Cologne Academy

Mathematics Department

Algebra 1B

(Aligned Text: Prentice Hall/Pearson Algebra 1)

Core Knowledge Curriculum – 78% Aligned

Adopted: 08/2014

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Table of Contents

Highlighted items indicate overlap of MN State Standards and the Core Knowledge Sequence.

Boxed items indicate content to be introduced post-MCAs.

Math Department Lesson Essentials

Topic: Title of lesson.

***Objective:** Academic goal for students to achieve by end of lesson.

***Standard:** MN State Standard or Core Knowledge Sequence reference.

Agenda: Sequence of instruction and activities

Closure: Brief summary/overview of lesson. May include formative assessment.

Homework: Continued practice of lesson. May be used as formative assessment.

*Indicates required components.

Note: The text has been as closely aligned with MN State Standards but additional resources may be required to include all skills (including within the Core Knowledge Sequence). Resources may be located on the s:drive under Mathematics Resources and by grade level or on the Cologne Academy intranet. Further research/exploration may be required to locate additional resources.

Overview

Strand(s): Number & Operation, Algebra, Geometry & Measurement

Unit 1: Algebra 1A Review (Accelerated Study)

Approximate Duration of Study: 8 Weeks Between Interims.

MNSS	Knowledge	Skills

Real Numbers
 	
8.1.1.1
8.1.1.2
8.1.1.3
	Students will know that:
	• A **rational number** can be expressed as a fraction where the denominator is not equal to 0.
	  ○ Rational numbers may belong to more than one subset.
	• A number that is not rational is **irrational**.
	• The square root of irrational numbers is irrational.
	• The square root of a positive **integer** can be an integer or irrational.
	• The product of a non-zero rational and irrational number is irrational.
	
	• Various methods can be used to approximate and verify solutions to problems involving real numbers.
		Student will be able to:
		• Classify real numbers as rational or irrational.
		  ○ *Classify numbers as **integer**, **whole**, **natural**, **imaginary**.*
		• Perform operations with rational and irrational numbers.
		
		• Estimate the square root of irrational numbers to the nearest tenth.

Exponents
 	
8.1.1.4
	Students will know that:
	• Properties of negative, zero, positive and rational **exponents** generate **equivalent** numerical expressions.
	• Properties of Exponents:
	  ○ Any constant is raised to a power of 1: $7 = 7^1$
	  ○ *Negative:* $x^{-m} = \frac{1}{x^m} \rightarrow x^{-3} = \frac{1}{x^3}$
	  ○ *Zero:* $x^0 = 1 \rightarrow 26^0 = 1$
	  ○ *Product of Powers:* $x^m \cdot x^n = x^{m+n} \rightarrow x^3 \cdot x^4 = x^7$
	  ○ *Quotient of Powers:* $\frac{x^m}{x^n} = x^{m-n} \rightarrow \frac{x^7}{x^2} = x^5$
	  ○ *Power of Powers:* $(x^m)^n = x^{m \cdot n} \rightarrow (7x^3)^2 = 49x^6$
		Student will be able to:
		• Create equivalent expressions by using properties of integer exponents.
		• Extend the rules of exponents to fractional exponents.
		  ○ $x^{\frac{m}{n}} = \sqrt[n]{x^m}$

Scientific Notation
 	
8.1.1.5
	Students will know that:
	• **Scientific notation** is a method of approximating very large and very small numbers.
	• Different technologies represent scientific notation in different forms.
	• Properties of exponents can be used to perform operations with numbers expressed in scientific notation.
	• With physical measurements, **Significant Digits** are each of the digits of a number that are used to express it to the required degree of accuracy, starting from the first nonzero digit.
	  ○ *All non-zero digits are significant.*
	  ○ *All zeroes between significant digits are significant.*
	  ○ *All zeroes to the right of the decimal point and to the right of significant digits after a decimal point are significant (Zeroes to the right of a decimal point and the left of significant digits are not significant).*
	  ○ *Zeroes after a non-zero digit without a decimal place, are not significant.*
		Student will be able to:
		• Convert between standard and scientific notation of numbers.
		• Compare and order numbers written in scientific notation.
		• Recognize and interpret results when using technology to operate on number written in scientific notation.
		• Perform operations with numbers in scientific notation.
		• Work with significant digits.
		• Perform operations on numbers written in scientific notation using the correct number of significant digits when physical measurements are involved.
		  ○ *$(4.2 \times 10^4) \times (8.25 \times 10^3) = 3.465 \times 10^8$, but if these numbers represent physical measurements, the answer should be expressed as 3.5×10^8 because the first factor, 4.2×10^4, only has two significant digits.*
		  ○ *1,204 has four significant digits.*
		  ○ *1,200 has two significant digits.*
		  ○ *0.95 has two significant digits but 0.950 has three.*

Represent & Solve Equations
 	
8.2.4.2
8.2.4.1
	Students will know that:
	• An **equation** is a number, a variable or a combination of both that includes an equal sign.
	• **Properties of Equality** and **Inverse Operations** can be used to isolate a variable when solving an algebraic equation.
	  ○ ***Reflexive**: $a = a$*
	  ○ ***Transitive**: If $a = b$, and $b = c$, then $a = c$*
	  ○ ***Symmetric**: If $a = b$ then $b = a$*
	  ○ ***Addition**: If $a = b$, then $a + c = b + c$*
	  ○ ***Subtraction**: If $a = b$, then $a - c = b - c$*
	  ○ ***Multiplication**: If $a = b$, then $ac = bc$*
	  ○ ***Division**: If $a = b$, then $a \div c = b \div c$*
	  ○ ***Additive Inverse:** $a + (-a) = 0$*
	  ○ ***Multiplicative Inverse:** $a \cdot \frac{1}{a} = 1$*
	• An equation is **linear** if it creates a straight, non-vertical line when plotted on a coordinate plane.
		Student will be able to:
		• Solve multi-step equations in one variable.
		• Solve equations, in one variable, with variables on both sides.
		• Solve for one variable in a multi-variable equation in terms of other variables (**Literal Equations**/**Formulas**).
		• Justify the steps by identifying Properties of Equality used.
		• Plot a set of ordered pairs and surmise a reasonable graph of which the points are a part.
		• Identify **constant rate of change**.

