a quadratic expression. Completing the square yields another form of a quadratic expression that is sometimes called the vertex or graphing form. This form, $y = a(x-h)^2 + k$, makes it relatively easy to find the vertex of the quadratic function and apply its form to transformations from geometry. Students also apply properties of exponents to create equivalent expressions that can give insight into the quantity described by the exponential expression. (*Common Core Mathematics Companion*, Pg. 84)	
Instructional Resources	

Mathematics Formative Assessments (MFAS)
Rocket Town Students are asked to rewrite a quadratic expression in vertex form to find maximum and minimum values.
Jumping Dolphin Students are asked to find the zeros of a quadratic function in the context of a modeling problem.
 	
Illustrative Mathematics Assessment Tasks
Building a General Quadratic Function In this resource, a method of deriving the quadratic formula from a theoretical standpoint is demonstrated.
Graphs of Quadratic Functions Students compare graphs of different quadratic functions, then produce equations of their own to satisfy
	Lesson Resources
	• Algebra Nation
	  ○ Solving Quadratic Equations by Factoring
	  ○ Solving Other Quadratic Equations by Factoring
	  ○ Solving Quadratic Equations by Factoring – Special Cases

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given conditions.

Decoded Standard

MAFS.912.A-REI.2.4
Students build the quadratic formula from a deep understanding of how to solve quadratic equations by completing the square. To do this, students need to be fluent with completing the square when the coefficients of the quadratic are in standard form, $ax^2 + bx + c$, where a, b and c are any real number, $a \neq 0$. In A-SSE.2.3, students were introduced to the concept of completing the square but only to find the maximum or minimum values. One method for doing this is to use an area model while another is using algebra tiles. The following is a sample of completing the square to solve for x from an equation in standard form to derive the quadratic formula. The first step is to change the coefficient of x^2 to 1 by dividing all the terms by a.

See the example on page 122

(*Common Core Mathematics Companion*, Pg. 122)

Instructional Resources

Mathematics Formative Assessments (MFAS)

Complete the Square-1 Students are asked to solve a quadratic equation by completing the square.
Complete the Square-2 Students are asked to solve a quadratic equation by completing the square.
Complete the Square-3 Students are asked to solve a quadratic equation by completing the square.
Quadratic Formula-1 Students are asked to derive the quadratic formula by completing the square.
Complex Solutions? Students are asked to explain how to recognize when the quadratic formula results in complex solutions.
Quadratic Formula-2 Students are asked to complete the derivation of the quadratic formula.
Which Strategy? Students are shown four quadratic equations and asked to choose the best method for solving each equation.

Lesson Resources

- Algebra Nation
  - Solving Equations Using the Zero Product Property
  - Solving Quadratic Equations by Factoring
  - Solving Other Quadratic Equations by Factoring
  - Solving Quadratic Equations by Factoring – Special Cases
  - Solving Quadratic Equations by Taking Square Roots
  - Solving Quadratic Equations by Completing the Square
  - Deriving the Quadratic Formula
  - Solving Quadratic Equations Using the Quadratic Formula
  - Quadratic Functions in Action
  - Nature of the Solutions of Quadratic Equations and Functions

Decoded Standard

MAFS.912.A-REI.3.7 (Algebra 2 Standard)
Solving a system consisting of a line and a quadratic is a natural extension from solving a system consisting of two lines. Students realize that while a linear system has the possibility of zero, one, or two solutions, with a system of a linear and a quadratic equation, there is not a possibility of infinite solutions. Students may find the solution set graphically or algebraically. Students connect to analytic geometry standards when they consider the geometric figures that lead to no solutions (figures' graphs don't intersect), one solution (the line is tangent to the quadratic), and two solutions (the line is a chord of the quadratic). The quadratics are not restricted to be circles or parabolas, though ellipses and hyperbolas are only in additional standards.

Instructional Resources

Illustrative Mathematics Assessment Tasks

A Linear and Quadratic System This task asks students to consider the linear and quadratic functions shown on a graph, and use quadratic functions to find the coordinates.

Lesson Resources

-

The Circle and the Line This lesson 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	

Semester 2	**Unit 13: Construct and compare linear, quadratic, and exponential models and solve problems.**	15 days: 2/24-3/13

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.F-LE.1.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	• Exponential functions should be in the form $a(b)^x + k$. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multi-select • Open response
MAFS.912.F-LE.1.2 (***Testing also assesses MAFS.912.F-BF.1.1, MAFS.912.F-IF.1.3***) Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph and a description of a relationship or two input-output pairs (include reading these from a table.)	• In items that require the student to construct arithmetic or geometric sequences, the real-world context should be discrete. • In items that require the student to construct a linear or exponential function, the real-world context should be continuous. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.F-LE.1.3 Observing using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	• Exponential functions represented in graphs or tables should be able to be written in the form $a(b)^x + k$. • For exponential relationships, tables or graphs must contain at least one pair of consecutive values. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open-Response
MAFS.912.F-LE.2.5 Interpret the parameters in a linear or exponential function in terms of a context.	• Exponential functions should be in the form $a(b)^x + k$. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multi-select • Open response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• Chapter 7: Exponents and Exponential Functions

