9th Grade Math Unit Plans and Spectrum

FOCUS STANDARDS FOR 9th GRADE

Teachers should focus on emphasizing lessons that cover the major work of 9th grade (green below). Supporting lessons (dark blue) and additional lessons (light blue) can be added to units if students progress quickly or demonstrate mastery. The most important concepts and skills for 9th graders to know before moving to 10th grade is:

- Algebra:
  - Seeing structure in expressions and using structure to write expressions in equivalent forms
  - Create and solve equations and inequalities with one and two variables to represent relationships between quantities.
  - Solve Systems of Equations
  - Represent and solve equations and inequalities graphically
- Number Sense:
  - Quantities- Reason quantitatively and use units to solve problems
  - Real Numbers- extend the properties of exponents to radical exponents
- Functions:
  - Interpreting Functions- Understand the concept of a function and use function notation, interpret and analyze functions

In the Unit Plan and Spectrum document there is a:

- 9th Grade Lesson Spectrum if you are creating your own unit plan
- Sample 9th Grade Lower Level Unit Plan
- Sample 9th Grade Higher Level Unit Plan

Unit	Topic	CCSS	Objective
MAJOR WORK TO EMPHASIZE	Seeing Structure in Expressions **(Expressions and Equations)**	HSA.SSE.A	Interpret the structure of expressions and write expressions in equivalent forms to solve problems.
	Create Equations and Inequalities	HSA.CED.A	Create equations and inequalities with one or two variables to solve problems and represent relationships between quantities.

	(Expressions and Equations)		
	Solve Equations and Inequalities **(Expressions and Equations)**	HSA.REI.B-D	Solve equations and inequalities algebraically and graphically.
	Solve Systems of Equations **(Expressions and Equations)**	HSA.REI.B	Solve systems of equations algebraically and graphically.
	Properties of Exponents to Rational Exponents **(Exponential Expressions and Equations)**	HSN. RN. A.	Rewrite expressions involving radicals and rational exponents using the properties of exponents
	Interpreting Functions **(Functions)**	HS.F.IF.A.	Understand the concept of a function, use function notation, interpret and analyze functions.
	Quantities **(Data, Statistics, and Probability).**	HSN.Q.A	Reason quantitatively and use units to solve problems.
SUPPORTING WORK	Building Functions **(Functions)**	HSF.BF.1	Write a function that describes a relationship between two quantities.
	Compare Linear and Exponential Functions **(Functions)**	HSF.LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
	Theorems involving Similarity **(Geometry)**	HGS.SRT.B	Use congruence and similarity criterion for triangles to solve problems and to prove relationships in geometric figures.
	Trigonometric Ratios **(Geometry)**	HSG.SRT.C	Define trigonometric ratios and solve problems involving right triangles
	Prove Theorems about lines and angles **(Geometry)**	HSG.CO.C	Prove theorems about lines and angles (including vertical angles, alternate interior angles, corresponding angles)

	Prove Theorems about Triangles **(Geometry)**	HSG.CO.C	Prove theorems about triangles (measures of interior angles of a triangle sum to 180 degrees, base angles of isosceles triangles are congruent).
	Data Distribution: Center and Spread **(Data, Statistics, and Probability)**	HS.ID.A.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. *Prerequisite 6.SP-8)
	Statistical Experiments **(Data, Statistics, and Probability)**	HSS.IC.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population
	Interpret Linear Models in the Context of Data	HSS.ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
ADDITIONAL WORK	Linear, Quadratic, and Exponential Models **(Functions)**	HSF.LEA.2.	Construct linear and exponential function (including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs .)
	Similarity and Transformations **(Geometry)**	HGS.SRT.A	Understand similarity in terms of similarity transformations (similarity transformations) *Prerequisite for HSG.SRT.B-C
	Transformations **(Geometry)**	HSG.CO.A	Experiment with Transformations *Prerequisite for HSG.CO.C
	Understand Congruence in Terms of Rigid Motions **(Geometry Unit)**	HSG.CO.B	Understand congruence in terms of rigid motions *Prerequisite for HSG.CO.C

