

# Mount Pleasant Central School District

## Pre-CalculusH, Math



*We believe that students should learn the mathematical practice standards by showing the connections between real world problems and mathematical solutions by modeling, explorations and discovery.*

How can we analyze and describe a wide variety of relationships using functions? In this class, students will develop a deeper understanding of functions and the foundational topics of calculus. Our main goal is to build upon students' knowledge of various types of functions, such as piecewise functions, rational functions, and trigonometric functions. Students will also explore parametric equations, conic sections, and polar coordinates and equations, and begin studying fundamental concepts of calculus, such as limits and derivatives. We emphasize connecting mathematical concepts through multiple representations (graphical, numerical, analytical, and verbal), justifying reasoning and solutions, and using correct notation and language to communicate such solutions. Assessment will be primarily through summative assessments and performance-based tasks.

Unit Title	Month	Content	Vocabulary	Standards	Skills	Big Ideas	Assessments
Absolute Value and Piecewise Functions	September	Solving, graphing, evaluating, and writing absolute value and piecewise functions.	Undefined, Domain Restriction, Range, Extraneous Solution	Solve equations and inequalities represented analytically, with and without technology. (CBAPPC-1.A)	Students will be able to graph, evaluate, write, and analyze absolute value and piecewise functions.	Absolute value and piecewise functions model situations where a relationship changes based on conditions.	Exam
Rational Functions	September	Determining characteristics of a rational function by algebraic methods. Testing for symmetry.	Symmetry, Intercepts, Asymptotes, Slant Asymptote, Indeterminate Values.	Express functions, equations, or expressions in analytically equivalent forms that are useful in a given mathematical or applied context. (CBAPPC-1.B)	Students will be able to graph, evaluate, and analyze rational functions. Students will be able to determine properties and characteristics of rational functions using algebraic methods.	Rational functions model relationships involving ratios.	Take Home Quiz, individualized, short answer

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Graphing Rational Functions	October	Graphing rational functions based on algebraic work. Graphing asymptotes and discontinuities.	Symmetry, Intercepts, Asymptotes, Slant Asymptote, Indeterminate Values.	Identify information from graphical, numerical, analytical, and verbal representations to answer a question or construct a model, with and without technology (CBAPPC-2.A)	Students will be able to formulate connections between properties such as domain restrictions and asymptotic behavior. Students will be able to use these connections and other given characteristics of a rational function to produce a graph.	The graph of a rational function reveals how the relationship between its numerator and denominator shapes its behavior.	In class, Multiple choice and short answer
Matrices, Sequences, and Series	October	Solving system of equations using Cramer's Rule.  Analyzing arithmetic	Matrix, Arithmetic, Geometric, Divergence, Common Difference/Ratio, Series.	Express functions, equations, or expressions in analytically equivalent forms that are useful in a given	Students will be able to solve a system of equations using Cramer's Rule of Matrices.	Sequences describe patterns and progressions, while series represent accumulation.	In class, Multiple choice and short answer

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		and geometric sequences and series.		mathematical or applied context. (CBAPPC-1.B)	Students will be able to determine if an infinite geometric series converges or diverges.		
Parametric Equations	November	Evaluating and graphing parametric equations.	Parameter, Orientation	Construct equivalent graphical, numerical, analytical, and verbal representations of functions that are useful in a given mathematical or applied context, with and without technology (CBAPPC-2.B)	Students will be able to graph parametric equations. Students will be able to use parametric equations to analyze motion of an object.	Parametric equations describe motion in two and three dimensions.	In class, Multiple choice and short answer
Conic Sections	December	Determining key characteristics and graphing conic sections.	Foci, Directrix, Asymptote, Transverse/Conjugate	Identify information from graphical, numerical, analytical,	Students will be able to graph conic sections given an equation or	Conic Sections arise from slicing a cone in different ways. The	Quiz mid-unit, Partner Project, Students must construct a picture