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

- Lesson 5: Exponential Functions
- Lesson 6: Growth and Decay
- Lesson 7: Geometric Sequences as Exponential Functions

Algebra Nation

- Observations from a Graph of a Quadratic Function
- Nature of the Solutions of Quadratic Equations and Functions
- Graphing Quadratic Functions Using a Table
- Graphing Quadratic Functions Using the Vertex and Intercepts
- Graphing Quadratic Functions Using Vertex Form – Part 1
- Graphing Quadratic Functions Using Vertex Form – Part 2
- Exponential Functions
- Graphs of Exponential Functions – Part 1
- Graphs of Exponential Functions – Part 2
- Growth and Decay Rates of Exponential Functions

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Algebra 1 Module 3, Topic A, Lesson 4
- Algebra 1 Module 3, Topic A, Lesson 5
- Algebra 1 Module 3, Topic A, Lesson 6
- Algebra 1 Module 3, Topic A, Lesson 7
- Algebra 1 Module 3, Topic D, Lesson 22
- Algebra 1 Module 3, Topic D, Lesson 23
- Algebra 1 Module 3, Topic D, Lesson 24
- Algebra 1 Module 5, Topic B, Lesson 4
- Algebra 1 Module 5, Topic B, Lesson 5
- Algebra 1 Module 5, Topic B, Lesson 6
- Algebra 1 Module 5, Topic B, Lesson 7
- Algebra 1 Module 5, Topic B, Lesson 8
- Algebra 1 Module 5, Topic B, Lesson 9

Decoded Standard

MAFS.912.F-LE.1.1

a. Students may use tables or graphs to investigate the rate of change of linear functions. While students may recognize that linear functions grow by adding the same constant difference over equal-sized intervals, proving the relationship means moving beyond examples and generalizing by using variable expressions. Likewise, students will find that exponential functions grow by multiplying by equal factors over equal intervals and then must use variable expressions to create a proof. (*Common Core Mathematics Companion*, Pg. 194)
b. Students examine the input and output for a context to determine if the rate of change involves adding a constant (positive or negative) for equal units of change in the input. Students connect this type of growth to linear functions (and, for appropriate integer inputs, to an arithmetic sequence). (*Common Core Mathematics Companion*, Pg. 196)
c. Students use contextual situations to determine if a situation is exponential and then to recognize whether a given situation represents decay or growth. (*Common Core Mathematics Companion*, Pg. 197)

Instructional Resources

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Mathematics Formative Assessments (MFAS)	Lesson Resources
Linear of Exponential? – (identify each verbal description as linear or exponential, 4 problems) Prove Linear – (prove that a linear function grows by equal differences, 2 problems) Prove Exponential – (prove that an exponential function grows by equal factors, 2 problems) How Does Your Garden Grow? – (compare the rate of change in linear and exponential, 4 problems) Predicting your Financial Future Students can use the formula to predict future value of an investment Illustrative Mathematics Assessment Tasks In the billions and linear modeling Deeper connections for real world application of nonlinear functions. Linear or Exponential Students analyze linear functions and nonlinear functions to determine understanding. Exponential Functions Task asks students to think about the exponential function increases by a multiplicative factor of b when x increases by 1. U.S Population 1982-1988 Students look at a linear model to examine population growth. Equal Factors over Equal intervals Helps deepen understanding of Exponential functions with introducing "successive quotient" terminology.	• MARS/Shell ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions. ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Decoded Standard	
MAFS.912.F-LE.1.2 Students apply the skills and concepts they have learned for linear and exponential functions to make functions based on information from multiple representations. Though the standard states a "description of a relationship," the implication is the relationship described is a function. (*Common Core Mathematics Companion*, Pg. 198)	
Instructional Resources	
Mathematics Formative Assessments (MFAS) Write an Exponential Function from a Table Students write an exponential function from two points in a table. Writing an Exponential Function From its Graph Students examine a graph and find the function that relates to the curve based on the given points. Illustrative Mathematics Assessment Tasks Rumors Looks at exponential growth as a matter of rumors spreading. To Points determine an Exponential Function Problem asks students to examine a graph and find an equation of the problem given two points.	Lesson Resources • MARS/Shell ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Decoded Standard
MAFS.912.F-LE.1.3 Students explore the rates of change of different functions using graphs and tables to determine a generalization for which functions grow the fastest. Students connect to their learning about average rate of change and end

behavior. (*Common Core Mathematics Companion*, Pg. 200)

Instructional Resources	
Mathematics Formative Assessments (MFAS) Compare Quadratic and Exponential functions Students are asked to explain characteristics relating to the graph and interpret the graph. Compare Linear and Exponential Functions Students are asked to compare linear and exponential functions from a graph in context. Illustrative Mathematics Assessment Tasks Exponential Growth verse Linear Growth Helps students to discover how an exponential function surpasses a linear function.	Lesson Resources • MARS/Shell ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Decoded Standard

