MMA Scope and Sequence 2014-15
Unit Outline

Process standards should be addressed in <u>all</u> units but M.1A, M.1B, M.1C (*new TEKS M.1A –G*) will be emphasized in the introduction unit.

Page #	Unit	Topic	Abbreviated Name	TEKS	Time (days)
3	1	Introduction to Problem Solving and Mathematical Modeling	PROBSOLV	M.1A, M.1B, M.1C, M.2D *(M.1A-G, M.9F)*	29 (includes team building)
5	2	Mathematical Modeling in the Social Sciences	SOCSCI	M.2A, M.2B, M.2C, M.2D, M.3A, M.3B, M.3C, M.4A, M.4B *(M.8A, M.9A, M.9B, M.9C, M.9D, M.9E, M.9F, M.10A, M.10B, M.8B, M.8C)*	39 (+ 10 for sem testing)
					78 days
		Approximate End of First Semester			
9	3	Mathematical Modeling in Science and Engineering	SCIENG	M.2D, M.8A, M.8B, M.8C, *(M.5A, M.5B, M.5C, M.6A, M.6B, M.6C M.6D)*	25
11	4	Mathematical Modeling in Fine Arts	FINARTS	**M.2D,** M.8B, M.9A, M.9B *(M.7A, M.7B, M.7C,* **M.7D***)*	24
13	5	Mathematical Modeling in Personal Finance	PERFIN	M.5A, M.5B, M.5C, M.6A, M.6B, M.6C, M.7A, M.7B, M.7C *(M.2A, M.2B, M.2C, M.3B, M.3A, M.3C, M.3D, M.4A, M.4B, M.4C)*	40 (+ 10 for sem testing)
					99 days

Unit 1: Introduction to Problem Solving and Mathematical Modeling (29 Days)

Enduring Understandings
Enduring Understandings
The student understands that situations in everyday life, society and the workplace can be modeled mathematically.
The student understands that precise mathematical language in written and oral communication can be used to explain or justify mathematical ideas and arguments.
The student understands the purpose of group collaboration.
The student understands and can use the math modeling cycle.
Vocabulary: linear, quadratic, sine, exponential, represent, compute, analyze, interpret, report, ***math modeling cycle,*** regression, reasoning, domain, range, independent, dependent, discrete, continuous
NEW TEKS: M.1The student uses mathematical process to acquire and demonstrate mathematical understanding. *(A) apply mathematics to problems arising in everyday life, society and the workplace;* *(B) use a problem-solving model the incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem solving process and the reasonableness of the solution.* *(C) select tools, including real objects, manipulatives, paper and pencil and technology as appropriate to solve problems;* *(D) communicate mathematical ides, reasoning and their implications using multiple representations, including symbols , diagrams , graphs and language as appropriate;* *(E) create and use representations to organize, record and communicate mathematical ideas;* *(F) analyze mathematical relationships to connect and communicate mathematical ideas; and* *(G) display, explain and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.*
Signature Activities:

The student will know…	The student will be able to…
	Work in groups and understand the • roles • responsibilities • norms • time management associated with working in groups. Work Collaboratively- • Team building • Learning Style (Learning Style Inventory) • Personality "color" (6 Thinking Hats) Introduction to the use the *Math Modeling Cycle* * in problem solving, including skills of: • estimation, fractions, decimal, percents • mental math • manipulatives • number sense • pictures & graphs • technology • oral & written justifications and presentations ****This model will be used throughout the year.***

Unit 1: Introduction to Problem Solving and Mathematical Modeling (continued)

M.1 The student uses a variety of strategies and approaches to solve both routine and non-routine problems. The student is expected to:
A) Compare and analyze various methods for solving a real-life problem
B) Use multiple approaches (algebraic, graphical and geometric methods) to solve problems from a variety of disciplines
C) Select a method to solve a problem, defend the method and justify the reasonableness of the results

The student will know…	The student will be able to…

•	Represent data in a variety of ways
	    • table
	    • graph
	    • verbal
	
	Use data
	    • to make predictions
	    • Draw conclusions
	    • justify solutions
	    • communicate validity
	    • defend answers
	
	Determine domain and range of given data, or real world situation

M.2D The student uses graphical and numerical techniques to study patterns and analyze data. The student is expected to:
D) use regression methods available through technology to describe various models for data such as linear, quadratic, [exponential, etc.,] select the most appropriate model, and use the model to interpret information.