9TH GRADE LESSON SPECTRUM

(Use as reference if you are creating your own unit plan)	
CODE:	**Descriptions**
GREEN	**Priority Lessons to Emphasize, Major Work of Grade.** ● Your Objective Map should include as many of these lessons as possible. ● For above average or advanced groups, some of these lessons can be skipped if the pre-test or RenSTAR data shows that they have mastered these skills ● Note that for below average or below grade level groups, some of these lessons may needed to be broken into two days
BLUE	**Supporting Lessons, Secondary Work of Grade** ● For average or above average groups, you may have time to include these additional lessons. ● **Dark Blue** Lessons - More Important to emphasize than **light blue** lessons
PURPLE	**Advanced Lessons** ● These lessons will help students prepare for the major work in next grade level. ● If your RenSTAR report shows that students are performing above grade level or if you know you have a more advanced group, or mixed grade level group, incorporate some of these additional lessons into your objective map.
RED	**Prerequisite Lessons** ● For below grade level groups, they may need these additional lessons as a review or to prepare them for grade level (green lessons). ● Use your RenSTAR report to get a feel of student prerequisite knowledge and whether these lessons will be necessary. Focus on looking at their Number and Operations Domain Scores.

Establishing a Culture of Learning (2 lessons)
(Foundational Skills)

Unit	Topic	CCSS	Objective
Setting Expectations (2 lessons)	Classroom Routines and Expectations	N/A	Today you will help create a set of classroom expectations by brainstorming ways to create a positive learning environment.
	Word Problem Strategies	N/A	Today you will help generate a class set of word problem strategies by creating a poster that demonstrates one of the strategies.

Number Sense (5 lessons)

Unit	Topic	CCSS	Objective
Adding and Subtracting Rational Numbers (1 lesson)	Addition and Subtraction of Rational Numbers	7.NS.A.1	Today you will add and subtract rational numbers by using addition and subtraction rules based on absolute value.
Multiplying and Dividing Rational Numbers (3 lessons)	Multiplication of Signed Numbers	7.NS.A.2	Today you will discover and apply the rules for multiplying integers by connecting multiplication to repeated addition.
	Division of Signed Numbers	7.NS.A.2	Today you will discover and apply the rules for dividing integers by recognizing that division is the reverse process of multiplication.
	Converting Rational Numbers to Decimals Using Long Division	7.NS.A.2	Today you will represent rational numbers as either terminating or repeating decimals by using the long division algorithm.

Operations Involving Rational Numbers (1 lesson)	Order of Operations	7.NS.A.1 7.NS.A.2	Today you will evaluate rational expressions involving several operations by using the order of operations.

Expressions and Equations (25 lessons)

Unit	Topic	CCSS	Objective
Expressions (5 lessons)	Combining Like Terms	7.EE.1	Today you will simplify expressions by combining like terms of algebraic expressions.
	The Distributive Property	7.EE.1	Today you will expand expressions by applying the distributive property on several expressions.
	Factoring Using the GCF	7.EE.1	Today you will factor expressions by finding and using the greatest common factor.
	Equivalent Expressions	7.EE.1	Today you will identify equivalent expressions by combining like terms, using the distributive property, and factoring using the GCF.
	Seeing Structure in Expressions	HSA.SSE.A	Today you will identify equivalent expressions by using the structure of expressions.
Solving Linear Equations (5 lessons)	One-step Equations	8.EE.7b HSA.REI.A	Today you will solve one-step equations by using inverse operations to isolate the variable.
	Two-step Equations	8.EE.7b HSA.REI.A	Today you will solve two-step equations by using inverse operations.
	Multi-step Equations	8.EE.7b HSA.REI.A	Today you will solve multi-step equations by combining like terms and using the distributive property.