MAFS.912.F-LE.2.5
When constructing functions, students are solving problems by considering rates of change, graphs, a verbal description or sets of ordered pairs to determine if a function is linear, exponential, or quadratic. Students are asked to prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over the same interval. Students explain their choices and communicate what mathematical reasoning was involved. Students use tables and graphs to compare rates of change and to make conclusions about each family of functions. Structure and repeated reasoning occur frequently, as students look at recursive definitions to refine their understanding of linear and exponential functions. The notation and language used in all of these functions is also important, so students must be careful with the precision of their language.
(*Common Core Mathematics Companion*, Pg. 204)

Instructional Resources	
Mathematics Formative Assessments (MFAS) Lunch Account Students are asked to interpret linear functions parameters in a context. Computer Repair Students are expected to interpret a linear function in context to a real world situation. Interpreting Exponential Functions Students are asked to interpret parameters of an exponential function in context.	Lesson Resources • MARS/Shell ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Semester 2	**Unit 14: Interpreting and analyzing functions.**	8 days: 3/24-4/2

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.F-IF.2.5 (Assessed under F-IF.1.2) 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 persons-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.	• Items may present relations in a variety of formats, including sets of ordered pairs, mapping diagrams, graphs, and input/output models. • In items requiring the student to find the domain from graphs, relationships may be on a closed or open interval. • In items requiring the student to find domain from graphs, relationships may be discontinuous. • Items may not require the student to use or know interval notation Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.F-IF.2.6 (Also assesses MAFS.912.S-ID.3.7) 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.	• Items requiring the student to calculate the rate of change will give a specified interval that is both continuous and differentiable. • Items should not require the student to find an equation of a line. • Items assessing F-IF.2.6 should not be linear. Calculator: Neutral • Equation Editor • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.F-IF.3.7 (part d is not tested) 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.	• Students will graph a linear function using key features. • Students will identify and interpret key features of a graph within the real-world context that the function represents. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response

MAFS.912.F-IF.3.8 (Also assesses MAFS.912.F-IF.3.7a,b,c,e and MAFS.912.A-APR.2.3) 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.	• Students will identify zeros, extreme values, and symmetry of a quadratic functions written symbolically. • For F-IF.3.7e and F-IF.3.8b, exponential functions are limited to simple exponential growth and decay functions and to exponential functions with one translation. Base e should not be used. • For F-IF.3.8, items may specify a required form using an equation or using common terminology such as standard form. • Items that require the student to interpret the vertex or a zero of a quadratic function within a real-world context, the student should interpret both the x-value and the y-value. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
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.	• Functions can be linear, quadratic or exponential • Functions can be represented using tables or graphs • Functions can have closed domains • Functions can be discontinuous • Items may not require students to use or know interval notation. Calculator: **NO** • Equation Editor • GRID • Hot Text • Multiple Choice • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
•

Algebra Nation
• Average Rate of Change Over an Interval • Finding Solution Sets of Systems of Equations Using Tables of Values and Successive Approximations • Comparing Linear, Quadratic, and Exponential Functions – Part 1 • Comparing Linear, Quadratic, and Exponential Functions – Part 2

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 3, Topic B, Lesson 13 • Algebra 1 Module 3, Topic B, Lesson 14 • Algebra 1 Module 4, Topic A, Lesson 10 • Algebra 1 Module 4, Topic B, Lesson 16 • Algebra 1 Module 4, Topic B, Lesson 17 • Algebra 1 Module 4, Topic C, Lesson 18 • Algebra 1 Module 4, Topic C, Lesson 19 • Algebra 1 Module 4, Topic C, Lesson 20 • Algebra 1 Module 4, Topic C, Lesson 21

- Algebra 1 Module 5, Topic A, Lesson 1
- Algebra 1 Module 5, Topic A, Lesson 2
- Algebra 1 Module 5, Topic A, Lesson 3

Decoded Standard	
MAFS.912.F-IF.2.5 Students consider situations that have continuous and discrete domains and/or ranges. A good starting example relates the number of Rees's cups purchased versus the number of packages at the candy counter. The domain is {1, 2, 3, …} while the range is {2, 4, 6, 8, …}. The graph is linear, has a constant rate of change of 2 cups per package, and is graphed with points (discrete). This can be compare with the distance a walker going 2 miles per hour is from a starting point versus time, which is continuous. Students need to explain why each domain and range occurs. Another example considers the number of same-size buses needed to seat students. One bus holds 34 students, then two buses hold 68 students, and so on. The domain (number of buses) is a natural number. The number of students is also a natural number. If there ae 38 students, two buses are still needed, so the graph is not a typical linear function that students may be used to seeing from previous experiences. (*Common Core Mathematics Companion*, Pg. 154)	
Instructional Resources	

Mathematics Formative Assessments (MFAS)
Describe the Domain Given verbal descriptions describe an appropriate domain.
Height vs. Shoe Size Students determine the domain from a context.
Car Wash Students determine the domain from a graph.
 	