Special Equations 8.2.4.6 (Absolute Value Equations)	**Students will know that:** • The **absolute value** is mathematical concept which cannot be defined using only one condition. • The absolute value of a linear expression can be used to model relationships in various contexts. ○ *A cylindrical machine part is manufactured with a radius of 2.1 cm. with a tolerance of $\frac{1}{100}$ cm. The radius r satisfies the inequality $\|r - 2.1\| \leq 0.01$.* • **Absolute Value Equations** must be solved by exploring 2 cases: the negative case and the positive case. ○ *For $\|x + 8\| = 12$, the value within the absolute value bars may have been positive or negative therefore the positive case: $x + 8 = 12$ and the negative case: $-(x + 8) = 12$ are solved to find $x = 4$ or $x = -20$ (also: $x + 8 = 12$ or $x + 8 = -12$).* ○ *$\|x\| = c$, two solutions; $\|x\| = 0$, one solution; $\|x\| = -c$, no solution (the absolute value of any quantity cannot be a negative number – cannot have a negative distance).*	**Student will be able to:** • Solve and justify procedures taken to solve problems involving absolute values. ○ *Solve $\|2x - 3\| + 3x = 4x - 2$*
	• Solutions to absolute value equations in one variable can be represented visually.	• Graph the solution set of absolute value equations on a number line.
Inequalities 8.2.4.4 8.2.4.5	**Students will know that:** • **Linear Inequalities** can be used to represent situations where there are infinitely many possibilities for the solution. • Properties of Inequality can be used to isolate a variable when solving an algebraic inequality. ○ *Addition: If $x < y$, then $x + z < y + z$, (similarly for $>$)* ○ *Subtraction: If $x < y$, then $x - z < y - z$, (similarly for $>$)* ○ *Multiplication and Division:* *If $x < y$, and $z > 0$, then $xz < yz$; if $x < y$, and $z < 0$, then $xz > yz$.* *If $x > y$, and $z > 0$, then $xz > yz$; if $x > y$, and $z < 0$, then $xz < yz$.*	**Student will be able to:** • Use linear inequalities to represent relationships in various contexts.
	• Solutions to inequalities in one variable can be represented visually on a number line.	• Solve and graph the solution set of a linear inequalities.

Special Inequalities
8.2.4.6
(Absolute Value Inequalities)
	Students will know that:
	• **Absolute Value Inequalities** are solved by identifying the two conditions to be satisfied and solving their associated compound inequality.
	• Less-than symbols indicate an "AND" statement; greater-than symbols indicate an "OR" statement.
	  ○ $\|x\| < c \rightarrow -c < x < c$
	  ○ $\|x\| > c \rightarrow x > c, x < -c$
	  ○ *Special Cases*
	  ▪ $\|x\| > -c$, *all real number solutions.*
	  ▪ $\|x\| < -c$, *no solution.*
	• Solutions to absolute value inequalities in one variable can be represented visually on a number line.
		Student will be able to:
		• Solve and graph the solution set of absolute value inequalities.
		  ○ *A food manufacturer makes 32-oz boxes of pasta. Not every box weights exactly 32 oz. The allowable difference from the idea weight is at most 0.05 oz. The weight w satisfies the inequality* $\|w - 32\| \leq 32$.

Intro to Functions
 	
8.2.1.1
8.2.1.2
8.2.1.3
8.2.2.1
9.2.2.3
	Students will know that:
	• A **function** is a relationship between an **independent** variable and a **dependent** variable in which the value of the independent variable determines the value of the dependent variable.
	• The graph of a function is the set of ordered pairs where each value of the **input** is associated with a unique value of the **output**.
	• A **relation** is any set of ordered pairs.
	• The **domain** is the set of all possible values for the input (independent variable – usually x) of a relation or function. The **range** is the set of all the possible values for the output (dependent variable – usually y) of a relation or function.
	• **Function Notation**: $f(x)$, can be used to represent relationships. $f(x) = y$
	  ○ $f(x) = 2x + 1$ *is the same as* $y = 2x + 1$
		Student will be able to:
		• Determine if a set of ordered pairs, a table, or a graph represents a function.
		• Write and use function notation to evaluate functions for inputs in their domains.
		• Interpret statements that use function notation in terms of a context.
		  ○ *The relationship between the area of a square* and the side length can be expressed as $f(x) = x^2$. *In this case,* $f(5) = 25$, *which represents the fact that a square of side length 5 units has an area of 25 units squared.*
		• Select the appropriate domain to represent a given situation.
		• Graph a function within a given domain and range.
		• Create a reasonable table of ordered pairs from a given function rule, plot the points, and surmise its graph.

	• A **Linear Function** has an associated straight, non-vertical graph.
	  ○ *No greater than an exponent of 1 on any variable.*
	• Linear functions represent relationships in which changing the input variable by some amount leads to a change in the output variable that is a constant times that amount.
	  ○ *Uncle Jim gave Emily $50 on the day she was born and $25 on each birthday after that. The function* $f(x) = 50 + 25x$ *represents the amount of money Jim has given after x years. The rate of change is $25 per year.*
		• Distinguish between the graphs of linear, **quadratic**, **cubic**, absolute value, and **exponential** functions.
		• Write a function to represent a linear relationship between two quantities.

	• Linear Functions can be represented with tables, verbal descriptions, symbols, equations and graphs.	• Translate from one linear function representation to another.
Slopes & Lines 8.2.4.3 8.3.2.1 8.3.2.2 8.3.2.3 8.2.2.2 8.2.2.3	**Students will know that:** • The **slope** is a **constant rate of change** that measures the steepness of a line. The greater the slope, the steeper the line. ○ *slope (m)* $= \frac{\Delta y}{\Delta x} = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$ • The relationship between two or more lines can be determined by comparing their slopes and **y-intercepts**. • Equations of lines can be found given: two **coordinate pairs**, one coordinate pair and the slope or the graph itself.	**Student will be able to:** • Find the slope of any line given two coordinate pairs. • Given sufficient information, find the equation of a line. ○ *Determine an equation of the line through the points (-1, 6) and* $\left(\frac{2}{3}, -\frac{3}{4}\right)$. • Identify graphical properties of lines (slopes and intercepts). • Graph linear equations by find the x- and y-intercepts.
	• Linear Equations can be expressed using the following forms: ○ *Slope-Intercept Form:* $y = mx + b$ ○ *Point-Slope Form:* $y - y_1 = m(x - x_1)$ ○ *Standard Form:* $Ax + By = C$	• Convert between slope-intercept form and standard form (also point-slope to other forms) and vice-versa.
	• The y-intercept is zero when the function represents a proportional relationship (**direct variation**). • A relationship between two variables, x and y, is proportional if it can be expressed in the form $y = kx$ or $\frac{y}{x} = k$ (also $y = mx + b$ where m = k and $b = 0$). • The graph of a proportional relationship is a straight, non-vertical line passing through the origin on the Cartesian Plane.	• Solve and graph direct variation equations. • Use linear equations to represent situations involving a constant rate of change, including proportional and non-proportional relationships. ○ *For the cylinder with a fixed radius of length 5, the surface area* $A = 2\pi(5)h + 2\pi(5)^2$, *is a linear function of height h, but the surface area is not proportional to the height.* • Give the graph of a line, determine if it represents a direct variation.
	• Changes to a graph can be related directly to the equation that describes the graph.	• Describe how changes in the slope and y-intercept affect the graph of a linear equation. • Interpret the meaning of the y-intercept and slope of a linear function. • Use graphing technology to examine transformations of linear equations and their associated graphs.
	• Parallel lines have the same slope. • Perpendicular lines have slopes that are opposite reciprocals. ○ A line with m = $\frac{2}{3}$ is perpendicular to a line with m = $-\frac{3}{2}$.	• Identify parallel and perpendicular lines. • Write and graph the equation of the line that passes through a given point that is parallel or perpendicular to a given line.