	Equations with Variables on Both Sides	8.EE.7b	Today you will solve multi-step equations with variables on both sides by using the additive inverse of the variable coefficients.
	Solving Multi-Step Equations (Applications)	8.EE.7b	Today you will analyze cell phone plans by writing and solving equations that model their monthly cost.
Systems of Equations (5 lessons)	Solving Systems of Equations by Graphing	8.EE.8b HSA.REI.C	Today you will determine how many solutions a system of equations has by comparing the slope and y-intercept of lines.
	Solving Systems of Equations by Elimination	8.EE.8b HSA.REI.C	Today you will solve systems of equations by using addition and subtraction to eliminate a variable.
	Solving Systems of Equations Using Multiplicative Elimination	8.EE.8b HSA.REI.C	Today you will solve systems of equations by using multiplication to eliminate a variable.
	Solving Systems of Equations Using Substitution	8.EE.8b HSA.REI.C	Today you will solve a system of equations by substituting expressions.
	Applications Involving Solve Systems of Equations	8.EE.8c HSA.REI.C	Today you will solve linear systems applications by translating word problems into equations.
Exponential Expressions and Equations (6 lessons)	Properties of Integer Exponents (Multiplication Properties)	8.EE.1 HSN.RN.A.1	Today you will generate equivalent expressions by applying the multiplication and power properties of exponents.
	Properties of Integer Exponents (Division, Negative, and Zero Properties)	8.EE.1 HSN.RN.A.1	Today you will rewrite expressions by applying the division, negative, and zero properties of integer exponents.

	Properties of Rational Exponents (Radicals)	HSN. RN. A. 2	Today you will rewrite expressions involving radicals and rational exponents using the properties of exponents.
	Operations on Numbers in Scientific Notation	8.EE.1 8.EE.4	Today you will solve real-world problems involving numbers by performing operations on numbers in scientific notation.
	Linear versus Exponential Models	HSF.LEA.1	Today you will distinguish between situations that can be modeled with linear functions and exponential functions.
	Exponential Growth and Decay	HS.F.LE.A	Today you will solve real-world problems involving exponential growth and decay by translating real-world scenarios into exponential equations.
Inequalities (4 lessons)	Solve Linear Inequalities	HS.A.REI.3	Today you will solve linear inequalities by finding and visually representing a solution set for a variable.
	Graph Linear Inequalities	HS.A.REI.11	Today you will graph the solution to a linear inequality by finding the half-plane that represents a solution set.
	Solving Systems of Inequalities	HS.A.REI.12	Today you will graph the solution to a system of linear inequalities by finding the half-plane intersection of each inequality.
	Applications of Linear Inequalities	HS.A.REI.12	Today you will represent real-world scenarios using inequalities by creating and solving inequality application problems.

Functions (14 lessons)

Unit	Topic	CCSS	Objective
Introduction to Functions (6 lessons)	Introduction to Relations	8.F.1	Today you will interpret relations in tables, graphs, and mappings by finding the ordered pairs, the domain/range, and the inverse of a relation.
	Introduction to Functions	8.F.1	Today you will determine if a relation is a function by analyzing the input and outputs of coordinates, graphs, tables, and mappings.
	Identifying Functions	8.F.1	Today you identify functions by determining if a relation in a graph or a table is a function.

	Graphing Functions	8.F.4	Today you will graph a linear function by making a table of input/output values and graphing the coordinates.
	Writing Function Rules from Graphs	8.F.4 HSF.BF.1	Today you will find function rules on a graph by finding the slope and the y-intercept of linear data.
	Modeling Real-World Functions	8.F.4 HS.ID.C.7	Today you will model real-world data by writing and graphing function rules. Interpreting the slope (rate of change) and the intercept (constant term) of a linear model in the context of data.
Interpreting and Building Functions (6 lessons)	Function Notation	HS.F.IF.A.2	Today you will use function notation to evaluate specific input and output values of functions.
	Composition of Functions	HS.F.BF.A.1	Today you will find the composition of two functions by using the output of one function as the input of the other.
	Functions as Sequences	HS.F.BF.A.2	Today you will write recursive and explicit formulas for arithmetic sequences by finding their starting values and common difference.
	Introduction to Interpreting Functions	HS.F.IF.B.4	Today you will interpret key features of graphs by determining the intervals where the function is increasing, decreasing, constant, positive or negative.
	Introduction to Function Transformations	HS.F.BF.B.3	Today you will transform functions by describing the effects on the graph when replacing f(x) by f(x)+k, k(f(x), f(kx), and f(x+k) for specific values of k (both positive and negative).
	Introduction to Function Transformations with Algebra	HS.F.BF.B.3	Today you will transform functions algebraically by using function composition.
End of Unit Project (2 lessons)	Linear Equations Art Day 1	HS.F.BF.B.3	Today you will demonstrate your understanding of key features and transformation of linear functions by constructing a unique image made up of Linear Equations on Desmos

