Finite

U-46 Curriculum Scope and Sequence

Reporting Strand	Instructional Focus	Standards	Semester
Matrices	Represent linear equations in matrices.	A.REI.8, A.REI.9	1
	Perform operations on matrices and use matrices in applications.	N.VM.6, N.VM.7,N.VM.8, N.VM.9, N.VM.10, N.VM.11, N.VM.12	
Linear Programing	Use geometric linear programing to solve problems.	A.REI.6, A.REI.12, A.CED.1, A.CED.3	1
	Use algebraic linear programing to solve problems.	A.REI.8, A.REI.9	
Applied Matrix Theory	Evaluate and analyze Markov Chains	A.REI.8	1
	Use Game Theory to solve problems.	S.MD.5, S.MD.6, S.MD.7	
Financial Math	Analyze and apply different types of interest and rate	A.SSE.1, A.CED.2, A.CED.4, F.BF.5, F.LE.3, F.IF.6	2
Probability	Calculate expected values and use them to solve problems	S.MD.1, S.MD.2, S.MD.3, S.MD.4	2
Statistics	Analyze and use data to solve problems	AP Stats Prep	2

Matrices

Instructional Focus: Representing linear equations

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Representing and finding inverses of matrices (A.REI.8, A.REI.9)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Represent a system of equations using matrices when variables are **on both sides of an equation, or have missing variables**. Find the inverse of a matrix and use it solve systems of linear equations with dimensions of • 2x2 **without** technology • 3x3 with technology	Represent a system of equations using matrices when all variables are **on one side of each equation**. Find the inverse of a matrix **and use it solve systems of linear equations with dimensions of** • 2x2 **with** technology • 3x3 with technology	**Identify** a system of equations in a matrix. Find the inverse of a matrix	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1

A.REI.9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations.

A.REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.

Matrices

Instructional Focus: Perform operations on matrices and use matrices in applications.

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Matrix operations and applications (N.VM.6, N.VM.7, N.VM.8, N.VM.11)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Extract a matrix or matrices from a situation (i.e. word problem) **and use the matrix or matrices to solve problems.** Given matrices, do **all** of the following with and without solving technology: • Multiply by scalars • Add matrices • Subtract matrices • Multiply matrices • Multiply by a vector	Extract a matrix or matrices from a situation (i.e. word problem) Given matrices, do **all** of the following with solving technology: • Multiply by scalars • Add matrices • Subtract matrices • Multiply matrices • Multiply by a vector	**Identify** the corresponding matrix from a situation. Given matrices, do **three** of the following with solving technology : • Multiply by scalars • Add matrices • Subtract matrices • Multiply matrices • Multiply by a vector	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1
Explaining properties of matrices (N.VM.9, N.VM.10)		Can explain **all** of the following: • Lack of Commutative property of Matrix Multiplication • Associative property of Matrix Multiplication • Distributive property of Matrix Multiplication • Zero Matrix • Identity Matrix	Can explain **four** of the following: • Lack of Commutative property of Matrix Multiplication • Associative property of Matrix Multiplication • Distributive property of Matrix Multiplication • Zero Matrix • Identity Matrix	Can explain **three** of the following: • Lack of Commutative property of Matrix Multiplication • Associative property of Matrix Multiplication • Distributive property of Matrix Multiplication • Zero Matrix • Identity Matrix	
Finding and using determinants and absolute values (N.VM.12)		Find the area by using the determinant and absolute value of a 2 x 2 matrix as a transformation on the plane.	Find determinant and absolute value of a 2 x 2 matrix as a transformation on the plane.	Find determinant and absolute value of a 2 x 2 matrix	

N.VM.6 Use matrices to represent and manipulate data.
N.VM.7 Multiply matrices by scalars to produce new matrices.
N.VM.8 Add, subtract, and multiply matrices of appropriate dimensions.
N.VM.11 Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
N.VM.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
N.VM.10 Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers.
N.VM.12 Work with 2 × 2 matrices as a transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Linear Programing

Instructional Focus: Geometric Linear Programing

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Solving systems of equations and inequalities (A.REI.6) **Graphing systems of equations and inequalities** (A.REI.6, A.REI.12) **Creating equations** (A.CED.1*) **Representing constraints and interpreting solutions** (A.CED.3*)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Graph the feasible region based on constraints Find each vertex of the feasible region by solving a system of equations State the feasible region as being bounded or unbounded Represent constraints with equations, inequalities and in a system of equations and/or inequalities in contextual situations Create the objective function with two or more variables from context and use it in a linear programming problem to find the optimal solution Interpret test points as viable or nonviable in context of the situation	Graph the feasible region based on constraints. Find each vertex of the feasible region by solving a system of equations State the feasible region as being bounded or unbounded Represent constraints with equations, inequalities and in a system of equations and/or inequalities in contextual situations Create the objective function with two or more variables from context Interpret test points in context of the situation	Identify the feasible region given a graph Identify each vertex of the feasible region given a graph State the feasible region as being bounded or unbounded Identify the objective function with two or more variables for a given context	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1

A.REI.6 **Solve** systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A.CED.1* **Create** equations and inequalities in one variable and **use** them to solve problems

A.CED.3* **Represent** constraints by equations or inequalities, and by systems of equations and/or inequalities~~,~~ and interpret solutions as viable or nonviable options in a modeling context.