	• Technology can be used to examine the relationships between slopes of parallel or perpendicular lines. • Shapes, on a coordinate grid, can be identified by comparing the slopes of the lines that compare the shapes.	• Categorize polygons by finding the slopes of their sides. • Analyze **polygons** on a **coordinate system** by determining the slopes of their sides. ○ *Given the coordinates of four points, determine whether the corresponding quadrilateral is a parallelogram.*
Arithmetic Sequence 8.2.1.4 8.2.2.4	**Students will know that:** • Visual and numerical patterns can be represented with a linear function. • Some **sequences** have function rules that can be used to find any term of the sequence. • When the pattern in a sequence is identified, the sequence can be extended. • An **Arithmetic Sequence** is a linear function that can be expressed in the form $f(x) = mx + b$, where x = 0, 1, 2, 3, … ○ *The arithmetic sequence 3, 7, 11, 15 can be expressed as $f(x) = 4x + 3$.* • A **recursive formula** is useful for finding the next **term** in a sequence. The **explicit formula** is more convenient when finding the **n^{th} term**.	**Student will be able to:** • Recognize and extend an arithmetic sequence. • Find a given **term** of an arithmetic sequence. • Represent arithmetic sequences using equations, tables, graphs and verbal descriptions. • Solve problems involving arithmetic patterns. • Find recursive and explicit formulas.
Line of Best Fit 8.4.1.1 8.4.1.2 8.4.1.3	**Students will know that:** • A **scatter plot** is a graph that relates two different sets of data by displaying them as ordered pairs. • Scatter plots can be used to find trends in data. • The shape of the graph indicates the **correlation** between the data. • Lines are widely used to model relationships between two quantitative variables. • The closer each point is to the **Line of Best Fit**, the better the fit. • Graphing technology computes the equation of the line of fit using a method called **Linear Regression**.	**Student will be able to:** • Collect, display and interpret data using scatterplots. ○ Use appropriate titles, labels and units • Use the shape of the scatterplot to informally estimate a line of best fit. • Determine an equation for the line of best fit. • Use graphing technology to display scatterplots and corresponding lines of best fit.

	• The line of best fit can be used to estimate or predict values.	• Use a line of best fit to make statements about approximate rate of change.
		• Make predictions about values not in the original data set.
		  ○ *Given a scatterplot relating student heights to shoe sizes, predict the shoe size of a 5'4" student, even if the data does not contain information for a student of that height.*
		• Asses the reasonableness of predictions using scatterplots by interpreting them in the original context.
		  ○ *A set of data may show that the number of women in the U.S. Senate is growing at a certain rate each election cycle. Is it reasonable to use this trend to predict the year in which the Senate will eventually include 1000 female Senators?*

Essential Vocabulary: Number Sets: Imaginary, $\mathbb{R}$, $\mathbb{Q}$, $\mathbb{Z}$, $\mathbb{W}$, $\mathbb{N}$, Exponents, Equivalent, Scientific Notation, Significant Digits, Equation, Expression, Literal Equation, Formula, Properties of Equality: Reflexive, Transitive, Addition, Subtraction, Multiplication, Division, Additive Inverse, Multiplicative Inverse; Linear, Constant Rate of Change, Absolute Value, Absolute Value Equation, Absolute Value Inequality, Cases, Extraneous Solution, Function, Independent, Dependent, Domain, Range, Input, Output, Relation, Function Notation: f(x); Linear Function, Quadratic, Cubic, Exponential, Slope, Constant, Rate of Change, Y-Intercept, Initial Value , Coordinate System, Coordinate Pair, Direct Variation, Arithmetic Sequence, Common Difference.		
INTERIM 1		

Pacing Chart Unit 1: Algebra 1A Review (Accelerated Study)

Time Frame	Topic	Suggested Activities/Assessments	Resources & Text Alignment
Week 1	PRE-TEST		
Week 1	Algebra 1A Review Real Numbers 8.1.1.1 8.1.1.2 8.1.1.3	**PH/P Text** Concept Byte: Always, Sometimes, or Never Concept Byte: Closure Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 1-3: Real Numbers and the Number Line 1-5: Adding and Subtracting Real Numbers 1-6: Multiplying and Dividing Real Numbers 1-7 The Distributive Property Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 2	Algebra 1A Review Exponents 8.1.1.4	**PH/P Text** Concept Byte: Powers of Powers and Powers of Products Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 7-1: Zero and Negative Exponents 7-3: Multiplying Powers With the Same Base 7-4: More Multiplication Properties of Exponents 7-5: Division Properties of Exponents Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 2	Algebra 1A Review Scientific Notation 8.1.1.5	**PH/P Text** Common Core Edition: Skills Handbook pg. T807 Scientific Notation and Significant Digits Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 7-2: Scientific Notation Discuss Significant Digits (Significant Figures) Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.

Week 3	Algebra 1A Review Represent & Solve Equations 8.2.4.2 8.2.4.1	**PH/P Text** Concept Byte: Modeling One-Step Equations Concept Byte: Modeling Equations With Variables on Both sides Concept Byte: Finding Perimeter, Area, and Volume Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 1-4: Properties of Real Numbers 2-1: Solving One-Step Equations 2-2: Solving Two-Step Equations 2-3: Solving Multi-Step Equations 2-4: Solving Equations With Variables on Both Sides 2-5: Literal Equations and Formulas **Use Table of Values & Graphs to test for linear equations. Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 3 - Week 4	Special Equations 8.2.4.9 8.2.4.6 (Absolute Value Equations)	**PH/P Text** Concept Bytes: Characteristics of Absolute Value Graphs Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 3-7: Absolute Value Equations and Inequalities 5-8: Graphing Absolute Value Functions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 5	Algebra 1A Review Inequalities 8.2.4.4 8.2.4.5 8.2.4.6 (Absolute Value Inequalities)	**PH/P Text** Concept Byte: More Algebraic Properties Concept Byte: Modeling Multi-step Inequalities Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 3-1: Inequalities and Their Graphs 3-2: Solving Inequalities Using Addition or Subtraction 3-3: Solving Inequalities Using Multiplication or Division 3-4: Solving Multi-Step Inequalities 3-6: Compound Inequalities Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 6	Special Inequalities 8.2.4.6 (Absolute Value Inequalities)	**PH/P Text** Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 3-7: Absolute Value Equations and Inequalities Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments

Week 6	Algebra 1A Review Intro to Functions 8.2.1.1 8.2.1.2 8.2.2.1 9.2.2.3	**PH/P Text** Concept Byte: Graphing Functions and Solving Equations Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice Desmos - Polygraph	**PH/P Text** 4-1: Using Graphs to Relate Two Quantities 4-2: Patterns and Linear Functions 4-4: Graphing a Function Rule 4-5: Writing a Function Rule 4-6: Formalizing Relations and Functions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 7 – Week 8	Algebra 1A Review Slopes & Lines 8.2.4.3 8.3.2.1 8.3.2.2 8.2.2.2 8.2.2.3	**PH/P Text** Concept Byte: Investigating $y = mx + b$ Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 5-1: Rate of Change and Slope 5-2: Direct Variation 5-3: Slope-Intercept Form 5-4: Point-Slope Form 5-5: Standard Form 5-6: Parallel and Perpendicular Lines Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 9	Arithmetic Sequence 8.2.2.4	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 4-7: Sequences and Functions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 9	Review		
Week 10	Interim 1		

Overview

Strand(s): Algebra, Geometry & Measurement

Unit 2: 1st, 2nd, and x-Degree Functions.

