NOUVEL CATHOLIC CENTRAL HIGH SCHOOL

HONORS PRE-CALCULUS

COURSE SYLLABUS

COURSE DESCRIPTION:	This one-year class is a continuation of Algebra II topics focusing on the analysis of functions. New topics include vectors, polar coordinates, complex numbers, trigonometry, conics, exponential and logarithmic functions and an introduction to limits. The goals include: developing proficiency with mathematical skills, expanding understanding of mathematical concepts using the graphing calculator, and preparing students for an AP or college calculus course. Grades offered: 10, 11 and 12 Prerequisite: Algebra II
MAJOR COURSE GOALS:	The goal is to provide students with the critical thinking skills and mathematical know-how needed to succeed in college or any endeavor. The goal includes graphing technology skills. Students will be comfortable with the language of functions and their algebraic properties always enforcing the connections among their algebraic, graphical, and numerical representations. Topics include: P1 Functions P1.1 Know and use a definition of a function to decide if a given relation is a function. P1.2 Perform algebraic operations (including compositions) on functions and apply transformations (translations, reflections, and rescalings). P1.3 Write an expression for the composition of one given function with another and find the domain, range, and graph of the composite function. Recognize components when a function is composed of two or more elementary functions. P1.4 Determine whether a function (given symbolically or graphically) has an inverse and express the inverse (symbolically, if the function is given symbolically, or graphically, if given graphically) if it exists. Know and interpret the function notation for inverses.

	P1.5 Determine whether two given functions are inverses, using composition. P1.6 Identify and describe discontinuities of a function (e.g., greatest integer function, 1/x) and how these relate to the graph. P1.7 Understand the concept of limit of a function as x approaches a number or infinity. Use the idea of limit to analyze a graph as it approaches an asymptote. Compute limits of simple functions (e.g., find the limit as x approaches 0 of f(x) = 1/x) informally. P1.8 Explain how the rates of change of functions in different families (e.g., linear functions, exponential functions, etc.) differ, referring to graphical representations. P2 Exponential and Logarithmic Functions P2.1 Use the inverse relationship between exponential and logarithmic functions to solve equations and problems. P2.2 Graph logarithmic functions. Graph translations and reflections of these functions. P2.3 Compare the large-scale behavior of exponential and logarithmic functions with different bases and recognize that different growth rates are visible in the graphs of the functions P2.4 Solve exponential and logarithmic equations when possible, (e.g. 5x=3(x+1)). For those that cannot be solved analytically, use graphical methods to find approximate solutions. P2.5 Explain how the parameters of an exponential or logarithmic model relate to the data set or situation being modeled. Find an exponential or logarithmic function to model a given data set or situation. Solve problems involving exponential growth and decay. P3 Quadratic Functions P3.1 Solve quadratic-type equations (e.g. e2x-4 ex+4=0) by substitution. P3.2 Apply quadratic functions and their graphs in the context of motion under gravity and simple optimization problems.

	P3.3 Explain how the parameters of an exponential or logarithmic model relate to the data set or situation being modeled. Find a quadratic function to model a given data set or situation. P4 Polynomial Functions P4.1 Given a polynomial function whose roots are known or can be calculated, find the intervals on which the function's values are positive and those where it is negative. P4.2 Solve polynomial equations and inequalities of degree greater than or equal to three. Graph polynomial functions given in factored form using zeros and their multiplicities, testing the sign-on intervals and analyzing the function's large-scale behavior. P4.3 Know and apply fundamental facts about polynomials: the Remainder Theorem, the Factor Theorem, and the Fundamental Theorem of Algebra. P5 Rational Functions and Difference Quotients P5.1 Solve equations and inequalities involving rational functions. Graph rational functions given in factored form using zeros, identifying asymptotes, analyzing their behavior for large x values, and testing intervals. P5.2 Given vertical and horizontal asymptotes, find an expression for a rational function with these features. P5.3 Know and apply the definition and geometric interpretation of difference quotient. Simplify difference quotients and interpret difference quotients as rates of change and slopes of secant lines. P6 Trigonometric Functions P6.1 Define (using the unit circle), graph, and use all trigonometric functions of any angle. Convert between radian and degree measure. Calculate arc lengths in given circles. P6.2 Graph transformations of the sine and cosine functions (involving changes in amplitude, period, midline, and phase) and explain the relationship between constants in the formula and transformed graph.

	P6.3 Know basic properties of the inverse trigonometric functions sin-1 x, cos-1 x, tan-1 x, including their domains and ranges. Recognize their graphs. P6.4 Know the basic trigonometric identities for sine, cosine, and tangent (e.g., the Pythagorean identities, sum and difference formulas, co-functions relationships, double angle and half-angle formulas). P6.5 Solve trigonometric equations using basic identities and inverse trigonometric functions. P6.6 Prove trigonometric identities and derive some of the basic ones (e.g., double-angle formula from sum and difference formulas, half-angle formula from double angle formula, etc.). P6.7 Find a sinusoidal function to model a given data set or situation and explain how the parameters of the model relate to the data set or situation. P7 Vectors, Matrices, and Systems of Equations P7.1 Perform operations (addition, subtraction, and multiplication by scalars) on vectors in the plane. Solve applied problems using vectors. P7.2 Know and apply the algebraic and geometric definitions of the dot product of vectors. P7.3 Know the definitions of matrix addition and multiplication. Add, subtract, and multiply matrices. Multiply a vector by a matrix. P7.4 Represent rotations of the plane as matrices and apply to find the equations of rotated conics. P7.5 Define the inverse of a matrix and compute the inverse of two-by-two and three-by-three matrices when they exist. P7.6 Explain the role of determinants in solving systems of linear equations using matrices and compute determinants of two-by-two and three-by-three matrices.