Illustrative Mathematics Assessment Tasks
The Canoe Trip The purpose of this task is to give students practice construction functions that represent a quantity in a context.
Oakland Coliseum Students find the domain and range of the given function
	Additional Lesson Resources
	• Algebra Nation
	  ○ Representing, Naming, and Evaluating Functions
	  ○ Modeling with Functions
	• MARS/Shell *A culminating lesson task using a coherent approach to this unit*
	  ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Decoded Standard	
MAFS.912.F-IF.2.6 The *Progressions for the Common Core State Standards: 6-7 Ratios and Proportional Relationships* (2011) gives examples of rate of change involving both ratios and proportions using similar triangles to show the additive and multiplicative conceptual underpinning of the concepts (p. 5, 9). This idea is extended in Functions, starting in Grade 8, by examining not only direct variations but also other linear functions. For Grades 9-12, the average rate of change may begin with the concept of linear functions, but it is not limited to linear functions. The average rate of change is the ratio of the change in the dependent variable to the change in the independent variable for a given interval (e.g., for $1 \leq x \leq 4$ on the function $f(x) = x^2$, the average rate of change $= \frac{f(4)-f(1)}{4-1} = \frac{16-1}{3} = \frac{15}{3} = 5$). For students moving into STEM careers, this work links to the difference quotient and the instantaneous rate of change (an application of the derivative in calculus). (*Common Core Mathematics Companion*, Pg. 155)	
Instructional Resources	

Mathematics Formative Assessments (MFAS)
Pizza Palace – (Rate of change, 2 problems)
Identifying Rate of Change – (Identifying Rate of Change, 3 problems)
	Additional Lesson Resources
	• Algebra Nation
	  ○ Average Rate of Change Over An Interval
	  ○ Comparing Linear, Quadratic, and

Air Cannon – (Rate of change given exponential graph, 3 problems) Estimating the Average Rate of Change – (Non-linear rate of change, 3 problems) Illustrative Mathematics Assessment Tasks The High School Gym—task build student reasoning skills for examining linear and non linear relationships Mathmafish Population—interpreting a real world problem for linear relationships at intervals.	Exponential Functions – Part 1 ○ Comparing Linear, Quadratic, and Exponential Functions – Part 2 • MARS/Shell ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Decoded Standard	
MAFS.912.F-IF.3.7 A. *Common Core Mathematics Companion*, Pg. 158 B. *Common Core Mathematics Companion*, Pg. 160 C. *Common Core Mathematics Companion*, Pg. 162 D. *Common Core Mathematics Companion*, Pg. 163 E. *Common Core Mathematics Companion*, Pg. 165	
Instructional Resources	
Mathematics Formative Assessments (MFAS) Graphing a Step Function students graph a step function state the domain and identify intercepts. Graphing a Quadratic Function Students graph a quadratic function and identify the intercepts and the maxima or minima. Graphing a Rational Function Students graph equations using technology and answer questions about key features. Graphing a Linear Function Students are given equations and asked to identify domains and with limits what are the maximum and minimum and intercepts. Graphing a Root Function Students answer questions about the domain, maxima and minima of Root functions. Graphing an Exponential Function Students graph an exponential function and to determine if the function is an example of exponential growth or decay, describe any intercepts, and describe the end behavior of the graph. Exponential Graphing using Technology Allows students to use technology to examine what happens when values are changed and how it affects the graph. Illustrative Mathematics Assessment Tasks Graphs of Quadratic Functions Students compare graphs of different quadratic functions, then produce equations of their own to satisfy given conditions.	Additional Lesson Resources • Algebra Nation ○ • MARS/Shell *A culminating lesson task using a coherent approach to this unit* ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions. ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Decoded Standard
MAFS.912.F-IF.3.8 A. This connects directly to A-SSE.2.3a and A-SSe.2.3b, as well as F-IF.3.7a. Students write expressions in equivalent forms for quadratics by using factoring and completing the square. From these equivalent forms,

students can determine whether a quadratic opens up or down (therefore identifying maximum or minimum values) and where the axis of symmetry is (using $f(x) = p(x-h)^2 + k$ allows students to see the axis of symmetry is at $x = h$). The factored form can be set equal to zero to find the zeros of the function. Students can verify all of these different properties of the function by looking at the graph of the function. When given a context, such as projectile motion graphed using time versus height, students can interpret the zeros as the times where the projectile is at height zero, the extreme as the maximum height of the projectile, and the axis of symmetry as an imaginary line that shows the symmetry between the projectile's upward and downward motion. (*Common Core Mathematics Companion*, Pg. 168)

B. Students use concepts from graphing in F-IF.3.7e and F-LE.1.1c to interpret the meaning of exponential functions. When the base is less than one, the graph falls as *x* increases. The function never gets to zero, though it is very close, so students recognize exponential decay. When the base is more than one, the graph rises as *x* increases (at an increasingly faster average rate of change), so students recognize exponential growth. (*Common Core Mathematics Companion*, Pg. 169)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Exponential Functions 1 Students are asked to identify the percent rate of change and determine if it is decay or growth. Exponential Functions 2 Students are asked to identify the percent rate of change and determine if it is decay or growth. Launch from a Hill Students are asked to factor and find the zeros of a polynomial function given in context. A Home for Fido Students are asked to rewrite a quadratic function in an equivalent form by completing the square and to use this form to identify the vertex of the graph and explain its meaning in context. Illustrative Mathematics Assessment Tasks Springboard Dive The student will gain valuable experience applying the quadratic formula and the exercise also gives a possible implementation of completing the square. Which Function The task addresses knowledge related to interpreting forms of functions derived by factoring or completing the square.	• Algebra Nation