Approximate Duration of Study: 8 Weeks Between Instruction.

MNSS	Knowledge	Skills

Systems
 	
8.2.4.7
8.2.4.8
	Students will know that:
	• A **system** is a set of two or more linear equations containing two or more variables.
	• A **solution** to a system is the coordinate pair that satisfies all equations of the system.
	• Systems can be solved symbolically, graphically and numerically.
	  ○ *A system with 0 solutions produces parallel lines.*
	  ○ *A system with 1 solution produces intersecting lines.*
	  ○ *A system with infinite solutions produces **coincident lines**.*
	• A system can be solved by substitution (algebraically), elimination or by graphing.
	• The points of intersections of two graphs are **simultaneous solutions** of the relations that define them.
	• The solutions of a system can be found by:
	  ○ Identifying the points of intersection of two functions graphically.
	  ○ Setting the expressions of both function equal to each other and solving
		Student will be able to:
		• Represent relationships in various contexts using systems of linear equations.
		• Determine the number of solutions that a system may have by inspection or by analyzing the graph.
		• Solve systems of linear equations.
		  ○ *Marty's cell phone company charges $15 per month plus $0.04 per minute for each call. Jeannine's company charges $0.25 per minute. Use a system of equations to determine the advantages of each plan based on the number of minutes used.*
		• Solve and list approximate numerical solutions to systems.
		• Solve a system of two linear equations in two variables algebraically and interpret the answer graphically.
		• Check whether a pair of numbers satisfies a system of two linear equations in two unknowns by substituting the numbers into both equations.

Polynomials
 	
9.2.3.2a
9.2.3.3
 	
(Not assessed via MCAs)
	Students will know that:
	• A **monomial** is a real number, a variable or a product of a real number and one or more variables with whole number exponents.
	• A **degree** of a monomial is the sum of the exponents of its variables.
	  ○ *The degree of a nonzero constant is 0.*
	  ○ *Zero has no degree*
	• A **polynomial** is a monomial or a sum of monomials.
		Student will be able to:
		• Write polynomials in standard form.
		• Classify polynomials.
		  ○ *$-2x^3 + 4x^5 + 3x^4$ is a Quintic Trinomial.*

	• Properties of Algebra can be used to rearrange and combine like terms of polynomials.	• Add and subtract polynomials.

	• Various methods can be used to multiply polynomials.
	• Some special cases, within polynomial multiplication, are easy to identify and have a pattern to their products.
	  ○ $(a + b)^2 = a^2 + 2ab + b^2$
	  ○ $(a - b)^2 = a^2 - 2ab + b^2$
	  ○ $(a + b)(a - b) = a^2 - b^2$
		• Use Distributive Property, a table or stacking to multiply polynomials.
		  ○ Stacking: $3x^2 - 5x + 3$
		$2x - 2$
		$-6x^2 + 10x - 6$
		$+ (6x^3 - 10x^2 + 6x)$
		$6x^3 - 16x^2 + 16x - 6$

	• Factoring a polynomial reverses the multiplication process.
	  ○ *Polynomials can be factored to yield expressions that are simpler to manipulate and make equation solving easier.*
		• Multiply special cases.
		
		• Factor second- and higher-degree polynomials when standard techniques apply.
		  ○ *Factor GCF, grouping, special binomial cases, difference of two squares, perfect square trinomials.*
		• Factor trinomials using the Factor/Sum or Box Methods.

Quadratics
9.2.1.5a
(Standard Form Only)
9.2.1.6
9.2.1.9
9.2.2.1
8.2.4.9
9.2.4.1
9.2.2.3
(Quadratics)
 	
(Not assessed via MCAs)
	Students will know that:
	• A quadratic polynomial can be used to define a **quadratic function**.
	  ○ *Written as $y = ax^2 + bx + c$ in standard form.*
	  ○ ***Parent function**: $y = ax^2$, where $a = 1$.*
	• A quadratic function is a nonlinear function that models situations where the rate of change is not constant.
	• The graph of a quadratic function is a symmetric curve with a highest or lowest point corresponding to a **maximum** or **minimum** value.
	  ○ *For $y = ax^2 + bx + c$ if $a > 0$ (positive), the function has a minimum; if $a < 0$ (negative), the function has a maximum.*
		Student will be able to:
		• Identify and graph a quadratic function.
		• Determine if a relation is quadratic.
		• Determine if a quadratic function has a maximum or minimum.
		• Determine the equation of the **axis of symmetry**.
		• Determine the coordinates of the **vertex**.
		  ○ *x-coordinate of the vertex: $x = \frac{-b}{2a}$*
		• Determine the **domain** and **range** of a quadratic function.
		• Identify **intervals of increase and decrease**.
		• Explain the effect that changing the values of *a* and *c* has on the graph of a quadratic function.

	• The **zeroes** of a quadratic function are the solutions to the function.
	• Squares and square roots are inverse operations.
	• Quadratic Formula is used to find the zeroes of a quadratic function.
	  ○ $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
	• The **discriminant** is used to determine the number of solutions a quadratic function has.
	  ○ *$b^2 - 4ac > 0$; the function has 2 real solutions.*
	  ○ *$b^2 - 4ac = 0$; the function has 1 real solution.*
	  ○ *$b^2 - 4ac < 0$; the function has no real solutions.*
		• Solve quadratic functions in one variable.
		  ○ *By factoring, graphing, using square roots, or **completing the square**, or using the quadratic formula.*
		• Use squaring to solve problems that lead to quadratic equations.
		  ○ $\sqrt{3x+4} = x$
		• Clear fractions to solve equations that lead to linear or quadratic equations.
		• Show the proof of the quadratic formula by completing the square.
		• Use the **zero product property** to reveal the zeroes of a quadratic function.
		• Complete the square to write a quadratic expression as the difference of two squares.

