Technical Transition Mathematics for Seniors

Mathematics – Technical Transition Mathematics for Seniors

All West Virginia teachers are responsible for classroom instruction that integrates content standards and mathematical habits of mind. Students Technical Transition Mathematics for Seniors will solidify their quantitative literacy by enhancing numeracy and problem solving skills as they investigate and use fundamental concepts of algebra, geometry, introductory trigonometry, and statistical analysis. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Students will continue developing mathematical proficiency in a developmentally-appropriate progressions of standards. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed:

Number and Quantity:	**Algebra: Seeing Structure in Expressions**
• Develop an understanding of basic operations, equivalent representations, and properties of the real number system.	• Create equations or inequalities that model physical situations.
Functions: Interpreting Functions	**Geometry/Trigonometry**
• Develop knowledge and understanding of the concept of functions as they use, analyze, represent, and interpret functions and their applications.	• Solve application problems by calculating area or surface area in two-dimensional object or volume in three-dimensional objects. • Understand and apply the Pythagorean Theorem for solving real-world problems. (e.g. checking accuracy on gate construction, conduit bending).
Modeling	**Statistics - Interpreting Categorical & Quantitative Data**
• Create and use two- and three-dimensional representations of authentic situations in problem solving. • Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	• Analyze and interpret tables, charts and graphs. (e.g. interpret a body mass index (BMI) chart). • Distinguish between correlation and causation.
Finance Mathematics	
• Determine, represent and analyze mathematical models for personal finance.	

Numbering of Standards

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Technical Transition Mathematics for Seniors:

Number and Quantity	
Math as a language	Standard 1-3
Math and Measurement	Standards 4-6
The Real Number System	Standards 7-8
Algebra: Seeing Structure in Expressions	
Understand the connections between proportional relationship, lines, and linear equations.	Standards 9-10
Create equations that describe numbers or relationships.	Standards 11-14
Solve systems of equations.	Standards 15-16

Functions: Interpreting Functions	
Understand the concept of a function and use function notation.	Standard 17
Analyze functions using different representations.	Standards 18-20
Build a function that models a relationship between two quantities.	Standards 21-22
Geometry/Trigonometry	
Visualize relationships between two dimensional and three-dimensional objects and apply geometric concepts in modeling situations.	Standards 23-26
Use geometric theorems and formulas to solve problems.	Standards 27-31
Define trigonometric ratios and solve problems involving right triangles.	Standards 32-33
Modeling	
Concrete geometric representation (physical modeling)	Standards 34-35
Summarize, represent, and interpret data on two quantitative variables.	Standards 36-39
Statistics - Interpreting Categorical & Quantitative Data	
Conduct statistical analysis	Standards 40-43
Summarize, represent, and interpret data on a single count or measurement variable.	Standards 44-48
Finance Mathematics	
Understand financial models	Standards 49-50
Personal use of finance	Standards 51-52

Number and Quantity

Cluster	**Math as a language**
M.TTMS.1	Demonstrate reasoning skills in developing, explaining and justifying sound mathematical arguments and analyze the soundness of mathematical arguments of others.
M.TTMS.2	Communicate with and about mathematics orally and in writing as part of independent and collaborative work, including making accurate and clear presentations of solutions to problems.
M.TTMS.3	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
Cluster	**Math and Measurement**
M.TTMS.4	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

M.TTMS.5	Solve real-life problems requiring conversion of units using dimensional analysis for measurements in English and metric systems. Solve problems involving multiple units of measurement. (e.g. converting between currencies, calculating dosages of medicine, trip planning from miles to kilometers.)
M.TTMS.6	Distinguish between proportional and non-proportional situations, apply proportional reasoning when appropriate, solve for an unknown quantity in proportional situations; apply scale factors to perform indirect measurements. (e.g., maps, blueprints, concentrations, dosages, and densities).

Cluster	**The Real Number System**
M.TTMS.7	Perform operations using positive and negative numbers, fractions, absolute value, decimals, percentages, and scientific notation. (e.g. given the cost of a project, determine what percentage of the budget went for salaries, percent of increase/ decrease)
M.TTMS.8	Solve real-world problems in a variety of contexts by representing quantities in equivalent forms (fractions, decimals, and percentages) to investigate and describe quantitative relationships. Compare the size of numbers in different forms arising in authentic real-world contexts, such as growth expressed as a fraction versus as a percentage. Interpret the meaning of numbers in different forms, such as scientific notation and the meaning of a fraction or percentage greater than 100 and its validity in a given context. Recognize incorrect or deceptive uses of fractions, decimals, or percentages.

Algebra – Seeing Structure in Expressions

Cluster	**Understand the connections between proportional relationship, lines, and linear equations.**
M.TTMS.9	Graph proportional relationships, interpreting the unit rates as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed. (e.g. Labor cost per time, material cost per job).
M.TTMS.10	Solve application problems using direct and inverse variation equations. (e.g. determine the mechanical advantage of gears, Ohm's Law)

Cluster	**Create equations that describe numbers or relationships.**
M.TTMS.11	Analyze real-world problem situations and use variables to construct and solve equations involving one or more unknown or variable quantities to answer questions about the situations, such as creating spreadsheet formulas to calculate prices based on percentage mark-up or solving formulas for specified values. Demonstrate understanding of the meaning of a solution. Identify when there is insufficient information given to solve a problem.

