Time	Unit 1 Functions, Equations, and Systems Essential Q's/Vocabulary	CPMP Lesson Objectives	Common Core Objective	Literacy Activities	Skills/Mathematical Practices
(6 weeks) 10 days	**Lesson 1 Direct and Inverse Variation** <u>Investigation 1 On a Roll</u> *How do course length and steepness affect run time for a downhill race?* *How can the relationship between those variables be expressed in symbolic form?* Vocab.: Variation Patterns, Direct Variation, Inverse Variation. <u>Investigation 2 Power Models</u> *What are the patterns of variation that can be modeled well by power functions?* *What practical and scientific problems can be solved by use of power functions?* Vocab.: Power functions.	Recognize numeric and graphic patterns of change in direct and inverse variation relationships Express direct and inverse variation relationships in symbolic forms Recognize and represent relationships between variables that can be modeled by power functions $y = ax^r$ (r not = 0) Solve problems involving direct and inverse variation	N Q 1 A SSE 1 F IF 6 F IF 6 F IF 7a F IF 7b F IF 7d S ID 6a	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

8 days	**Lesson 2 Multivariable Functions** <u>Investigation 1 Combining Direct and Inverse Variation</u> *What symbolic rules represent the relationship of current, voltage, and resistance in a simple electrical circuit?* *How can relationships among several variables be written in useful equivalent forms?* Vocab.: Constant, Function. <u>Investigation 2Linear Functions and Equations</u> *How can you use linear functions of two independent variables to represent problem situations?* *How can you graph and find solutions for linear equations in two variables?* Vocab. : Linear function, linear equations.	Write rules to define functions of two variables that combine direct and inverse variation Solve for one variable in terms of the others in situations where the variables are related by direct and inverse variation Write equations in the general form ax + by = c to express conditions relating two variables Solve linear equations for one variable in terms of the other Graph linear equations in the form ax + by = c	N Q 1 A SSE 1 A CED 2 A CED 3 A CED 4 A REI 3 A REI 10 F IF 7a F BF 1a	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

9 days 3 (days)	**Lesson 3 Systems of Linear Equations** <u>Investigation 1 Solving With Graphs and Substitution</u> *How can graphs and algebraic substitution be used to solve systems of linear equations?* Vocab.: Substitution method, Solve a system of equations? <u>Investigation 2 Solving by Elimination</u> *How can the elimination of a variable be used to solve a system of linear equations?* Vocab.: Elimination method. <u>Investigation 3 Systems with Zero and Infinitely Many Solutions</u> *What are the properties of linear systems that do not have exactly one ordered pair solution?* Vocab.: Zero solutions, Infinitely many solutions. (Lesson 4 Looking Back)	Write systems of linear equations to match given problem conditions Solve linear systems by graphing, substitution, and elimination methods Recognize linear systems with zero or infinitely many solutions by inspecting graphs, equation forms, and results of reasoning by substitution and elimination (Review and synthesize the major objectives of the unit)	A CED 2 A CED 3 A CED 4 A REI 1 A REI 6 A REI 11 F BF 1a	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

Time	Unit 2 Matrix Methods Essential Q's/Vocabulary	Content & Common Core		Literacy Activities	Skills/Mathematical Practices
(6 weeks) 7 days	**Lesson 1 Constructing, Interpreting, and Operating on Matrices** <u>Investigation 1 There's No Business Like Shoe Business</u> *How can you construct and use a rectangular array of numbers (a matrix) to organize, display, and analyze information?* Vocab.: Matrix, Rows, Columns, Size of a matrix. <u>Investigation 2 Analyzing Matrices</u> *How can you interpret and operate on a matrix to help understand and analyze data?* Vocab.: Degree of difference, square matrix, main diagonal, row sum, and column sum. <u>Investigation 3 Combining Matrices</u> *What are some other useful methods for operating on a matrix or combining two matrices?* Vocab.: Adding matrices, subtracting matrices, scalar multiplication.	Construct matrices to organize, display, and analyze information Interpret given matrices Understand, carry out, and interpret matrix operations – row and column sums, matrix addition and subtraction and scalar multiplications	N VM 6 N VM 7 N VM 8	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

10 days	**Lesson 2 Multiplying Matrices** <u>Investigation 1 Brand Switching</u> *How can you multiply matrices to help make predictions based on trend data?* Vocab.: Matrix multiplication. <u>Investigation 2 More Matrix Multiplication</u> *How do you multiply two matrices, each of which has several rows and columns ?* *Under what conditions is it possible and sensible to multiply two matrices ?* Vocab.:Order of Matrix multiplication. <u>Investigation 3 The Power of a Matrix</u> *How can you represent a vertex-edge graph with a matrix? If you multiply such a matrix by itself, what information do you get about the vertex-edge graph and the situation represented by the graph?* Vocab.: Food web, directed graph or digraph, path length.	Understand, carry out and interpret matrix multiplication Use matrix multiplication, including powers of matrices, to solve problems in a variety of settings Represent a vertex-edge graph as a matrix and use powers of that matrix to analyze the situation modeled by the vertex-edge graph	N VM 6 N VM 8	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