	• Quadratics can be used to model problems **involving objects under the force of gravity** and solved using various methods.
	  ○ *Sketching the graph, guess-and-check, data tables, factoring, quadratic formula.*
	• The **altitude** of an object under the force of gravity: **$a = -16t^2 + vt + h$** where a is the altitude of the object in feet, t is time in seconds, v is the initial upward **velocity** of the object in feet per second and h is the initial height of the object.
	  ○ *An object thrown downward with an initial velocity of v feet per second travels a distance **$d = 16t^2 + vt$**, where t is time in seconds.*
		• Solve physical word problems.
		• *Motion of an object under the force of gravity.*

Exponential Functions
 	
9.2.2.2
9.2.2.3
(Exponential Only)
	Students will know that:
	• An **exponential function** models a situation where an initial value has been repeatedly multiplied by the same positive number.
	  ○ $f(x) = b \cdot g^x$ where b is the initial value, g is the **growth factor** and x is a real number.
	• In an exponential function, the exponent is the independent variable.
	• In general, the graph of an exponential function never crosses the x-axis (always greater than 0).
	• An exponential function can model **growth** or **decay** of an initial amount.
	• Compound Interest models exponential growth or decay.
	  ○ *Compound Interest Formula:* $A = P(1 + \frac{r}{n})^{nt}$
		Student will be able to:
		• Identify an exponential function.
		• Evaluate and graph exponential functions.
		• Represent and solve problems using exponential functions.
		  ○ Investment Growth/Decay
		  ▪ *If a girl invests $100 at 10% annual interest, she will have* $100(1.1)^x$ *dollars after x years.*
		  ○ **Depreciation**/**Appreciation**
		  ○ Population Growth/Decay

Geometric Sequence 8.2.1.5 8.2.2.5	**Students will know that:** • Visual and numerical patterns can be represented with non-linear functions. • A **Geometric Sequence** has an initial value and a subsequent **sequence** of values based on a **common ratio**. • A geometric sequence can be modeled with an exponential function. • A geometric sequence is a non-linear, exponential function that can be expressed in the form $f(x) = ab^x$, *where a is the initial value, b is the growth factor and* $x = 0, 1, 2, 3, \ldots$ ○ *The geometric sequence 6, 12, 24, 48, …, can be expressed in the form* $f(x) = 6(2^x)$ • A **recursive formula** ($a_n = a_{n-1}r$) is useful for finding the next **term** in a sequence. The **explicit formula** ($a_n = a_1 \cdot r^{n-1}$) is more convenient when finding the **nth term**.	**Student will be able to:** • Recognize and extend a geometric sequence. • Find the **nth** term of a geometric sequence. • Represent geometric sequences using equations, tables, graphs and verbal descriptions. • Solve problems involving geometric patterns. • Extension: Use recursive and explicit formulas.
Essential Vocabulary: System, Solution, Simultaneous Solutions, Coincident Lines, Systems: Inconsistent, Consistent, Dependent, Independent; Boundary Line, System of Linear Inequalities, Exponential Function, Exponential Growth, Exponential Decay, Growth Factor, Decay Factor, Compound Interest, Depreciation, Appreciation, Geometric Sequence, Common Ratio, Recursive, Explicit, Sequence, Term, Nth Term, Pythagorean Theorem, Converse, Right Triangle, Hypotenuse, Leg, Perimeter, Distance Formula, Polygon, Quadratic Function, Parent Function, Maxima, Minima, Zeroes, Discriminant, Axis of Symmetry, Vertex, Domain, Range, Interval of Increase/Decrease, Completing the Square, Zero Product Property, Monomial, Degree, Polynomial, Quartic, Quintic, Stacking (to multiply polynomials), Special Cases,.		
INTERIM 2		

Pacing Chart

Unit 2: 1st, 2nd and x-Degree Functions

Time Frame	Topic	Suggested Activities/Assessments	Resources & Text Alignment
Week 11	Systems 8.2.4.7 8.2.4.8	**PH/P Text:** Concept Byte: Solving Systems Using Tables and Graphs Concept Byte: Solving Systems Using Algebra Tiles Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 6-1: Solving Systems by graphing 6-2: Solving systems Using substitution 6-3: Solving Systems Using Elimination 6-4: Applications of Linear Systems Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 12 – Week 13	Polynomials 9.2.3.2a 9.2.3.3 (Not assessed via MCAs)	PH/P Text Concept Byte: Using Models to Multiply Concept Byte: Using Models to Factor Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 8-1: Adding and Subtracting Polynomials 8-2: Multiplying and Factoring 8-3: Multiplying Binomials 8-4: Multiplying Special Cases 8-5: Factoring $x^2 + bx + c$ 8-6: Factoring $ax^2 + bx + c$ 8-7: Factoring Special Cases 8-8: Factoring by Grouping Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 14 – Week 16	Quadratics 9.2.1.5a (Standard Form Only) 9.2.1.6 9.2.1.9 9.2.2.1 8.2.4.9 9.2.4.1 9.2.2.3 (Quadratics) (Not assessed via MCAs)	**PH/P Text** Concept Byte: Collecting Quadratic Data Concept Byte: Finding Roots Concept Byte: Performing Regressions Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 9-1: Quadratic Graphs and Their Properties 9-2: Quadratic Functions 9-3: Solving Quadratic Equations 9-4: Factoring to Solve Quadratic Equations 9-5: Completing the Square ***Complete the Square to Derive Quadratic Formula*** 9-6: The Quadratic Formula and the Discriminant 9-7: Linear, Quadratic and Exponential Models *(Optional)* Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.

Week 17	Exponential Functions 9.2.2.2 9.2.2.3 (Exponential Only)	**PH/P Text** Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 7-6: Exponential Functions 7-7: Exponential Growth and Decay Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 17	Geometric Sequence 8.2.1.5 8.2.2.5	**PH/P Text** Concept Byte: Geometric Sequences Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy; Study Island: grade level practice	**PH/P Text** 7-8 (Common Core Edition): Geometric Sequences Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 18	Review		
Week 19	Interim 2		

Overview

Strand(s): Algebra

Unit 3: Right Triangles, Radicals & Rationals

Approximate Duration of Study: 9 Weeks Between Instruction.