	Linear Equations Art Day 2	HS.F.BF.B.3	Today you will demonstrate your understanding of key features and transformation of linear functions by constructing a unique image made up of Linear Equations on Desmos

Geometry (8 lessons)

Unit	Topic	CCSS	Objective
Congruence/ Similarity (1 lessons)	Similarity, Congruence, Transformations	8.G.A HSG.SRT.B HSG.CO.A	Today you will determine if shapes are similar or congruent using your knowledge of transformations and their properties.
Angles and Lines (3 lessons)	Unknown Angles	7.G.B.5	Use facts about supplementary, complementary, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
	Prove Theorems about lines and angles	HSG.CO.C 7.G.B.5	Prove theorems about lines and angles (including vertical angles, alternate interior angles, corresponding angles)
	Prove Theorems about Triangles	HSG.CO.C	Prove theorems about triangles (measures of interior angles of a triangle sum to 180 degrees, base angles of isosceles triangles are congruent).
Trigonometry (4 lessons)	Trigonometric Ratios	HS.G.SRT.6	Today you will apply trigonometric ratios of right triangles by defining and finding the sine, cosine, and tangent ratios of right triangles.
	Using Trigonometric Ratios to Find Missing Measures	HS.G.SRT.8	Today you will find missing sides of right triangles by setting up and solving trigonometric equations.
	Applications of Trigonometric Ratios	HS.G.SRT.8	Today you will find the height of objects in application problems by using trigonometric ratios and the angle of elevation and depression.

	Indirect Measurement	HS.G.SRT.8	Today you will indirectly find the height of tall objects by setting up and solving trigonometric equations.

SAMPLE LOWER LEVEL 9th GRADE UNIT PLAN

The below unit plan contains 19 lessons. Orange lessons are prerequisite lessons that students may not need, use diagnostic data and RenStar reports to determine student prerequisite skills. Light blue lessons are additional practice day lessons to incorporate if you feel students have not mastered the skill. Dark blue lessons can be potentially removed if short on time.

Unit	Topic	CCSS	Objective
Expressions (2 lessons)	Day 1: Equivalent Expressions	7.EE.1	Today you will identify equivalent expressions by combining like terms, using the distributive property, and factoring using the GCF.
	Day 2: Seeing Structure in Expressions	HSA.SSE.A	Today you will identify equivalent expressions by using the structure of expressions.