10 days (3 days)	**Lesson 3 Matrices and Systems of Linear Equations** Investigation 1 Properties of Matrices *What are some important properties of operations with matrices?* *How are these properties similar to, and different from, properties of operations with real numbers?* Vocab.: Matrix addition, commutative property of addition, additive identity, additive inverse, matrix multiplication, commutative property of multiplication, multiplicative identity, multiplicative inverse, inverse matrix. Investigation 2 Smart Promotions, Smart Solutions *How can a system of linear equations be represented and solved using matrices?* Vocab.: Solving a linear equation, solving a matrix equation. Investigation 3 Analyzing and Comparing Methods *For solving systems of linear equations: What are some limitations of the inverse-matrix method? What are some advantages and disadvantages of each of the other methods you know?* Vocab.: Limitations of the inverse-matrix method. (Lesson 4 Looking Back)	Examine properties of operations with matrices Compare properties of matrices with those of real numbers Use matrices and their properties to solve systems of linear equations Review, analyze, and compare various methods for solving systems of linear equations (Review and synthesize the major objectives of the unit)	N VM 6 N VM 9 N VM 10 A CED 3 A REI 1 A REI 6 A REI 8 F BF 1a	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

Time	Unit 3 Coordinate Methods Essential Q's/Vocabulary	Content & Common Core		Literacy Activities	Skills/Mathematical Practices
(6 weeks) 13 days	**Lesson 1 A Coordinate Model of a Plane** <u>Investigation 1 Representing Geometric Ideas with Coordinates</u> *How can you create a polygon using interactive geometry software?* *What information and calculations are needed to find slopes, lengths, and midpoints of sides?* Vocab.: Calculation midpoints and distance between any two points. <u>Investigation 2 Reasoning with Slopes and Lengths</u> *Two nonvertical lines are parallel if and only if their slopes are equal.* *How can you use slopes to create and reason about figures in a coordinate plane?* *In general, how can you determine if two lines in a coordinate plane are perpendicular?* Vocab.: Parallelogram, opposite reciprocals. <u>Investigation 3 Representing and Reasoning with Circles</u> *What information is needed to create a circle in a coordinate plane?* *How can you represent circles in a coordinate plane with equations?* *How can you use general coordinates of points to reason about special properties of circles?*	Use coordinates to represent points, lines, and geometric figures in a plane Develop and use coordinate representations of geometric ideas such as distance, slope, and midpoint to analyze properties of lines and shapes Design algorithms for programming calculators or computers to perform routine geometry-related computations Develop and use equations for circles in a coordinate plane Reason with general coordinates to establish properties of triangles, quadrilaterals, and circles	G CO 1 G CO 5 G CO 8 G GPE 1 G GPE 4 G GPE 5	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

	Vocab.: Inscribed in the square, circumscribed about the square, tangent.					

14 days	**Lesson 2 Coordinate Models of Transformations** <u>Investigation 1 Modeling Rigid Transformations</u> *How can coordinates be used to describe a sliding motion or translation? How can coordinates be used to describe a turning motion or rotation?* *How can coordinate be used to describe a mirror or line reflection?* Vocab.: Translation, Horizontal translation, vertical translation, oblique translation, preimage, line reflection, rotation about the origin. <u>Investigation 2 Modeling Size Transformations</u> *How can coordinates be used to rescale or resize a shape?* Vocab.: Size transformation (dilation), Center, Magnitude. <u>Investigation 3 Combining Transformations</u> *How can rigid transformations and/or size transformations be combined to form new transformations?* Vocab.: Composition of translations, orientation, combining two reflections,	Use coordinates to develop function rules modeling translations, line reflections, and rotations and size transformations centered at the origin Use coordinates to investigate properties of figures under one or more rigid transformations or under similarity transformations Explore the concept of function composition using successive application of two transformations	G CO 2 G CO 4 G CO 5 G CO 6 G CO 8 G SRT 1a G SRT 1b G SRT 5	Inv. 1 Cyu, A1,A3-A7 Inv. 2 Cyu, A8-A10,C15 Inv. 3 Cyu, A11-A14,C16-C22 Lesson 2 Quiz	The Core-Plus Mathematics Curriculum , by design, incorporates CCSS Mathematical Practices in to each lesson throughout units 1-8.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