Decoded Standard

MAFS.912.F-IF.3.9

Students are extending their fluency with function notation and representation. Students may compare a symbolic representation of a function with a tabular version of another function or compare a graph with a verbal description as examples of what may occur in this standard. (*Common Core Mathematics Companion*, Pg. 170)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources

	• Algebra Nation
	  ○ Comparing Linear, Quadratic, and Exponential Functions – Part 1
	  ○ Comparing Linear, Quadratic, and Exponential Functions – Part 2
	• MARS/Shell

	○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Semester 2	**Unit 15: Build a function that models a relationship between two quantities.**	10 days: 4/3-4/17

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
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. c. Compose Functions.	• In items where the student must write a function using arithmetic operations or by composing functions, the student should have to generate the new function only. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.F-BF.1.2 (Algebra 2 tested standard) Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	• Calculator: •
MAFS.912.A-SSE.2.4 (Algebra 2 tested standard) 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.	• Calculator: •

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

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Algebra Nation

- Finding Zeros of Polynomial Functions of Higher Degrees
- End Behavior of Graphs of Polynomials
- Graphing Polynomial Functions of Higher Degrees
- Recognizing Even and Odd Functions
- Solutions to Systems of Functions

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Algebra 1 Module 1, Topic D, Lesson 26
- Algebra 1 Module 1, Topic D, Lesson 27

Decoded Standard

MAFS.912.F-BF.1.1

A. Students use contextual situations and sets of ordered pairs to create functions to describe the relationship. This standard is used when students fit curves to data in the Statistics conceptual category. (*Common Core Mathematics Companion*, Pg. 177)

B. Students apply their understanding of the algebra of expressions and the algebra of creating equations to situations that combine existing functions. This standard adds to the ideas in F-IF.3 of graphing and recognizing key characteristics by having the students write the function and use their algebraic skills to do so. (*Common Core Mathematics Companion*, Pg. 178)

C. This is an additional standard that implies an understanding of the composition of functions. The use of contexts is needed so that students have more than a symbolic reference to what composition involves. Two ways students can consider compositions are with graphs and symbols. (*Common Core Mathematics Companion*, Pg. 180)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Saving for a Car Students write an explicit function rule given a verbal description Giveaway Students write an explicit function from a verbal description and use it to answer questions. Furniture Purchase Students writes 2 explicit function from verbal descriptions and answers questions Illustrative Mathematics Assessment Tasks Graphs of Compositions Students work with compositions to address important issues around inverse functions. Sum of functions This lesson asks students to think about how adding functions works at a fundamental level.	

Decoded Standard

MAFS.912.F-BF.1.2 *(Algebra 2 Tested Standard)*
When given an addition/subtraction pattern or a multiplication/division sequence, students will recognize an arithmetic (add a common difference each time) or geometric sequence (multiply by a common ratio each time) and be able to create both recursive and explicit functions for the pattern. (*Common Core Mathematics Companion*, Pg. 181)

Instructional Resources

Illustrative Mathematics Assessment Tasks	Additional Lesson Resources
Snake on a Plane Students look at functions via recursive and algebraic definitions.	• CPalms ○ Temperatures in Degrees Fahrenheit and Celsius 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. ○ Plants versus Pollutants Model Eliciting Activity Students work together to clean up toxins through mathematical analysis identifying sequence.

Decoded Standard

MAFS.912.A-SSE.2.4 *(Algebra 2 Tested Standard)*
Common Core Mathematics Companion, Pg. 86

Instructional Resources

	Lesson Resources
	•

Semester 2	Unit 16: Building new functions from existing functions.	5 days: 4/20-2/24

Standards/Learning Goals:	Content Limits, Assessment Types, Calculator
MAFS.912.F-BF.2.3 Identify the effect on the graph of replacing the 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 he 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.	• Functions represented algebraically are limited to linear, quadratic, or exponential. • Functions represented using tables or graphs are not limited to linear, quadratic, or exponential. • Functions may be represented using tables or graphs. • Functions may have closed domains. • Functions may be discontinuous. Items should have a single transformation. Calculator: Neutral • Equation Editor • GRID • Matching Item • Multiple Choice • Open Response • Table Item
MAFS.912.F-BF.2.4 **(Algebra 2 tested standard)** 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 ≠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.	• Calculator: •

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
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Algebra Nation
• Transformation of Functions • Transformations of the Dependent Variable of Quadratic Functions • Transformations of the Independent Variable of Quadratic Functions • Transformations of Exponential Functions

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 3, Topic C, Lesson 15 • Algebra 1 Module 3, Topic C, Lesson 16 • Algebra 1 Module 3, Topic C, Lesson 17 • Algebra 1 Module 3, Topic C, Lesson 18 • Algebra 1 Module 3, Topic C, Lesson 19 • Algebra 1 Module 3, Topic C, Lesson 20 • Algebra 1 Module 3, Topic D, Lesson 21 • Algebra 1 Module 3, Topic D, Lesson 22