Solving Linear Equations (1 lesson)	Day 3: Equations with Variables on Both Sides	8.EE.7b	Today you will solve multi-step equations with variables on both sides by using the additive inverse of the variable coefficients.
	(Optional) Solving Multi-Step Equations (Applications)	8.EE.7b	Today you will analyze cell phone plans by writing and solving equations that model their monthly cost.
Systems of Equations (5 lessons)	Day 4: Solving Systems of Equations by Graphing	8.EE.8b HSA.REI.C	Today you will determine how many solutions a system of equations has by comparing the slope and y-intercept of lines.
	Day 5: Solving Systems of Equations by Elimination	8.EE.8b HSA.REI.C	Today you will solve systems of equations by using addition and subtraction to eliminate a variable.
	Day 6: Solving Systems of Equations Using Multiplicative Elimination	8.EE.8b HSA.REI.C	Today you will solve systems of equations by using multiplication to eliminate a variable.
	Day 7: Solving Systems of Equations Using Substitution	8.EE.8b HSA.REI.C	Today you will solve a system of equations by substituting expressions.
	Additional Practice Day Solving Systems of Equations Algebraically	8.EE.8b HSA.REI.C	Provide additional practice day if needed solving systems of equations with either of the algebraic methods (elimination or substitution)
	Day 8: Applications Involving Solve Systems of Equations	8.EE.8c HSA.REI.C	Today you will solve linear systems applications by translating word problems into equations.
Exponential Expressions and Equations (3 lessons)	Day 9: Properties of Integer Exponents (Multiplication Properties)	8.EE.1 HSN.RN.A.1	Today you will generate equivalent expressions by applying the multiplication and power properties of exponents.
	Day 10: Properties of Integer Exponents	8.EE.1 HSN.RN.A.1	Today you will rewrite expressions by applying the division, negative, and zero properties of integer exponents.

	(Division, Negative, and Zero Properties)		
	Day 11: Properties of Rational Exponents (Radicals)	HSN. RN. A. 2	Today you will rewrite expressions involving radicals and rational exponents using the properties of exponents.
	Additional Practice Day Solving Systems of Equations Algebraically	8.EE.8b HSA.REI.C	Provide additional practice day if needed solving systems of equations with either of the algebraic methods (elimination or substitution)
Inequalities (4 lessons)	Day 12: Solve Linear Inequalities	HS.A.REI.3	Today you will solve linear inequalities by finding and visually representing a solution set for a variable.
	Day 13: Graph Linear Inequalities	HS.A.REI.11	Today you will graph the solution to a linear inequality by finding the half-plane that represents a solution set.
	Day 14: Solving Systems of Inequalities	HS.A.REI.12	Today you will graph the solution to a system of linear inequalities by finding the half-plane intersection of each inequality.
	Additional Practice Day Solving and Graphing Linear Inequalities	8.EE.8b HSA.REI.C	Provide additional practice day if needed solving and graphing linear inequalities
	Day 15: Applications of Linear Inequalities	HS.A.REI.12	Today you will represent real-world scenarios using inequalities by creating and solving inequality application problems.
Functions (4 lessons)	Day 16: Identifying Functions	8.F.1	Today you identify functions by determining if a relation in a graph or a table is a function.
	Day 17: Writing Function Rules from Graphs	8.F.4 HSF.BF.1	Today you will find function rules on a graph by finding the slope and the y-intercept of linear data.

	Day 18: Modeling Real-World Functions	8.F.4 HS.ID.C.7	Today you will model real-world data by writing and graphing function rules. Interpreting the slope (rate of change) and the intercept (constant term) of a linear model in the context of data.
	Day 19: Function Notation	HS.F.IF.A.2	Today you will use function notation to evaluate specific input and output values of functions.

SAMPLE HIGHER LEVEL 9TH GRADE UNIT PLAN

The below unit plan contains 24 lessons. Blue lessons can be eliminated if short on time, green lessons are the ones to prioritize. However, if students' RenSTAR reports or diagnostic data shows that they have already mastered a skill, feel free to remove any of these lessons and incorporate the blue lessons, lessons from the general lesson spectrum or create opportunities for projects.

Unit	Topic	CCSS	Objective
Expressions (1 lessons)	Day 1: Seeing Structure in Expressions	HSA.SSE.A	Today you will identify equivalent expressions by using the structure of expressions.