(3 days)	similarity transformation, scale factor. (Lesson 4 Looking Back)	(Review and synthesize the major objectives of the unit)				

Time	Unit 5 Nonlinear Functions and Equations Essential Q's/Vocabulary	Content & Common Core		Literacy Activities	Skills/Mathematical Practices
(6 weeks) 11 days	**Lesson 1 Quadratic Functions, Expressions, and Equations** <u>Investigation 1Functions and Function Notation</u> *What types of relationships between variables are called functions?* *How is function notation used to express facts and questions about functions and the situations they describe?* Vocab.: Domain, Range. <u>Investigation 2 Designing Parabolas</u> *What strategies can be used to find functions that model specific parabolic shapes?* Vocab.: X-intercepts, Y-intercepts, factored expression, maximum point, minimum point. <u>Investigation 3 Expanding and Factoring</u> *What reasoning can be used to expand products of linear factors into equivalent standard form?* *How can standard-form quadratic expressions be written as products of linear factors?* Vocab.: Expanding expressions and Factoring expressions. <u>Investigation 4 Solving Quadratic Equations</u> *What strategies can be used to solve quadratic equations by factoring and the quadratic formula?* Vocab.: Quadratic formula, algebraic reasoning.	Distinguish relationships between variables that are functions from those that are not Use f(x) notation to represent functions and the common questions about functions that arise in applied problems Identify domain and range of functions Construct rules for quadratic function based on given properties such as x-intercepts, y-intercept, and maximum, minimum points Write quadratic expressions in equivalent expanded or factored form Solve quadratic equations by factoring, by applying the quadratic formula, or by a CAS	A SSE 1 A SSE 1a A SSE 1b A SSE 2 A SSE 3 A APR 3 A CED 1 A REI 1 A REI 4b F IF 1 F IF 2 F IF 4 F IF 5 F IF 7a F IF 8a	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

8 days	**Lesson 2 Nonlinear Systems of Equations** Investigation 1 Supply and Demand *What strategies are useful in solving problems that involve links between two functions-one linear function and one an inverse variation function?* Vocab.: Linear equation, inverse equation, equivalent forms. Investigation 2 Making More by Charging Less *What strategies are effective in solving equations that relate linear and quadratic functions?* Vocab.: Combinations of linear and quadratic functions.	Write an equation or inequality to represent a question about a "real-life" situation involving a comparison between a linear function and either an inverse variation or quadratic function Estimate solutions to equations in the form $ax + b = k/x$ using tables or graphs and solve algebraically Estimate solutions to equations in the form $mx + d = ax^2+bx+c$ using tables or graphs and solve algebraically	A SSE 1 A SSE 1b A SSE 3 A APR 3 A CED 1 A CED 2 A REI 2 A REI 7 A REI 11 F BF 1a	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

8 days (3 days)	**Lesson 3 Common Logarithms and Exponential Equations** <u>Investigation 1 How Loud is Too Loud?</u> *How can any positive number be expressed as a power of 10?* Vocab.: Base 10 logarithm, Log, exponents. <u>Investigation 2 Solving for Exponents</u> *How can common logarithms help in finding solutions of exponential equations?* Vocab.: How to use logarithms to solve equations. (Lesson 4 Looking Back)	Recognize what is meant by "taking the common logarithm" of a real number Be able to rewrite any real number as a power of 10 by finding common logarithms Use common logarithms to solve exponential equations, both in and out of context (Review and synthesize the major objectives of the unit)	A SSE 1 A SSE 1a A SSE 2 A SSE 3c A CED 1 A CED 2 A CED 4 A REI 1 F IF 7e F IF 8b F LE 1c F LE 2	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

Time	Unit 7 Trigonometric Methods Essential Q's/Vocabulary	Content & Common Core		Literacy Activities	Skills/Mathematical Practices
(6 weeks) 14 days	**Lesson 1 Trigonometric Functions** <u>Investigation 1 Connecting Angle Measures and Linear Measures</u> *How are the sine, cosine, and tangent functions defined?* *How can their values be estimated?* Vocab.: Vertex, initial side, terminal side, standard position, trigonometric functions. <u>Investigation 2 Measuring Without Measuring</u> *How can trigonometric functions be used to calculate heights like that of Mount Everest and other distances that cannot be measured directly?* Vocab.: Right triangle definitions of sine, cosine, and tangent. <u>Investigation 3 What's the Angle?</u> *How can trigonometric functions be used to determine the measure of an acute angle in a right triangle when the lengths of two sides are known?* Vocab.: Right triangle, acute angles, sine function, cosine function, tangent fuctions.	Determine values of the sine, cosine, and tangent functions of an angle in standard position in a square coordinate plane Determine the sine, cosine, and tangent of an acute angle in a right triangle, and determine the angle given one of those ratios Solve problems involving indirect measurement that can be modeled as parts of a right triangle Explore basic properties of the sine, cosine, and tangent function with reference to their interrelationships and their patterns of change as the angle measure changes	N Q 3 G SRT 6 G SRT 8 G MG 1	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