M.TTMS.12	Analyze real-world problem situations and use variables to construct and solve equations and inequalities in one variable. Include equations arising from linear functions and simple rational and exponential functions. (e.g. using spreadsheet functions, determine sale price of items)
M.TTMS.13	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (e.g. profit vs. number of units, cost vs. number of units, resistance vs. current)
M.TTMS.14	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (e.g., Rearrange Ohm's law V = IR to highlight resistance R)
Cluster	**Solve systems of equations.**
M.TTMS.15	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (e.g. child care facility – sq. footage to number of children; solving electrical current in a circuit with multiple paths, Break-Even point)
M.TTMS.16	Explain why the x-coordinates of the points where the graphs of the equation y = f(x) and y = g(x) intersect are the solution of the equation f(x) = g (x); find the solution approximately (e.g., using technology to graph the functions, make tables of values or find successive approximations).

Functions – Interpreting Functions

Cluster	**Understand the concept of a function and use function notation.**
M.TTMS.17	Understand a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
Cluster	**Analyze functions using different representations.**
M.TTMS.18	Interpret the parameters in a linear function in terms of a context.
M.TTMS.19	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line, give examples of functions that are not linear.
M.TTMS.20	Describe qualitatively the functional relationship between two quantities by analyzing a graph.
Cluster	**Build a function that models a relationship between two quantities.**
M.TTMS.21	Represent application problems as linear equations. Write a function that describes a relationship between two quantities. (e.g. level of education versus pay; rate of speed versus fuel consumption; caloric intake versus expenditure)
M.TTMS.22	Recognize that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Instructional Note: Focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.

Cluster	**Visualize relationships between two dimensional and three-dimensional objects and apply geometric concepts in modeling situations.**
M.TTMS.23	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
M.TTMS.24	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
M.TTMS.25	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot, airflow per cubic foot).
M.TTMS.26	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with topographic grid systems based on ratios).
Cluster	**Use geometric theorems and formulas to solve problems.**
M.TTMS.27	Use theorems about triangles to solve real-world application problems. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.
M.TTMS.28	Understand and apply the Pythagorean Theorem for solving real-world problems. (e.g. checking accuracy on gate construction, conduit bending)
M.TTMS.29	Solve application problems by calculating area and surface area for two dimensional objects. (e.g. calculate the cost of heating a building based on square footage).
M.TTMS.30	Solve application problems by calculating volume for three dimensional objects using formulas for cylinders, pyramids, prisms, cones, and spheres. (e.g. compute amount of cement needed for a sidewalk, amount of water in a fire hose, amount of air in ductwork)
M.TTMS.31	Solve application problems by calculating circumference, area, radius, diameter, area of sector, arc length of a circle with appropriate unit labels. (e.g. develop a circular watering system)
Cluster	**Define trigonometric ratios and solve problems involving right triangles.**
M.TTMS.32	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. (e.g. angles of depression/elevation, conduit bending)
M.TTMS.33	Identify and apply special right triangle relationships, 30-60-90 and 45-45-90. (e.g. isometric drawing in drafting, conduit bending)

Modeling

Cluster	**Concrete geometric representation (physical modeling)**
M.TTMS.34	Create and use two- and three-dimensional representations of authentic situations using paper techniques or dynamic geometric environments for computer-aided design and other applications.
M.TTMS.35	Gather data, conduct investigations and apply mathematical concepts and models to solve problems in mathematics and other disciplines.

Cluster	**Summarize, represent, and interpret data on two quantitative variables.**
M.TTMS.36	Collect numerical bivariate data; represent data on two quantitative variables on a scatter plot; determine whether or not a relationship exists; if so, describe how the variables are related and select a function to model the data, justify the selection and use the model to make predictions.
M.TTMS.37	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
M.TTMS.38	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship.
M.TTMS.39	Compute (using technology) and interpret the correlation coefficient of a linear fit. Identify positive and negative correlations. (e.g. vehicle depreciation)

Statistics - Interpreting Categorical & Quantitative Data

Cluster	**Conduct statistical analysis.**
M.TTMS.40	Identify the population of interest, select an appropriate sampling technique and collect data.
M.TTMS.41	Identify the variables to be used in a study.
M.TTMS.42	Determine possible sources of statistical bias in a study and how such bias may affect the ability to generalize the results.
M.TTMS.43	Determine possible sources of variability of data, both those that can be controlled and those that cannot be controlled.

Cluster	**Summarize, represent, and interpret data on a single count or measurement variable.**
M.TTMS.44	Represent data with plots on the real number line (dot plots, histograms, and box plots).
M.TTMS.45	Analyze and interpret tables, charts and graphs. (e.g. interpret a body mass index (BMI) chart)

M.TTMS.46	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
M.TTMS.47	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
M.TTMS.48	Distinguish between correlation and causation.

Finance Mathematics

Cluster	**Understanding financial models**
M.TTMS.49	Determine, represent and analyze mathematical models for loan amortization and the effects of different payments and/or finance terms (e.g., Business Loans, Auto, Mortgage, and/or Credit Card).
M.TTMS.50	Determine, represent and analyze mathematical models for investments involving simple and compound interest with and without additional deposits. (e.g., Savings accounts, bonds, and/or certificates of deposit.)

Cluster	**Personal use of finance**
M.TTMS.51	Research, develop and analyze personal budgets based on given parameters (e.g., Fixed and discretionary expenses, insurance, gross vs. net pay, types of income, wage, salary, commission, career choice, geographic region, retirement and/or investment planning, etc.).
M.TTMS.52	Research and analyze taxes including payroll, sales, personal property, real estate and income tax returns.