Solving Linear Equations (1 lessons)	(Optional) : Equations with Variables on Both Sides	8.EE.7b	Today you will solve multi-step equations with variables on both sides by using the additive inverse of the variable coefficients.
Systems of Equations (5 lessons)	Day 2: Solving Systems of Equations by Graphing	8.EE.8b HSA.REI.C	Today you will determine how many solutions a system of equations has by comparing the slope and y-intercept of lines.
	Day 3: Solving Systems of Equations by Elimination	8.EE.8b HSA.REI.C	Today you will solve systems of equations by using addition and subtraction to eliminate a variable.
	Day 4: Solving Systems of Equations Using Multiplicative Elimination	8.EE.8b HSA.REI.C	Today you will solve systems of equations by using multiplication to eliminate a variable.
	Day 5: Solving Systems of Equations Using Substitution	8.EE.8b HSA.REI.C	Today you will solve a system of equations by substituting expressions.
	Day 6: Applications Involving Solve Systems of Equations	8.EE.8c HSA.REI.C	Today you will solve linear systems applications by translating word problems into equations.
Exponential Expressions and Equations (6 lessons)	Day 7: Properties of Integer Exponents (Multiplication Properties)	8.EE.1	Today you will generate equivalent expressions by applying the multiplication and power properties of exponents.
	Day 8: Properties of Integer Exponents (Division, Negative, and Zero Properties)	8.EE.1	Today you will rewrite expressions by applying the division, negative, and zero properties of integer exponents.

	Day 9: Properties of Rational Exponents (Radicals)	HSN. RN. A. 2	Today you will rewrite expressions involving radicals and rational exponents using the properties of exponents.
	Day 10: Linear versus Exponential Models	HSF.LEA.1	Today you will distinguish between situations that can be modeled with linear functions and exponential functions.
	Day 11: Exponential Growth and Decay	HS.F.LE.A	Today you will solve real-world problems involving exponential growth and decay by translating real-world scenarios into exponential equations.
Inequalities (4 lessons)	Day 12: Solve Linear Inequalities	HS.A.REI.3	Today you will solve linear inequalities by finding and visually representing a solution set for a variable.
	Day 13: Graph Linear Inequalities	HS.A.REI.11	Today you will graph the solution to a linear inequality by finding the half-plane that represents a solution set.
	Day 14: Solving Systems of Inequalities	HS.A.REI.12	Today you will graph the solution to a system of linear inequalities by finding the half-plane intersection of each inequality.
	Day 15: Applications of Linear Inequalities	HS.A.REI.12	Today you will represent real-world scenarios using inequalities by creating and solving inequality application problems.
Functions (10 lessons)	Day 16: Writing Function Rules from Graphs	8.F.4 HSF.BF.1	Today you will find function rules on a graph by finding the slope and the y-intercept of linear data.
	Day 17: Modeling Real-World Functions	8.F.4 HS.ID.C.7	Today you will model real-world data by writing and graphing function rules. Interpreting the slope (rate of change) and the intercept (constant term) of a linear model in the context of data.
	Day 18: Function Notation	HS.F.IF.A.2	Today you will use function notation to evaluate specific input and output values of functions.
	Day 19: Composition of Functions	HS.F.BF.A.1	Today you will find the composition of two functions by using the output of one function as the input of the other.

	Day 20: Functions as Sequences	HS.F.BF.A.2	Today you will write recursive and explicit formulas for arithmetic sequences by finding their starting values and common difference.
	Day 21: Introduction to Interpreting Functions	HS.F.IF.B.4	Today you will interpret key features of graphs by determining the intervals where the function is increasing, decreasing, constant, positive or negative.
	Day 22: Introduction to Function Transformations	HS.F.BF.B.3	Today you will transform functions by describing the effects on the graph when replacing f(x) by f(x)+k, k(f(x), f(kx), and f(x+k) for specific values of k (both positive and negative).
	Day 23: Introduction to Function Transformations with Algebra	HS.F.BF.B.3	Today you will transform functions algebraically by using function composition.
	Day 24: Linear Equations Art Day 1	HS.F.BF.B.3	Today you will demonstrate your understanding of key features and transformation of linear functions by constructing a unique image made up of Linear Equations on Desmos
	Day 25: Linear Equations Art Day 2	HS.F.BF.B.3	Today you will demonstrate your understanding of key features and transformation of linear functions by constructing a unique image made up of Linear Equations on Desmos