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

- Algebra 1 Module 3, Topic D, Lesson 23
- Algebra 1 Module 3, Topic D, Lesson 24

Decoded Standard
MAFS.912.F-BF.2.3 Students use graphing calculators or technology such as Desmos to experiment with a parent function and the results when different transformations are applied. This standard aligns well with F-BF.1.1b in which arithmetic of functions was considered (adding a constant to a function is the same as adding a constant function to the function). Students connect the effects to related geometric transformations: translations and dilations. Students also consider the effect of replacing *x* with –*x* - that is, they compare $f(x)$ with $f(-x)$. The results of those investigations are used to help students define even and odd functions algebraically. Students also investigate graphs of even and odd functions so they may recognize new functions as even or odd, and so they can generalize graphic and symbolic characteristics of even and odd functions. This standard also aligns with F-IF.3 and the different families of functions, as new functions may be created from the parent function by applying transformations. (*Common Core Mathematics Companion*, Pg. 183)

Instructional Resources	

Mathematics Formative Assessments (MFAS)
Write the equation Students are asked to write the function of three absolute value graphs.
Comparing functions Students are asked to compare functions to a given function to help see transformations
Comparing Functions - Quadratic Students compare the graphs of quadratics to the parent graph.
 	
Illustrative Mathematics Assessment Tasks
Medieval Archer This activity helps examine the vertical and horizontal changes placed upon the changing functions.
Transforming the graph of a function Allows students to follow the shifts and recognize patterns in terms of functions.
Building a Quadratic Function from f(x)=x^2 This task aims for students to understand the quadratic formula in a geometric way in terms of the graph of a quadratic function.
Medieval Archer Students will identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative).
Building a General Quadratic Function This task is for instructional purposes only and builds on "Building an explicit quadratic function."
	Lesson Resources
	• CPalms
	  • Translating Quadratic Functions Students will examine what happens to the graph as it is modified in four different ways
	  • Graphing Quadratic Equations This lesson uses graphing technology to examine the differences between quadratic equations and linear equations.

Decoded Standard
MAFS.912.F-BF.2.4a A. Students connect back to pairs of arithmetic operations, such as adding and subtracting and of functions, such as squaring and square rooting, to understand inverse functions. The concept students begin with is that inverse functions undo each other. Once the concept is learned, students examine graphs of inverse functions to reach an understanding that the ordered pair (*x*, *y*) on one function is the ordered pair (*y*, *x*) on its inverse. Students also can see that inverse functions are reflections of each other over the line *x*=*y*. Use of MIRA's , paper folding, and patty paper can then be used to assist students in finding the graph of the inverse

of a given function and verify one function is the inverse of another. By using the understanding that the ordered pair (x, y) is reversed, students create ways to find the inverse of some functions algebraically. (*Common Core Mathematics Companion*, Pg. 185)

B, C, D. These are small grain size standards. Since students have learned about composition, undoing can be demonstrated by composing f and f^{-1} to get back a given specific input or the general x value. By using the concept of the ordered pair being reversed in the inverse functions, students can look at a table of values of $f(x)$ and create ordered pairs for f^{-1}. (*Common Core Mathematics Companion*, Pg. 186)

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
	• MARS/Shell ◦ Generalizing Patterns—this task ask students to explain their rational behind their method in describing patterns

ALGEBRA 1 HONORS

Semester 2	Unit 17: Summarize, represent, and interpret data on two categorical and quantitative variables.	4 days: 4/27-4/30

Standards/Learning Goals:	Content Limits, Assessment Types, Calculator
MAFS.912.S-ID.2.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data	• In data with only two categorical variables, items should require the student to determine relative frequencies and use the frequencies to complete the table or to answer questions. Calculator: **YES** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.S-ID.2.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association	• In items that require the student to interpret or use the correlation coefficient, the value of the correlation coefficient must be given in the stem. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
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Algebra Nation
• Relationship between Two Categorical Values – Marginal and Joint Relative Frequency – Part 1 • Relationship between Two Categorical Values – Marginal and Joint Relative Frequency – Part 2 • Relationship between Two Categorical Values – Conditional Frequency • Scatter Plots and Function Models • Residuals and Residual Plots – Part 1 • Residuals and Residual Plots – Part 2

EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Algebra 1 Module 2, Topic C, Lesson 9 • Algebra 1 Module 2, Topic C, Lesson 10 • Algebra 1 Module 2, Topic D, Lesson 16 • Algebra 1 Module 2, Topic D, Lesson 17 • Algebra 1 Module 2, Topic D, Lesson 18

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Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