Linear Programing

Instructional Focus: Algebraic Linear Programing

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Solving linear programming problems using matrices (A.REI.8, A.REI.9)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Represent a system of given constraints using a matrix • Identify an optimized problem • Identify the pivot • Find the solution (more than 1 pivot required) • Interpret the tableau in context of the situation Create a system of optimized constraints from a context	Represent a system of given constraints using a 2x2 or 3x3 matrix • Identify an optimized problem • Identify the pivot • Find the solution using the simplex method (1 pivot required) • Interpret the tableau in context of the situation	Represent a system of given constraints using a 2x2 matrix • Identify an optimized problem • Identify the pivot • Find solution using the simplex method (1 pivot required) • Interpret the parts of the tableau	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1

A.REI.8 Represent a system of linear equations as a single matrix equation in a vector variable

A.REI.9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Applied Matrix Theory

Instructional Focus: Markov Chains

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Creating and interpreting Markov chains (A.REI.8)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Create a transition matrix and distribution vector from context Find and interpret the steady state distribution, distribution after n transitions (regular or absorbing), and probability of being absorbed	Create a transition matrix and distribution vector from context Find the steady state distribution or the distribution after n transitions	Create a transition matrix from a diagram Classify given matrices by type	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1

A.REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.

Applied Matrix Theory

Instructional Focus: Game Theory

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Creating and analyzing matrices in Game Theory (S.MD.5, S.MD.6, S.MD.7)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	For zero sum games including **at least two** options **without a saddle point** • Create a payoff matrix • Find the mixed strategy (probability distributions) for each player • Find the expected value of the game	For zero sum games including two options with **more than one** saddle point • Create a payoff matrix • Find the **mixed strategy** (probability distributions) for each player • Find the expected value of the game	For zero sum games including two options with **a** saddle point • Create a payoff matrix • Find the strategy (probability distributions) for each player • Find the expected value of the game	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1

S.MD.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

S.MD.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

S.MD.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Financial Math

Instructional Focus: Analyze and apply different types of interest and rate

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Interpret Expressions (A.SSE.1)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Interpret individual parts of expressions (such as variables, coefficients, factors, etc.) and explain their meaning in terms of the context in **all of the following:** • Simple Interest • Compound Interest • Annuities Group parts of an expression and interpret their meaning in terms of the context in **all of the following:** • Simple Interest • Compound Interest • Annuities	Interpret individual parts of expressions (such as variables, coefficients, factors, etc.) **and explain their meaning in terms of the context in two of the following:** • Simple Interest • Compound Interest • Annuities Group parts of an expression and interpret their meaning **in terms of the context in two of the following:** • Simple Interest • Compound Interest • Annuities	Interpret individual parts of expressions (such as variables, coefficients, factors, etc.) in all of the following: • Simple Interest • Compound Interest • Annuities Group parts of an expression and interpret their meaning in all of the following: • Simple Interest • Compound Interest • Annuities	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1
Create and solve equations (A.CED.2 A.CED.4)		Create and solve equations to represent relationships in contextual situations, including **all** the following situations: • Simple Interest • Compound Interest • Annuities • Amortization	**Create and solve equations** to represent relationships in contextual situations, including **two** the following situations: • Simple Interest • Compound Interest • Annuities • Amortization	**Create and solve equations** to represent relationships in contextual situations, in **one** of the following situations: • Simple Interest • Compound Interest • Annuities • Amortization	
Exponential and Logarithmic inverses (F.BF.5)		Recognize that exponential and logarithmic functions are inverses of each other and use these functions to **solve real-world problems.**	Recognize that exponential and logarithmic functions are inverses of each other and use these functions **to solve logarithmic and exponential equations.**	Recognize that exponential and logarithmic functions are inverses of each other and **convert from one form into the other.**	
Compare Rate of Change (F.LE.3, F.IF.6)		Calculate and compare the rate of change and value of function presented in symbolic and table form in context of a situation **and use it to make a decision** • Stated rate • Effective rate	Calculate and compare the rate of change and value of function presented in symbolic **and** table form **in context of a situation** • Stated rate • Effective rate	Calculate the rate of change and value of a function presented in symbolic **or** table form • Stated rate • Effective rate	

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

A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V =IR to highlight resistance R.

A.SSE.1 Interpret expressions that represent a quantity in terms of its context.★
a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P*(1+*r*)n *as the product of P and a factor not depending on P.*

F.BF5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. *(Modeling Standard)

F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★

Probability

Instructional Focus: Calculate expected values and use them to solve problems

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Representing probability distributions (S.MD.1)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Define a random variable for a quantity of interest Assign a numerical value to each event in a sample space Graph the corresponding probability distribution using the same graphical displays as for data distributions.	Assign a numerical value to each event in a sample space Graph the corresponding probability distribution using the same graphical displays as for data distributions.	Graph a given probability distribution	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1
Calculating and interpreting expected values (S.MD.2)		Calculate and interpret the expected value of a random variable and use the information to make a decision	Calculate the expected value of a random variable and use the information to make a decision	Calculate the expected value of a random variable	
Developing probability distributions and finding expected values (S.MD.3, S.MD.4)		Develop a probability distribution for a random variable for a sample space of • theoretical probabilities • experimental probabilities and find the expected value	Develop a probability distribution for a random variable for a sample space of • theoretical probabilities • experimental probabilities	Calculate probabilities for a sample space of • theoretical probabilities • experimental probabilities	

S.MD.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

S.MD.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

S.MD.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value

S.MD.4 Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

Statistics

Instructional Focus: Analyze and use data to solve problems

CCSS	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Calculating and interpreting standard deviations **Determining the probability of normal distributions**	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	For random variables and binomial random variables, calculate and interpret the standard deviation Determine binomial probability by using normal approximation	For random variables and binomial random variables, calculate the standard deviation Determine the probability of nonstandard normal distributions by calculating a z-score	For random variables or binomial random variables, calculate the standard deviation Determine the probability of standard normal distributions, given a z-score	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1