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			Axis, Major/Minor Axis	and verbal representations to answer a question or construct a model, with and without technology (CBAPPC-2.A)	list of properties. Students will be able to convert a conic equation from general to standard form and identify properties of the conic.	equations that result reveal geometric properties and symmetries.	using conic sections, then find all properties of conics used
Trigonometric Functions and Graphing	February	Writing and graphing sinusoidal functions.  Modeling a real-world situation using a sinusoidal function.	Amplitude, Frequency, Period, Horizontal Shift, Vertical Shift,	Describe the characteristics of a function with varying levels of precision, depending on the function representation and available mathematical tools (CBAPPC-3.A.)	Students will be able to write, graph, and analyze trigonometric functions. Students will be able to formulate connections between a real world context, sinusoidal graph, equation, and value.	Trigonometric functions describe periodic behavior.	In class, Multiple choice and short answer

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Polars	March	Graphing polar equations.  Solving equations for all solutions using DeMoivre's theorem.	Polar axis, Cardioid, Limacon, Leminscate, Rose Curve	Identify information from graphical, numerical, analytical, and verbal representations to answer a question or construct a model, with and without technology (CBAPPC-2.A)	Students will be able to graph polar curves. Students will be able to solve equations for all solutions in the real and imaginary domain using DeMoivre's Theorem.	The polar coordinate system offers a new way to represent points and model relationships using distance and angles as opposed to horizontal and vertical measures.	Mid-unit Quiz, Individual Project, Students construct three flowers using polar curves and find properties of these curves
Vectors and Kinematics	April	Representing and analyzing motion using vectors	Vector, Scalar, Speed, Velocity, Acceleration,	Identify information from graphical, numerical, analytical, and verbal representations to answer a question or construct a model, with and without technology	Students will be able to analyze graphs of position vs time, velocity vs time, and acceleration vs time. Students will be able to analyze an object's motion in regards to	Vectors describe motion and direction in two dimensions. Vectors have connections with parametrics, trigonometry, conics, and physics.	Group project. Students collect data from running a obstacle course. Students construct position vs time graphs and velocity vs time graphs based on data.

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				(CBAPPC-2.A)	position, velocity, and acceleration.		Students analyze these graphs and answer short response questions.
Limits	May	Calculating limits analytically, graphically, using a table.	Limit, Undefined, Infinite, Degree, Conjugate,	Identify mathematical information from graphical, numerical, analytical, and/or verbal representations. (CBAPAB-2.B)	Students will be able to evaluate limits given a graph, function, or table. Students will be able to apply several analytical methods to a function to evaluate a limit.	Limits describe how functions behave and lay the foundation for continuity, derivatives, and the study of change.	Group project. Students create a recipe where all quantities are replaced with limit expressions. Students must evaluate these expression graphically and analytically.
Continuity	May	Determining continuity of a function.  Classifying discontinuities.	Jump Discontinuity, Infinite Discontinuity, Removable Discontinuity, Vertical Asymptote,	Confirm whether hypotheses or conditions of a selected definition, theorem, or test	Students will be able to use the formal definition of continuity to explain whether or not a function is	Continuity helps to analyze how functions change and anticipate the behavior of functions near specific	In class, short answer

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			Indeterminate,	have been satisfied. (CBAPAB-3.C)	continuous at that point	points.	
Derivatives	June	Determining derivative function.  Analyzing behavior of function using derivatives.	Rate of Change, Instantaneous Rate of Change, Tangent Line, Secant Line, Slope	Identify mathematical information from graphical, numerical, analytical, and/or verbal representations. (CBAPAB-2.B)	Students will be able to formulate connections between a function and its derivative.  Students will be able to determine the derivative of a function using different methods and interpret the meaning of a calculated derivative value.	The derivative represents how a quantity changes. It connects algebraic, graphical, and numerical perspective of rate of change.	Mid-unit Quiz, Final Exam will assess student understanding of Derivatives.