MNSS	Knowledge	Skills
Pythagorean Theorem 8.3.1.1 8.3.1.2 8.3.1.3	**Students will know that:** • **Pythagorean Theorem:** ○ $a^2 + b^2 = c^2$, *where a and b are* ***legs*** *and c is the* ***hypotenuse.*** *The sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse.* • **Converse** of the Pythagorean Theorem: ○ *If the sum of the squares of the two shorter sides of a triangle is equal to the square of its longest side, then it is a right triangle.*	**Student will be able to:** • Use Pythagorean Theorem to solve problems involving **right triangles**. ○ *Determine the* ***perimeter*** *of a right triangle, given the lengths of two of its sides.* ○ *Show that a triangle with side lengths 4, 5 and 6 is not a right triangle.* • Solve problems involving the converse of the Pythagorean Theorem. • Use irrational numbers to represent lengths.
	• The Pythagorean Theorem can be used to find the distance between any two points in a coordinate plane. ○ **Distance Formula**: $d = \sqrt{(x_1 - x_2)^2 + (y_2 - y_1)^2}$	• Find the distance between two points on a horizontal, vertical or diagonal line in a coordinate system.
	• The Pythagorean Theorem can be informally justified by using measurements, diagrams and computer software.	• Prove and explain a simple proof of the Pythagorean Theorem. ○ *Proofs: Bhaskara, Garfield, Chinese Square.*
Trigonometric Ratios 9.3.4.1b 9.3.4.3	**Students will know that:** • In a right triangle the **cosine** of an angle is the ratio of the **adjacent** side to the hypotenuse. • In a right triangle the **sine** is the ratio of the opposite side to the hypotenuse. • In a right triangle the **tangent** is the ration of the opposite side to the adjacent side. • Sine, cosine and tangent ratios can be used to find the measurements of sides or angles of right triangles. • Inverses ($\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$) are used to find angle measures given the trigonometric ratio.	**Student will be able to:** • Find and use **trigonometric ratios**. • Use a scientific calculator to determine the approximate value of any acute angle. • Use a scientific calculator to determine the approximate value of an acute angle of a given sine, cosine, or tangent.

Radicals
9.2.3
9.2.3.6
 	
Prerequisite to: 9.2.4.7
	Students will know that:
	• A **radical** includes the radical symbol: √; the expression underneath the symbol is the **radicand**, the **index** which indicates the degree of the radical.
	  ○ For $\sqrt[3]{27}$, 3 is the index; find the third root of the radicand 27.
	• **Radical expressions** can be simplified using the multiplication and division properties of square roots.
	• **Rationalizing the denominator** of a radical expression removes the radical from the denominator of the expression.
	• **Multiplication and Division Properties of Square Roots** are extensions of the Properties of Exponents.
	• Properties of rational exponents generate equivalent numerical expressions.
	  ○ *Rational Exponents:* $(x)^{\frac{m}{n}} = (\sqrt[n]{x})^m \rightarrow (7x)^{\frac{2}{3}} = (\sqrt[3]{7x})^2$
		Student will be able to:
		• Simplify radicals involving products and quotients.
		• Rationalize the denominator of a simple radical expression.
		• Raise a positive number to a fractional power and simplify appropriately.

Radical Operations Prerequisite to: 9.2.4.7	**Students will know that:** • Properties of real numbers can be used to perform operations with radical expressions. • Denominators of some radical expressions can be rationalized by multiplying by **conjugates**. • Addition and subtraction cannot be performed on **unlike radicals**.	**Student will be able to:** • Add and subtract radical expressions.
Radical Equations 9.2.4.7 8.2.4.9	**Students will know that:** • A **radical equation** is an equation that has a variable as the radicand. • Some radical equations can be solved by squaring both sides and testing the solutions. • Extraneous solutions may arise when solving radical equations. • When extraneous solutions are tested, they do not solve the original equation. • "Extraneous solutions" are not the same as "no solutions". •	**Student will be able to:** • Solve equations that contain radical expressions. • Identify **extraneous solutions**. • Explain why extraneous solutions are not solutions at all. • Solve an equation with radical expressions on both sides of the equal sign. • Identify radical equations with no solution.

Graphing Square Roots
 	
9.2.2.6
	Students will know that:
	• The parent function for the family of square root functions is $f(x) = \sqrt{x}$.
	• Square roots functions are radical functions.
	• The value of the radicand cannot be negative.
	• Square root functions can be graphed by plotting points or using translations of the parent square root function.
	• Vertical translations are indicated by the constant outside of the radicand. $f(x) = \sqrt{x} + k$
	  ○ If k > 0, translate up.
	  ○ If k < 0, translate down.
	• Horizontal translations are indicated by the constant in the radicand. $f(x) = \sqrt{x + h}$
	  ○ If h < 0, translate to the right.
	  ○ If h > 0, translate to the left.
		Student will be able to:
		• Graph square root functions manually or using graphing technology.
		• Translate graphs of square root functions manually or using graphing technology.
		• Determine the appropriate domain of a square root function.

Rational Simplification 9.2.3.2 9.2.3.3	**Students will know that:** • A **rational expression** is an expression with a polynomial in its denominator and numerator: $\frac{polynomial}{polynomial}$. • A rational expression has been completely simplified when the numerator and denominator have no common factor other than 1. • Rational expressions are simplified by dividing out common factors found in the numerator and denominator. • An **excluded value** is the value of x for which a rational expression $f(x)$ is undefined. • Excluded values indicate the location of holes in the graph in the original function, called **vertical/horizontal asymptotes**.	**Student will be able to:** • Simplify rational expressions. • Identify excluded values. • Identify value of vertical and/or horizontal asymptotes. (Graphing at end of unit.)
Rational Operations (Expressions) 9.2.3.2 9.2.3.3	**Students will know that:** • A **complex fraction** contains one or more fractions in the numerator, denominator or both. • Complex fractions can be rewritten using division symbols. • Multiplication and division of rational expressions is performed using the same method as multiplication and division of fractions. • Polynomial factoring is used to simplify rational expressions before or after operations have been performed. • Factoring a polynomial, in the numerator or denominator may reveal identical expressions. • Identical expressions, in complex fractions, can be divided out.	**Student will be able to:** • Multiply and divide rational expressions. • Express rational operation solutions in simplest form. • Simplify complex fractions.

	• Addition and subtraction of rational expressions is performed using the same method as addition and subtraction of fractions. • Addition and subtraction of rational expression can only be completed if the fractions have like denominators.	• Add and subtract rational expressions.
Rational Equations 9.2.2	**Students will know that:** • A **rational equation** can be solved by first multiplying each side of the equation by the **LCD**. • **Cross Products Property** can be used to solve equations where each side is a single rational expression. • While solving a rational equation a quadratic expression may be produced on one side of the equal sign, use factoring to solve. • Solving rational equations may produce extraneous solutions. • Solutions must be checked to verify whether they are extraneous solutions or not.	**Student will be able to:** • Solve rational equations and proportions. • Solve combined rate problems. • Identify extraneous solutions.
	• **Combined rate (Work)** word problems are simplified by determining a unit rate or least common multiple unit of time. ○ *If person A completes a job in 5 hours and person B completes the same job in 6 hours then person A completes* $\frac{1}{5}$ *of the job in an hour and person B completes* $\frac{1}{6}$ *of the job in an hour. Alternatively, person A completes 6 jobs in 30 hours and person B completes 5 jobs in 30 hours; combine and find the unit rate.*	• Solve combined rate (work) word problems that involve linear equations.
	• A relationship between two variables, x and y, is inversely proportional if it can be expressed in the form $\frac{k}{x} = y$ or $xy = k$. • If the product of two variables is a nonzero constant, then the variables form an **inverse variation**. • Graphs of inverse variation will not intersect the x- or y-axis.	• Write and graph equations for inverse variations. • Compare direct and inverse variation. • Determine if data represents inverse or direct variation. • Identify direct or inverse variation given a situation.