	P7.7 Write systems of two and three linear equations in matrix form. Solve such systems using Gaussian elimination or inverse matrices. P7.8 Represent and solve systems of inequalities in two variables and apply these methods in linear programming situations to solve problems. P8 Sequences, Series, and Mathematical Induction P8.1 Know, explain, and use sigma and factorial notation. P8.2 Given an arithmetic, geometric, or recursively defined sequence, write an expression for the nth term when possible. Write a particular term of a sequence when given the nth term. P8.3 Understand, explain, and use the formulas for the sums of finite arithmetic and geometric sequences. P8.4 Compute the sums of infinite geometric series. Understand and apply the convergence criterion for geometric series. P8.5 Understand and explain the principle of mathematical induction and prove statements using mathematical induction. P8.6 Prove the binomial theorem using mathematical induction. Show its relationships to Pascal's triangle and to combinations. Use the binomial theorem to find terms in the expansion of a binomial to a power greater than 3. P9 Polar Coordinates, Parameterizations, and Conic Sections P9.1 Convert between polar and rectangular coordinates. Graph functions given in polar coordinates. P9.2 Write complex numbers in polar form. Know and use De Moivre's Theorem. P9.3 Evaluate parametric equations for given values of the parameter. P9.4 Convert between parametric and rectangular forms of equations.

	P9.5 Graph curves described by parametric equations and find parametric equations for a given graph. P9.6 Use parametric equations in applied contexts (e.g., orbits and projectiles) to model situations and solve problems. P9.7 Know, explain, and apply the locus definitions of parabolas, ellipses, and hyperbolas and recognize these conic sections in applied situations. P9.8 Identify parabolas, ellipses, and hyperbolas from equations, write the equations in standard form, and sketch an appropriate graph of the conic section. P9.9 Derive the equation for a conic section from given geometric information (e.g., find the equation of an ellipse given its two axes). Identify key characteristics (e.g. foci and asymptotes) of a conic section from its equation or graph. P9.10 Identify conic sections whose equations are in polar or parametric form.
COURSE ASSESSMENT PLAN:	The student will demonstrate their attainment of the course goals through a variety of assessments. Each chapter will have at least one summative assessment (chapter test). Chapter assessments will include show-your-work problems and short answer conceptual questions. Frequent formative assessments such as quizzes, homework problems, in class activities, will be used throughout the course to measure student progress towards the course goals. Course grades will be calculated on a percentage basis as follows: 80% Assessments (chapter tests, quizzes and other assessments) 20% Assignments (problem sets, lesson reflections, class activities, etc…). A comprehensive exam will be given at the end of each semester. Semester exams will count as 20% of the semester grade.
RECOMMENDED SUPPLIES AND MATERIALS:	• 3-ring binder with dividers OR spiral notebook and folder combination • Lined paper and graph paper • Post-it Notes

	• Pencils and erasers (ink is not allowed) • Graphing or scientific calculator (TI-83, TI-84 or TI-34) • Textbook: PRE-CALCULUS
EXTRA HELP:	Before and after school extra help can be arranged by appointment. Students are encouraged to come in for extra help as soon as the need arises. All make-up tests and quizzes must take place before or after school. Students are also encouraged to email the teacher or post questions to the online learning platform at any time for assistance
INSTRUCTIONAL PHILOSOPHY:	Student participation is at the core of every teaching strategy used in the course. This course utilizes lecture, video lessons, discussion, demonstration, and student centered investigations. In doing so, the purpose is to maximize learning by branching across many learning and teaching styles and therefore helping all students gain a deeper understanding of mathematics. Learning is a two sided relationship where both the student and the teacher need to put forth their best effort. Communication is key. Students will be asked to reflect upon and communicate on the progress of their learning on a regular basis.
INSTRUCTIONAL ACTIVITIES AND COURSE PROJECTS:	There will be a combination of individual, group and partner work in this class to challenge all students towards their absolute potential. During and after presenting a lesson, the learner will have time to try out assigned problems and ask questions if necessary. Students who use their time wisely will be able to finish most of the assigned problems in class but should expect some form of homework daily. All assigned problems for a particular lesson are due the day after that lesson is presented. The learner will also participate in projects and class investigations in order to achieve the most out of his/her learning experience.
CLASSROOM EXPECTATIONS:	The student is expected to… • Be fully prepared for class and in their seats when the bell rings. • Participate fully in all class activities. • Show respect toward each other, the teacher, and school property at all times. • Take responsibility for their performance by asking questions and seeking additional help when needed.

	• Refrain from using any personal electronic device in the classroom unless directed by the teacher. • Be familiar with and adhere to all policies outlined in the Student Handbook
HOMEWORK POLICY AND GRADING SCALE:	Practice is essential to success in Pre-Calculus. Each problem is different. The more exposure to calculus problems, the better you get at solving them. Homework practice problems or online tutorials are assigned almost every day and must be completed by stated deadlines. Incomplete assignments are not accepted. Every problem assigned should be attempted and all work must be shown. Homework will be graded by a combination of completeness and correctness. Course letter grades are determined by the grading scale listed in the Student Handbook
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