# Math Models: Year at a Glance

## First Semester

| **Unit** | **Modeling Geometry ≈29 days** | **Modeling Linear functions ≈40 days** |
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| **TEKS** | 6A, 6B, **6C**, 6D, 7A, 7B, 7C, 7D | 5A, **9F** |
| **Stage One Snapshot** | * Identify types of symmetry as it applies in pictures, art, and architecture * Create transformations of rigid shapes * Review solving equations * Apply scale factors to similar figures * Find missing sides and angles of right triangles | * Create analyze graphical depiction of a situation * Identify characteristics of linear functions * Review solving equations * Write and identify direct variation with Hooke’s Law * Compare and contrast different forms of a linear equations * Solve a linear system of equations * Compare and contrast parallel and perpendicular lines * Examine multiple representations of linear functions * Perform linear regression |

## Second Semester

| **Unit** | **Modeling Non-Linear Functions**  **≈3 days (First Semester)**  **≈37 days (Second Semester)** | **Modeling Probability and Statistics**  **≈23 days** | **Modeling Personal Finance ≈22 days** |
| --- | --- | --- | --- |
| **TEKS** | 5A, **5B**, **5C** | 8A, **8B**, 8C, **9A**, **9B**, 9C, 9D, 9E, **10A**,  **10B** | **2A**, 2B, **2C**, 3A, **3B**, 3C, 3D, 4A, 4B,  **4C** |
| **Stage One Snapshot** | *Begins in 1st Sem.*   * Identify period, frequency, and amplitude of periodic motion graphs and apply to music * Write and identify inverse variation with Boyle’s Law     *Continues in 2nd Sem.*   * Factor quadratic functions * Graph quadratics from different forms of the equation * Identify characteristics of quadratic functions * Solve quadratic equations * Write and analyze models of exponential growth and decay * Perform exponential regression | * Read trends and make comparisons from graphs * Calculate and compare theoretical and empirical probability * Calculate joint probability * Create, analyze, and interpret graphs (bar, circle, line, box plots, stem and leaf, histogram, dot plot, scatter plot) * Calculate central tendencies of data | * Calculate and compare simple and compound interest * Analyze stock market table * Utilize TVM solver to calculate various information related to investments and loans * Create and analyze personal budget * Calculate income (gross vs. net pay) and taxes * Compare and contrast benefits of buying vs. renting homes/apartments * Compare and contrast benefits of buying vs. leasing a vehicle |

# Texas Essential Knowledge and Skills

MM.(1) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

1. apply mathematics to problems arising in everyday life, society, and the workplace;
2. use a problem-solving model that 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;
3. select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;  **(D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
4. create and use representations to organize, record, and communicate mathematical ideas;
5. analyze mathematical relationships to connect and communicate mathematical ideas; and
6. display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

MM.(2) **Mathematical modeling in personal finance**. The student uses mathematical processes with graphical and numerical techniques to study patterns and analyze data related to personal finance. The student is expected to:  **(A)** use rates and linear functions to solve problems involving personal finance and budgeting, including compensations and deductions;

1. solve problems involving personal taxes; and
2. analyze data to make decisions about banking, including options for online banking, checking accounts, overdraft protection, processing fees, and debit card/ATM fees.

MM.(3) **Mathematical modeling in personal finance**. The student uses mathematical processes with algebraic formulas, graphs, and amortization modeling to solve problems involving credit. The student is expected to:

1. use formulas to generate tables to display series of payments for loan amortizations resulting from financed purchases;
2. analyze personal credit options in retail purchasing and compare relative advantages and disadvantages of each option;
3. use technology to create amortization models to investigate home financing and compare buying a home to renting a home; and
4. use technology to create amortization models to investigate automobile financing and compare buying a vehicle to leasing a vehicle.

MM.(4) **Mathematical modeling in personal finance**. The student uses mathematical processes with algebraic formulas, numerical techniques, and graphs to solve problems related to financial planning. The student is expected to:

1. analyze and compare coverage options and rates in insurance;
2. investigate and compare investment options, including stocks, bonds, annuities, certificates of deposit, and retirement plans; and
3. analyze types of savings options involving simple and compound interest and compare relative advantages of these options.

MM.(5) **Mathematical modeling in science and engineering**. The student applies mathematical processes with algebraic techniques to study patterns and analyze data as it applies to science. The student is expected to:

1. use proportionality and inverse variation to describe physical laws such as Hook's Law, Newton's Second Law of Motion, and Boyle's Law;
2. use exponential models available through technology to model growth and decay in areas, including radioactive decay; and
3. use quadratic functions to model motion.

MM.(6) **Mathematical modeling in science and engineering**. The student applies mathematical processes with algebra and geometry to study patterns and analyze data as it applies to architecture and engineering. The student is expected to:

1. use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in architecture;
2. use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and nonproportional changes in surface area and volume as applied to fields;
3. use the Pythagorean Theorem and special right-triangle relationships to calculate distances; and(D) use trigonometric ratios to calculate distances and angle measures as applied to fields.

MM.(7) **Mathematical modeling in fine arts**. 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:

1. use trigonometric ratios and functions available through technology to model periodic behavior in art and music;
2. use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in art and photography;
3. use geometric transformations, proportions, and periodic motion to describe mathematical patterns and structure in music; and
4. 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.

MM.(8) **Mathematical modeling in social sciences**. The student applies mathematical processes to determine the number of elements in a finite sample space and compute the probability of an event. The student is expected to:

1. determine the number of ways an event may occur using combinations, permutations, and the Fundamental

Counting Principle;

1. compare theoretical to empirical probability; and
2. use experiments to determine the reasonableness of a theoretical model such as binomial or geometric. MM.(9) **Mathematical modeling in social sciences**. The student applies mathematical processes and mathematical models to analyze data as it applies to social sciences. The student is expected to:
3. interpret information from various graphs, including line graphs, bar graphs, circle graphs, histograms, scatterplots, dot plots, stem-and-leaf plots, and box and whisker plots, to draw conclusions from the data and determine the strengths and weaknesses of conclusions;
4. analyze numerical data using measures of central tendency (mean, median, and mode) and variability (range, interquartile range or IQR, and standard deviation) in order to make inferences with normal distributions;
5. distinguish the purposes and differences among types of research, including surveys, experiments, and observational studies;
6. use data from a sample to estimate population mean or population proportion;
7. analyze marketing claims based on graphs and statistics from electronic and print media and justify the validity of stated or implied conclusions; and
8. use regression methods available through technology to model linear and exponential functions, interpret correlations, and make predictions.

MM.(10) **Mathematical modeling in social sciences**. The student applies mathematical processes to design a study and use graphical, numerical, and analytical techniques to communicate the results of the study. The student is expected to:

1. formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions; and
2. communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project through the use of one or more of the following: a written report, a visual display, an oral report, or a multimedia presentation.