Graphing Rational Functions
 	
9.2.1.7
9.2.2.6
	Students will know that:
	• **Rational Functions** are written in the form $f(x) = \frac{polynomial}{polynomial}$
	• The characteristics of rational functions and their representations are useful in solving real-world problems.
	• Rational functions have "holes" in their graphs called **vertical and horizontal asymptotes**.
	• To graph a function, $f(x)$, it is necessary to understand the graph's behavior near values of x where the function is undefined.
	• In the graph of a rational function of the form $y = \frac{a}{x-b} + c$:
	  ○ The vertical asymptote occurs at $x = m$ when the value of $f(m)$ is undefined.
	  ○ The horizontal asymptote occurs at $y = c$.
		Student will be able to:
		• Graph rational functions.
		• Identify excluded values of rational functions.
		• Graph the vertical asymptote.
		• Graph the horizontal asymptote.

Essential Vocabulary: Sine, Cosine, Tangent, Adjacent, ∞, Trigonometric Ratio, Undefined. Radical Expressions, Radical, Radical Equation, Radicand, Rationalize the Denominator, Multiplication and Division Property of Square Roots, Perfect Square Factors, Conjugate, Unlike Radicals, Extraneous Solution, Rational Expression, Excluded Value, Vertical/Horizontal Asymptote, Complex Fraction, Rational Equation, Combined Rate (Work),s LCD, Cross Products Property, Inverse Variation, Rational Function, Asymptote, Vertical Asymptote, Horizontal Asymptote.		
Interim 3		

Pacing Chart

Unit 3: Right Triangles, Radicals & Rationals

Time Frame	Topic	Suggested Activities/Assessments	Resources & Text Alignment
Week 20	Pythagorean Theorem 8.3.1.1 8.3.1.2 8.3.1.3	**PH/P Text:** Concept Byte: Distance and Midpoint Formulas Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 10-1: The Pythagorean Theorem ***Proof of Pythagorean Theorem*** Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 20	Trigonometric Ratios 9.3.4.1b 9.3.4.3	**PH/P Text:** Concept Byte: Right Triangle Ratios Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 10-6: Trigonometric Ratios Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 21	Radicals 9.2.3 9.2.3.6 Prerequisite to: 9.2.4.7	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 10-2: Simplifying Radicals Fractional Exponents 7-5 (Common Core Ed.): Rational Exponents and Radicals Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 22	Radical Operations Prerequisite to: 9.2.4.7	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 10-3: Operations With Radical Expressions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 23 – Week 24	Radical Equations 9.2.4.7 8.2.4.9	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 10-4: Solving Radical Equations Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.

Week 25	Graphing Square Roots 9.2.2.6	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 10-5: Graphing Square Root Functions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 26	Rational Simplification 9.2.3.2 9.2.3.3	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 11-1: Simplifying Rational Expressions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 27	Rational Operations (Expressions) 9.2.3.2 9.2.3.3	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 11-2: Multiplying and Dividing Rational Expressions 11-4: Adding and Subtracting Rational Expressions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 28	Rational Equations 9.2.2	Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 11-5: Solving Rational Equations 11-6: Inverse Variation Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 28	Graphing Rational Functions 9.2.1.7 9.2.2.6	PH/P Text: Concept Byte: Graphing Rational Functions Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 11-7: Graphing Rational Functions Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 29	Interim 3		

Overview

Strand(s): Algebra, Data Analysis & Probability

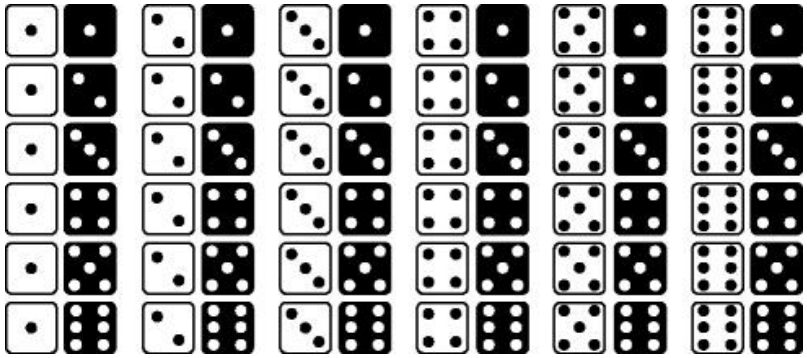
Unit 4: Data Analysis, Advanced Division & Core Knowledge

Approximate Duration of Study: 6 Weeks Between Interims.

MNSS	Knowledge	Skills
Data Displays 9.4.1.1	**Students will know that:** • A **frequency table** groups a set of data values into **intervals** and tallies the number of time each element occurs in each interval. • The intervals do not overlap, do not have gaps, and are equal in size.	**Student will be able to:** • Create and interpret a frequency table.
	• A **histogram**, a special bar graph, organizes numerical data into intervals. • A histogram is used to display data from a frequency table. • Histograms are useful for displaying large data sets. • Individual data elements are not visible in a histogram. • Each bar is of equal width and there are no gaps between bars.	• Create and interpret histograms. • Describe a histogram in terms of its shape.
	• A **cumulative frequency table** displays the number of data values that are less than or equal to the upper limit of each interval.	• Create and interpret a cumulative frequency table.
Measures and Plots 9.4.1.1 9.4.1.2	**Students will know that:** • Special values can be used to describe a set of numerical data. • The **Measures of Central Tendency** are: **Mean**, **Median** and **Mode**. • The **Measure of Dispersion**, **range**, describes how spread out the values in a data set are. • **Outliers** may affect any of the measures of central tendency or dispersion.	**Student will be able to:** • Calculate mean, median, mode and range given a data set. • Find a missing piece of data given the mean of the data. • Make predictions/decisions given a measure of central tendency. • Calculate measures of central tendency and dispersion given a data display.

	• A **box-and-whisker** plot is used to display quantitative data and is plotted on a number line.
	• Box-and-Whisker plots are split into four **quartiles**, each representing 25% of the data.
	• Five data points are displayed on a box-and-whisker plot.
	  ○ *Minimum, First Quartile, Second Quartile (Median), Third Quartile, Maximum.*
	• The **Interquartile Range** is not affected by the minimum, maximum, or any outliers. It only represents the middle of the data set.
	• **Percentiles** separate data into 100 equal parts.
		• Construct and interpret a box-and-whisker plot.
		• Calculate the interquartile range of a set of data displayed in a box-and-whisker plot.
		• Find a **percentile rank**.
		  ○ Use percentile rank to find a data value in a set ordered from least to greatest.
		  ▪ *To find the k^{th} percentile, multiply k% by the total number of values n (the product is called the index). If necessary, round the value up to the nearest whole number. Count the values in the set until reaching the index.*

Samples and Surveys	**Students will know that:** • When collecting data, it is important for the results to accurately represent the situation; methods of collecting data must be fair and **unbiased**. • **Surveys** can use **random**, **systematic**, or **stratified** sampling methods. • A **bivariate** set of data includes two distinct variables; **univariate** uses only one variable. • Results gained from a **sample** can be used to draw conclusions about the **population** from which the sample was drawn.	**Student will be able to:** • Classify data as **quantitative** or **qualitative**. • Analyze samples and surveys to determine bias. • Design and conduct a survey.