Decoded Standard	
MAFS.912.S-ID.2.5 *Common Core Mathematics Companion*, Pg. 359	
Instructional Resources	
Mathematics Formative Assessments (MFAS) Breakfast Drink Preference Students are asked to use data from a survey to create a two-way frequency table. Who is Vegetarian Students are given a two-way frequency table and asked to determine if there is a relationship between the two variables. Conditional Relative Frequency Students are asked to use a two-way frequency table to interpret two different conditional relative frequencies. Marginal and Joint Frequency Students are asked to use a two-way frequency table to interpret marginal and joint relative frequencies. Illustrative Mathematics Assessment Tasks Musical Preferences This problem solving task asks students to make deductions about what kind of music students like by examining a table with data. Can You Make Heads or Tails of It? This is a lesson for teaching students how to make Two-Way Frequency and Relevant Frequency tables and to use the data collected and displayed in the tables for interpretation and prediction.	Lesson Resources • CPalms ○ The Music is On and Popping This MEA is designed to have teams of 4 students look at data in a two-way table. ○ Show me the Money This lesson is an application activity in which students will use relative frequencies to support an argument. ○ Devising a Measure for Correlation This lesson unit is intended to help you assess how well students understand the notion of correlation

Decoded Standard	
MAFS.912.S-ID.2.6 A. *Common Core Mathematics Companion*, Pg. 361 B. *Common Core Mathematics Companion*, Pg. 363 C. *Common Core Mathematics Companion*, Pg. 366	
Instructional Resources	
Mathematics Formative Assessments (MFAS) Swimming Prediction Students are asked to use a linear model to make and interpret predictions in the context of the data. Fit a Function Students are given a set of data and are asked to use technology to create a scatter plot and write a function that fits the data set. Residuals Students are asked to compute, graph, and interpret the residuals associated with a line of best fit. House Prices Students are asked to informally fit a line to model the relationship between two quantitative variables in a scatterplot, write the equation of the line, and use it to make a prediction.	Additional Lesson Resources • Illuminations ○ Barbee Bungee In this lesson students collect data using a rubber band bungee cord and a Barbie doll, construct a scatter plot, generate a line of best fit, and consequently examine linear functions • CPalms ○ Doggie Data: It's a dogs life This lesson allows students to use real-world data to construct and interpret scatter plots using technology. • MARS/Shell ○ Devising a Measure for Correlation This lesson unit is intended to help you assess how well students understand the notion of correlation.

Math
Success Criteria
Algebra
Updated 2/22/18

Competency #1: Algebra and the Number System The student creates, interprets, uses, and analyzes patterns of algebraic structures to make sense of problems				
Success Criteria				
Performance Indicators	**Emerging**	**Progressing**	**Proficient**	**Exceeds**
a. Interpret the structure of expressions and rewrite expressions in equivalent forms for both real-world and mathematical contexts *A-SSE.1.1, 1.2, 2.3*	The student defines and identifies parts of an expression.	The student explains the meanings of the different parts of an expression according to the context of a real-world problem.	The student interprets the structure of expressions and rewrites expressions in equivalent forms for both real-world and mathematical contexts.	The student can interpret the parts of an expression given in any form.
b. Perform arithmetic operations and apply an understanding of closure on polynomials, understand the relationship between zeros and factors of polynomials, and use the zeros to sketch a graph of polynomials. *A-APR.1.1, 2.3*	The student performs arithmetic operations on one variable polynomials with no more than 3 terms.	The student performs arithmetic operations on polynomials and understands the relationship between zeros and factors of polynomials.	The student performs arithmetic operations on polynomials, understands the relationship between zeros and factors of polynomials, and uses the zeros to sketch a graph of polynomials. The student applies an understanding of closure to polynomial operations.	The student models a given situation using polynomials. The student graphs a polynomial by first factoring in order to identify zeros.
c. Create equations and inequalities (including systems) in two or more variables from a real-world context to describe numbers or relationships, and rearrange a formula representing a real-world relationship to solve for a variable. *A-CED.1.2, 1.3, 1.4*	The student identifies variables to represent unknown quantities in a real-world context.	The student chooses from a list of equations or inequalities in two variables from a real-world context to describe numbers, relationships, or constraints. The student rearranges a formula with one procedural step to solve for a variable.	The student creates equations and inequalities (including systems) in two or more variables from a real-world context to describe numbers, relationships, or constraints. The student rearranges a formula representing a real-world relationship to solve for a variable.	The student creates a formula to describe a real-world relationship.
d. The student creates and solves equations and inequalities in one variable and can explain each step.	The student solves one and two step linear equations.	The student selects an equation or inequality in one variable to represent a real-world situation.	The student creates an equation or inequality in one variable to represent a real-world situation.	The student can derive the quadratic formula by completing the square.

