HIGH SCHOOL
TECHNICAL MATHEMATICS

Mathematical Practices

The Standards for Mathematical Practice are essential in the extension of mathematical thinking. Students develop these habits of mind through specific, intentional experiences of writing, reading, talking, and reasoning that connect mathematics to their daily lives and career situations. Even though all of the Standards are important for all quality math courses, the following are highlighted in a technical mathematics course:

- Construct viable arguments and critique the reasoning of others (MP.3)
- Modeling with mathematics (MP.4)
- Attend to precision (MP.6)
- Look for and make use of structure (MP.7)
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In number and quantity, students should recognize that much of mathematics is concerned with understanding quantities and their relationships. They should pick appropriate units for quantities being modeled, using them as a guide to understand a situation, and be attentive to the level of accuracy that is reported in a solution.

Fluency 1: Number, Quantity and Measurement		
Standards	**Strands**	**Goals and Performance Objectives**
HSN-Q.A.1	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture Probability & Distributions Art & Mathematics	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.
HSN-Q.A.2	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture Probability & Distributions Art & Mathematics	Define appropriate quantities for the purpose of descriptive modeling.

HSN-Q.A.3	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture Probability & Distributions Art & Mathematics	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

In Algebra and Functions, students should use the understanding of the structure of an algebraic expression, equation, or inequality and the properties to solve problems in a range of situations related to their career pathways. Students should understand the mathematics involved and develop fluency in solving career-based problems.

Standard 2: Algebra		
Standards	**Strand**	**Goals and Performance Objectives**
HSA.CED.3	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture	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.
HSA.SSE.3	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture Probability & Distributions	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression
HSA.CED.2	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales
HSA.REI.11	Personal Finance & Banking Optimization Issues Medicine & Physical Science	Explain why the x-coordinates of the points where the graphs of the equations $y=f(x)$ and $y = g(x)$ intersect are the solutions of the equations $f(x) = g(x)$; find the solutions approximately, using technology to graph the functions, make

	Business & Agriculture	tables of values, or find successive approximations.

Standard 3: Functions		
Standards	**Strand**	**Goals and Performance Objectives**
HSF-F.4	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts, intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
HSF-IF.5	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
HSF-IF.6	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture	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.
HSF-IF.7	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
HSF-BF.1	Personal Finance & Banking Optimization Issues Medicine & Physical Science Business & Agriculture	Write a function that describes a relationship between two quantities.
HSF-BF.3	Personal Finance & Banking Optimization Issues Medicine & Physical Science	Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $k\,f(x)$, $f(kx)$, and $f(x-k)$ for specific values of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and

	Business & Agriculture	odd functions from their graphs and algebraic expressions for them.

Geometric visualization is a critical tool in analyzing and solving problems. Students should experience the power found in using geometric understanding as a problem-solving tool. Students should create geometric models and use physical and computational construction tools to solve career-related problems.

Standard 4: Geometry		
Standards	**Strand**	**Goals and Performance Objectives**
HSG.SRT.8	Business & Agriculture Arts & Mathematics	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
HSG.CO.2	Business & Agriculture Arts & Mathematics	Represent transformations in the plane using transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformation that preserve distance and angle to those that do not (e.g. translation versus horizontal stretch)
H1SG.GMD.1	Business & Agriculture Arts & Mathematics	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.
HSG.C.5	Business & Agriculture Arts & Mathematics	Derive using similarity the fact that the length of an arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of the sector.
HSG.MG.1	Business & Agriculture Arts & Mathematics	Use geometric shapes, their measures, and their proportions to describe objects (e.g. modeling a tree trunk or a human torso as a cylinder)

Students should be able to create a visual representation of a data set that is useful in understanding or solving a problem.

Standard 5: Statistics and Probability		
Standards	**Strand**	**Goals and Performance Objectives**
HSS.ID.7	Personal Finance & Banking Optimization Issues	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data
HSS.ID.8	Medicine & Physical Science Optimization Issues	Compute (using technology) and interpret the correlation coefficient of a linear fit
HSS.MD.6	Probability & Distributions	Use probabilities to make fair decisions (e.g. drawing by lots, using a random number generator)

Mathematical Modeling

Seeing mathematics as a tool to model real-world situations should be an underlying perspective in everything students do, including writing algebraic expressions, creating functions, creating geometric models and understanding statistical relationships. This will help students appreciate the importance of mathematics in their career fields and in daily life.

Strands and Possible Projects for 2021-2022 School Year

Personal Finance & Banking
Checkbook
Checking/Savings/Money Markets/CDs
Personal Loans
Subsidized/Unsubsidized Student Loans
Car Loans & multi-criteria decision making
Mortgages

Business & Agriculture
Owning a Franchise
Starting a Business
Running a Farm/Ranch
Apple Orchard (patterns w/numbers)
Well Issues
Skeeter growth (exponential work)

Probability & Distributions
Queuing
Gerrymandering
Sabermetrics
absenteeism/graduation rates
Failure rates/quality control
Carnival Games using area probability

Optimization Issues
Linear programming
Optimal Locations
Gasoline blending
House flipping
College admittance
Queuing
Circuits (Hamiltonian)

Art & Mathematics
Tesselations (heartcubed for Vday)
Golden Ratio
Kites in squares
https://nrich.maths.org/8301
Parent graphs coloring page
Ratios in Mullets
http://mrvaudrey.com/2012/05/03/the-only-lesson-theyll-remember/

Medicine & Physical Science
Sinusoidal Modeling (daylight hours)
Quadratic Modeling (CBL readers)
Linear Regression Modeling
Genetics mapping
Barbie Bungee
https://www.nctm.org/Classroom-Resources/Illuminations/Lessons/Barbie-Bungee/

Resources:
https://mathmontana.org/
AMP - Applied Mathematics Practices Textbook - T. Edwards & K. Chelst, authors
https://www.youcubed.org/
www.nctm.org/Classroom-Resources/Illuminations/Lessons