The student will know…	The student will be able to…

•	Determine appropriate representation of data including, but not limited to:
	    • regression models- linear and quadratic [exponential will be addressed in SCIENG, sine will be addressed in FINARTS]
	    • graphs
	    • best fit model
	
	Use calculator to graph and find regression equations of real world data sets

Unit 2: Mathematical Modeling in the Social Sciences (39 Days + 10 for end of semester testing)

Enduring Understandings
The student understands the need for, how to collect, analyze, model and draw conclusions from real world data.
The student understands how to formulate, design and execute a statistical study.
The student understands how to use probability models to describe everyday situations involving chance.
The student understands how to design a study, execute the study, communicate the results, formulate a conclusion and refine the study. (Math Modeling Cycle)
Vocabulary: Fundamental Counting Principal, combination, permutation, theoretical, empirical, binomial model, geometric model, line graph, bar graph, circle graphs, histograms, scatter plots, dot plots, stem & leaf, box & whiskers, mean, median, mode, range, IQR, standard deviation, survey, population, observational study, experiment, linear, exponential
Signature Activities:

M.2 The student uses graphical and numerical techniques to study patterns and analyze data. The student is expected to:
A) interpret information from various graphs, including line graphs, bar graphs, circle graphs, histograms, scatterplots, line plots, stem and leaf plots, and box and whisker plots to draw conclusions from the data;
B) analyze numerical data using measures of central tendency, variability, and correlation in order to make inferences;
C) analyze graphs from journals, newspapers, and other sources to determine the validity of stated arguments; and
D) use regression methods available through technology to describe various models for data such as linear, quadratic, [exponential, etc.,] select the most appropriate model, and use the model to interpret information.

The student will know…	**The student will be able to…**

•	Collect Data
	  • Surveys (Poll Everywhere, student polls, etc.)
	  • Pre-collected data from websites
	  • Experiments (CBRs, CBLs, etc.)
	
	Analyze Data in a variety of ways:
	  • Use professional sources to determine the validity of data collected
	  • Use a variety of graphs to draw conclusions; determine strengths and weakness (no building or creating- using)
	  • Use mean, median, mode to determine the validity of data collected, draw conclusions, make predictions
	  • Find and apply regressions

Unit 2: Mathematical Modeling in the Social Sciences (continued)

M.3 The student develops and implements a plan for collecting and analyzing data (qualitative and quantitative) in order to make decisions. The student is expected to: A) formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions; B) communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project by written report, visual display, oral report, or multi-media presentation; and C) determine the appropriateness of a model for making predictions from a given set of data.	
The student will know…	**The student will be able to…**
•	*Use the Math Modeling Cycle to:* • *formulate meaningful questions* • *gather data* • *draw conclusions* • *communicate about the data* • *display data* • *make predictions with data* • *represent the data in a variety of ways, with and without technology*

M.4 The student uses probability models to describe everyday situations involving chance. The student is expected to: A) compare theoretical and empirical probability; and B) use experiments to determine the reasonableness of a theoretical model such as binomial, geometric, etc.	
The student will know…	**The student will be able to…**
•	Use games of chance to compare theoretical and empirical probability (number cubes, cards, spinners) Use the binomial model in experiments such as flipping a coin 20 times. Use geometric probability in experiments to determine possible outcomes and their likely hood. Use meaningful examples to explore combinations, permutations and Fundamental Counting Principal

2nd Semester

Unit 3: Mathematical Modeling in Science and Engineering (25 Days)

Enduring Understandings
The student understands that Geometric and Algebraic principals exist in science, engineering and architecture.
Vocabulary: proportionality, prospective drawing, exponential function, trig ratio, Pythagorean Theorem, transformations [special right triangles, quadratic functions], best fit model, sine, cosine, tangent, growth, decay, Hooke's Law, Boyle's Law, direct variation, inverse variation
Signature Activities: UT Dana Center Population Growth

M.2 The student uses graphical and numerical techniques to study patterns and analyze data. The student is expected to:
D) use regression methods available through technology to describe various models for data such as linear, quadratic, exponential, [etc.,] select the most appropriate model, and use the model to interpret information.
M.8 The student uses algebraic and geometric models to describe situations and solve problems. The student is expected to:
A) use geometric models available through technology to model growth and decay in areas such as population, biology, and ecology;
B) use trigonometric ratios and functions available through technology to calculate distances and model periodic motion; and
C) use direct and inverse variation to describe physical laws such as Hook's, Newton's, and Boyle's laws.

The student will know…	The student will be able to…
• That proportionality exists when one variable increases the other increases, or decreases when the other decreases • The inverse variation exists when one variable increases and the other decreases	**Engineering:** Determine appropriate representation of data including, but not limited to: - regression models- linear and quadratic and exponential [sine will be addressed in FINARTS] - graphs - best fit model Use proportionality to determine the relationship between data items in engineering applications Use Pythagorean Theorem and Trig Ratios in real world applications - to calculate distances - to find angle measures (optional) **Science:** Investigate direct and inverse variation using scientific laws such as Hook's, Newton's Second Law of Motion or Boyle's Law Mathematically model growth and decay in areas such as: • Biology [and radioactive decay(1/2 life)] (Dana Center) • population • ecology [Model parabolic motion using quadratic formula] Use Pythagorean Theorem and Trig Ratios in real world applications - to calculate distances - to find angle measures (optional)

Unit 4: Mathematical Modeling in Fine Arts (24 Days)

Enduring Understandings
The student understands that algebraic and geometric relationships exist in the arts..
The student understands that the Golden Ratio is applied in art and photography to create order and beauty.