13 days (3 days)	**Lesson 2 Using Trigonometry in Any Triangle** <u>Investigation 1 The Law of Sines</u> *What is the Law of Sines, and how can it be used to find side lengths or angle measures in triangles?* Vocab.: Law of Sines. <u>Investigation 2 The Law of Cosines</u> *What is the Law of Cosines, and how can it be used to find side lengths or angle measures in triangles?* Vocab.: Law of Cosines. <u>Investigation 3 Triangle Models – Two, One, or None?</u> *What can you conclude about triangle models for situations in which you know the lengths of two sides and the measure of an angle not included between the sides?* Vocab.: Opposite angle, adjacent angle, given angle measure. (Lesson 3 Looking Back)	Determine measures of sides and angles of triangles using the Law of Sines and Law of Cosines Use these laws to solve problems involving indirect measurement and analysis of mechanisms that use triangles with a side of variable length Determine whether two, one, or no triangles are possible when the lengths of two sides and the measure of an angle not included between these sides are known (Review and synthesize the major objectives of the unit)	A SSE 1a G SRT 10 G SRT 11 G MG 1 G MG 3	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

Time	Unit 8 Probability Distributions Essential Q's/Vocabulary	Content & Common Core		Literacy Activities	Skills/Mathematical Practices
(6 weeks) 11 days	**Lesson 1 Probability Models** <u>Investigation 1 The Multiplication Rule for Independent Events</u> *How can you use an area model to find the probability that two events both happen?* *How can you calculate that probability using the individual probabilities?* Vocab.: Independent events, multiplication rule, independent evernts. <u>Investigation 2 Conditional Probability</u> *How can you find probabilities in situations with conditions?* Vocab.: Conditional probability, mutually exclusive. <u>Investigation 3 The Multiplication Rule When Events Are Not Independent</u> *How do you find P(A and B) when A and B are not independent?* Vocab.: Not independent events.	Use an area model to find the probability that two independent events both occur Use the Multiplication Rule to find the probability that two independent events both occur Find conditional probabilities and determine if two events are independent Use the Multiplication Rule to find the probability that two events both occur when the events are not independent	S ID 5 S CP 1 S CP 2 S CP 3 S CP 4 S CP 5 S CP 6 S CP 8	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

8 days	**Lesson 2 Expected Value** <u>Investigation 1 What's a Fair Price?</u> *How can you compute the fair price for a game or insurance policy?* Vocab.: Fair price, average winnings. <u>Investigation 2 Expected Value of a Probability Distribution</u> *How can you compute the fair price of a game if you are given the probability distribution of the prizes?* *In general, how can you find the expected value of a probability distributions?* Vocab.: Expected value (EV), Probability Distribution.	Compute the fair price (expected value) of insurance and games of chance Develop a formula for the expected value of a probability distribution Compute the expected value of a probability distribution using the formula Estimate the expected value from the graph of the probability distribution	S MD 1 S MD 2 S MD 3 S MD 5 S MD 5a S MD 5b S MD 6	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

8 days (3 days)	**Lesson 3 The Waiting-Time Distribution** Investigation 1 Waiting for Doubles *How can you roll dice to estimate the probability that it will take a specified number of rolls to get doubles?* *How can you calculate that probability exactly?* *What is the shape of a waiting-time distribution?* Vocab.: Waiting time distribution, independent trials. Investigation 2 The Waiting-Time Formula *What general formula can be used to calculate the probability that it will take exactly x trials to get the first success in a waiting-time distribution?* Vocab.: Rare event. Investigation 3 Expected Waiting Time *How can you find the expected value of a waiting-time distribution?* Vocab.: Formula for expected value of a waiting-time distribution, histogram. (Lesson 4 Looking Back)	Use simulation to construct an approximate waiting-time distribution and understand why the shape is skewed to the right Recognize rare events in a waiting-time situation Use the formula to construct the probability distribution for a waiting-time situation Discover the formula for the expected value of a waiting-time distribution Understand that some infinite series have a finite sum (Review and synthesize the major objectives of the unit)	S IC 2 S MD 1 S MD 2 S MD 3	Close reading, teacher/student think aloud, contextual problem solving and turn and talk.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.