Counting Methods
 	
9.4.3.1
	Students will know that:
	• A **sample space** of an experiment is a display of the set of all possible outcomes of that experiment.
	• Counting methods can be used to find the number of possible ways to choose objects with and without regard to order.
	• If the arrangement of objects in a sequence is important, a **permutation** can be used to find the sample space of arrangements.
	• The **Factorial** function: multiply a series of descending natural numbers.
	  ○ $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$
	• Permutations can be calculated with and without repetition of objects.
	  ○ *With repetition:* n^r*, where n is the number of objects and r is the number of choices allowable - choose a 4 digit number using digits 0 – 9:* 10^4*.*
	  ○ *Without repetition, the number of objects must be reduced after each choice is made. Choose a 4 digit number using digits 0 – 9; objects would reduce by one each time.* $10 \cdot 9 \cdot 8 \cdot 7$ *or 10!(stop here; only 4 digits are needed.) Cancel out the remaining factors by dividing by 6!:* $_nP_r = \frac{n!}{(n-r)!}$.
	• If the arrangement of objects in a sequence is not important, a **combination** can be used to find the sample space of arrangements.
	  ○ $_nC_r = \frac{n!}{r!(n-r)!}$
		Student will be able to:
		• Find sample spaces by calculating permutations and combinations.
		
		• Sample space for two dice.
		 

Probability
9.4.3.2
	Students will know that:
	• The **probability** of an event is the chance that an event will occur; represented by a percent, decimal or fraction with a value that falls between 0 and 1.
	  ○ The closer to one, the more likely the event will occur; the closer to 0, the less likely the event will occur.
	  ○ Probability $= \frac{Number\ desired\ events}{Total\ number\ of\ possible\ outcomes}$
	• Probability can be used to make predictions about future events.
	• **Theoretical Probability** is based on what should or is expected to happen. **Experimental Probability** is based on data collected from repeated **trials**.
		Student will be able to:
		• Determine theoretical and experimental probabilities from given or collected data.
		• Perform experiments to confirm or refute probabilities.
		• Calculate **odds** in favor or against an event.
		  ○ *In favor – for:against*
		  ○ *Against – against:for*
		• Design an experiment that illustrates Law of Large Numbers.

	• The **Law of Large Numbers** states that the experimental probability will approach the theoretical probability as the number of trials increases. • A **simple event** has a single **outcome**. • A **compound event** is an event that is made up of two or more simple events.	
Dividing Polynomials 9.2.3.2 9.2.3.3	**Students will know that:** • **Synthetic division** is a method of dividing polynomials. • Division of polynomials is performed using similar methods as when dividing real numbers. • Exponent properties can be used when dividing by a monomial. • When dividing polynomials by using the long division algorithm, the dividend must be in standard form and missing terms must be included using coefficients of 0.	**Student will be able to:** • Divide polynomials using synthetic division or properties of exponents.
Mixture, Digit, Age Core Knowledge	**Students will know that:** • Linear equations or systems of linear equations can be used to solve word problems involving **mixtures**, **digits**, **age**, or **combined rate**.	**Student will be able to:**
	• Constructing a three column chart may be a helpful to organize the information needed to write an equation (the number of rows may vary) for a mixture problem.	• Solve mixture word problems that involve linear equations.
	• Understanding of place value is used to solve digit word problems.	• Solve digit word problems that involve linear equations.
	• An age word problem involving one person can be translated into an integer problem. ○ *2 years ago, Sansa's age was half the age she will be in 3 years:* $x - 2 = \frac{1}{2}(x + 3)$. • A table is helpful in solving age problems involving two or more people.	• Solve age word problems that involve linear equations.
Essential Vocabulary: Frequency Table, Interval, Histogram, Outlier, Cumulative Frequency Table, Skewed, Uniform, Symmetric, Measures of Central Tendency, Measure of Dispersion, Mean, Median, Mode, Range, Outlier, Box-and-Whisker Plot, Quartile, Maximum, Minimum, Interquartile Range, First Quartile, Second Quartile, Third Quartile, Percentile, Percentile Rank, Index, Survey, Random, Systematic, Stratified, Univariate, Bivariate, Sample, Population, Bias, Quantitative, Qualitative, Permutation, Combination, Factorial, Multiplication Counting Principal, Sample Space, Probability, Simple Event, Outcome, Compound Event, Theoretical Probability, Experimental Probability, Complement of an Event, Odds, Trials, Law of Large Numbers, Synthetic Division, Word Problems: Mixture, Age, Digit, Combined Rate, Motion of Object Under Force of Gravity, Altitude, Velocity.		
Interim 4		

Pacing Chart

Unit 4: Data Analysis, Advanced Division & Core Knowledge

Time Frame	Topic	Suggested Activities/Assessments	Resources & Text Alignment
Week 31	**Grade 8 Grade Level Review**		
Week 32	**Mathematics MCA**		
Week 33	Data Displays 9.4.1.1	**PH/P Text:** Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 12-2: Frequency and Histograms Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 33	Measures and Plots 9.4.1.1 9.4.1.2	**PH/P Text:** Concept Byte: Standard Deviation Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 12-3: Measures of Central Tendency and Dispersion 12-4: Box-and-Whisker Plots Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 33	Samples and Surveys	**PH/P Text:** Concept Byte: Designing Your Own Survey Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 12-5: Samples and Surveys Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 34	Counting Methods 9.4.3.1	**PH/P Text:** Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 12-6: Permutations and Combinations Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.

Week 34 – Week 35	Probability 9.4.3.2	**PH/P Text:** Concept Byte: Conducting Simulations Concept Byte: Conditional Probability Putting It All Together: Performance Tasks PowerAlgebra.com Khan Academy Study Island: grade level practice	**PH/P Text** 12-7: Theoretical and Experimental Probability 12-8: Probability of Compound Events Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.
Week 35 ***Optional***	*Dividing Polynomials* *9.2.3.2* *9.2.3.3*	***PH/P Text:*** *Concept Byte: Dividing Polynomials Using Algebra Tiles* *Putting It All Together: Performance Tasks* *PowerAlgebra.com* *Khan Academy* *Study Island: grade level practice*	***PH/P Text*** *11-3: Dividing Polynomials* *Resources include: Math Videos, Online Assessment, Algebra 1 Companion, Interventions and Enrichments.*
Week 35	Mixture, Digit, Age Core Knowledge	**PH/P Text:**	**PH/P Text** Need Resources: Age, Digit.
Week 36	Interim 4		