Vocabulary
Golden Ratio, transformations, symmetry, perspective drawing, trig functions, periodic function, scale factor, amplitude, frequency, 2D, 3D, volume, surface area proportions, translations, rotations, dilations, reflections, Golden Ratio, tessellations, similarity

Signature Activities: LOGO Project

M.2 The student uses graphical and numerical techniques to study patterns and analyze data. The student is expected to:
D) use regression methods available through technology to describe various models for data such as linear, quadratic, exponential, etc., select the most appropriate model, and use the model to interpret information.
M.8 The student uses algebraic and geometric models to describe situations and solve problems. The student is expected to:
B) use trigonometric ratios and functions available through technology to calculate distances and model periodic motion.
M.9 The student uses algebraic and geometric models to represent patterns and structures. The student is expected to:
A) use geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in art and architecture; and
B) use geometric transformations, proportions, and periodic motion to describe mathematical patterns and structure in music.
NEW TEKS
M.7 The student uses mathematical processes with algebra and geometry to study patterns and analyze data as it applies to fine arts. The student is expected to:
(D) use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and non-proportional changes in surface area and volume as applied to fields.

The student will know…	The student will be able to…
•	Determine appropriate representation of data including, but not limited to:
	• regression models- linear and quadratic, exponential and sine
	• graphs
	• best fit model
	Describe transformations, symmetry in perspective drawings in field of arts and architecture
	• Translations
	• Rotations
	• Dilations
	• Reflections
	• Golden ratio (Apply the Golden Ratio in a meaningful way and know how it is use in the areas of the arts and architecture. Ex. Art of Mark Rothko)
	• Tessellations
	• Similarity
	Investigate patterns of periodic (trig) functions including:
	• Using amplitude (volume) and frequency (pitch) of music
	• Other examples:
	-daylight patterns
	-wave patterns
	Apply the use of scale factor in 2D & 3D objects:
	• proportional and non proportional changes
	• when finding volume and area (such as Google Sketchup)
	• as it applies to models and the actual object

Unit 5: Mathematical Modeling in Personal Finance (40 Days + 10 for end of semester testing)

Enduring Understandings
The student understands that mathematical process exist related to personal financial planning. The student understands that mathematical process including amortization modeling are used to solve problems involving credit.

Vocabulary: credit, budget, processing fees, interest, stocks, bonds, mutual funds, certificate of deposit, insurance, overdraft, deduction, compensation, tax, amortization, loan, mortgage, loan, origination fee, lease, deposit, rates, weekly, bi-weekly, monthly, bi-monthly, semi-monthly, annually, semi-annually, gross income, net income, commission, risk, return

Signature Activities:

M.5 The student uses functional relationships to solve problems related to personal income. The student is expected to:
A) use rates, linear functions, and direct variation to solve problems involving personal finance and budgeting, including compensations and deductions;
B) solve problems involving personal taxes; and
C) analyze data to make decisions about banking.

The student will know…	The student will be able to…
•	**Earning Money (through employment)** To analyze and apply wage earning models to real world situations. Calculate gross income • Commission • Annual salary (various pay periods) • Hourly wages • Overtime • Contract work Compute net income (deductions, taxes, etc.) • FICA (Social Security) • Medicare • EIC (Earned Income Credits) • FIT (Withholdings) Use information on a W-2 to complete a tax forms

Unit 5: Mathematical Modeling in Personal Finance (continued)

M.6 The student uses algebraic formulas, graphs, and amortization models to solve problems involving credit. The student is expected to: A) analyze methods of payment available in retail purchasing and compare relative advantages and disadvantages of each option; B) use amortization models to investigate home financing and compare buying and renting a home; and C) use amortization models to investigate automobile financing and compare buying and leasing a vehicle.	
The student will know…	**The student will be able to…**
•	**Spending Money (budgeting)** Apply mathematical principals to draw conclusions and make sound choices in the areas of: • acquiring possessions • establishing credit • obtaining mortgages • obtaining personal loans • buying insurance • determine payments • leasing vs buying • determine credit score • interpreting amortization schedules Compute compound and simple interest Create budgets Compare and contrast aspects including fees and minimum balances different banking accounts to determine best choice

M.7 The student uses algebraic formulas, numerical techniques, and graphs to solve problems related to financial planning. The student is expected to: A) analyze types of savings options involving simple and compound interest and compare relative advantages of these options; B) analyze and compare coverage options and rates in insurance; and C) investigate and compare investment options including stocks, bonds, annuities, and retirement plans.	
The student will know…	**The student will be able to…**
•	**Saving and Making Money (investments)** Determine the similarities and difference between: • stocks • bonds • annuities • various retirement plans • investment options Compute compound and simple interest Compute return on investments Evaluate risk of investments