The student rewrites quadratic equations by completing the square and can complete a proof of the quadratic formula using this method. *A-REI.1.1, 2.3, 2.4* *A-CED.1.1*		The student solves equations (both linear and quadratic) in one variable.	The student solves equations (both linear and quadratic) and inequalities (simple and compound) in one variable and can explain each step when solving linear equations. The student rewrites quadratic equations by completing the square and can complete a proof of the quadratic formula using this method.	
e. Solve and verify the solution to a system of equations or inequalities via algebraic process, table, graph or successive approximations, and can confirm if two systems of equations are equivalent using linear combination. *A-REI.3.5, 3.6, 4.10, 4.11, 4.12*	The student can verify the solution to a system of equations or inequalities by inspection.	The student explains the difference in the methods of solving systems of equations and inequalities and can solve using one of the methods.	The student can solve and verify the solution to a system of equations or inequalities via algebraic process, table, graph or successive approximations. The student can provide steps for the algebraic process of linear combination and can confirm if two systems of equations are equivalent using linear combination.	The student distinguishes the most efficient way to solve a system of equations and justifies their reasoning. The student can construct a proof of the algebraic process of linear combination.
f. Simplify radical expressions, and use the properties of exponents to rewrite expressions. Apply an understanding of closure to operations with rational and irrational numbers. *N-RN.1.1, 1.2, 2.3*	The student can identify perfect squares. The student can use the properties of exponents to rewrite expressions with integer exponents. The student can identify rational and irrational numbers.	The student can rewrite a square root as an expression with a rational exponent. The student can identify perfect squares and perfect cubes. The student can recall the properties of exponents. The student applies an understanding of closure to operations with rational numbers.	The student can rewrite a radical as an expression with a rational exponent. The student can rewrite a square root so that the radicand has no square factors. The student can use the properties of exponents to rewrite expressions with rational exponents. The student applies an understanding of closure to operations with rational and irrational numbers.	The student can rewrite expressions with radicals or rational exponents that contain more than two operations. The student can rewrite a cube root so that the radicand has no cube factors.

Competency #2: Functions
The student uses functions to interpret and analyze a variety of contexts. Functions describe situations where one quantity determines another.

Success Criteria				
Performance Indicators	**Emerging**	**Progressing**	**Proficient**	**Exceeds**
a. Uses different representations to interpret and analyze functions, calculate and interpret average rate of change, evaluate inputs in the domain using function notation and choose if the situation is best represented by a linear or exponential model. *F-IF.1.2, 1.1, 2.5, 2.6 S-ID.3.7, F-LE.1.1, 2.5*	The student defines a relation and a function, identifies dependent and independent variables, and recognizes different representations of a function.	The student identifies the domain and range, explains the features of linear and exponential functions..	The student uses different representations to interpret and analyze functions, calculate and interpret average rate of change, evaluate inputs in the domain using function notation and choose if the situation is best represented by a linear or exponential model.	The student creates a function rule to model a given situation that best models a problem and defends their choice.
b. Build a sequence or function that models a relationship between two quantities, build new functions from existing functions and interpret key features of graphs and tables given a verbal description. *F-IF.1.3, 2.4, F-BF.1.1b, 1.1c, 2.3*	The student describes the relationship between two quantities. Given a graph of the relationship between two quantities the student can identify key features.	The student models the relationship between two quantities with a function. Given a graph and/or table of the relationship between two quantities the student can identify key features.	The student builds a sequence or function that models a relationship between two quantities, builds and/or transforms new functions from existing functions, identifies the transformation, and interprets key features of functions using either a graph, table, or verbal description.	The student creates multiple functions to model a given situation.

c. Construct, graph and compare linear, quadratic and exponential models, solve problems and interpret expressions for functions, making conclusions about their meaning in terms of the situation they model. *F.IF.3.7a, b, c, e, F-IF.3.8a, b, F-IF.3.9, F-BF.1.1a* *F.LE.1.1, 1.2, 1.3*	The student identifies the different forms of linear, quadratic, and exponential equations. The student can graph piecewise-defined and absolute value functions.	The student distinguishes between situations that can be represented with linear, quadratic, and exponential functions and describes how a function changes when its parameters are changed.	The student constructs, graphs and compares linear, quadratic and exponential models, solves problems and interprets expressions for functions, making conclusions about their meaning in terms of the situation they model.	The student constructs linear, quadratic, and exponential functions given a graph or description of the situation and defends their conclusions about the parameters of the function.

Competency #3: Statistics
The student uses a variety of data analysis and statistics strategies to analyze, develop and evaluate inferences based on data.

Success Criteria				
Performance Indicators	**Emerging**	**Progressing**	**Proficient**	**Exceeds**
a. Summarize, represent, and interpret data in a single variable or two variables and interpret linear models, including assessing the fit of a function by analyzing residuals. Distinguish between correlation and causation. *S-ID.1.1, 2.5, 2.6, 3.7, 3.8, 3.9*	The student identifies a box plot, histogram, or dot plot on a number line for a given data set in one variable. The student identifies the constant rate of change in a linear model.	The student represents data with an appropriate model. The student identifies slope and y-intercept of a linear model. Students can plot residual values.	The student summarizes, represents, and interprets data in a single variable or two variables and interprets linear models, including assessing the fit of a function by analyzing residuals. The student can distinguish between correlation and causation.	The student draws conclusions from a linear model, making contextual conclusions about trends in the data. The student relates the correlation coefficient to causation in a contextual model.

b. Use the center and spread to compare two or more different data sets and use their understanding of normal distribution and the empirical rule to answer questions about data sets.. *S-ID.1.2, 1.3*	The student can define measures of center and spread of data.	The student can calculate the measure of the center and spread of data and identify the appropriate measure of center and spread for a set of data.	The student uses the center and spread to compare two or more different data sets and use their understanding of normal distribution and the empirical rule to answer questions about data sets.	The student uses contextual data from two or more data sets and draws conclusions based on the distribution and spread.