Archdiocese of Newark Catholic Schools

Curriculum Mapping

Curriculum mapping is a process that helps schools and districts/dioceses determine the "agreed-upon" learning for all students. Curriculum mapping was undertaken in the Archdiocese of Newark in order to ensure that a consistent, clearly articulated curriculum infused with Gospel values is being provided to all students in our schools. The curriculum maps for the Catholic schools of the Archdiocese of Newark identify the content to be taught and skills to be mastered at each grade level.

The expertise and experience of the educators within our schools is the main source for determining the content and skills students will be expected to master. The Archdiocesan curriculum maps are developed through a collaborative process which involves individual teacher contributions, small group sessions and larger group meetings. Relevant educational standards, including those proposed by content area experts, the New Jersey Core Curriculum Content Standards, and the Common Core State Standards, are used as a resource in the curriculum mapping process. The resulting consensus maps reflect the collective thinking of classroom teachers based on their observation of student learning and their knowledge of educational practice and research. The Archdiocesan curriculum maps include teacher generated ideas for the infusion of Gospel values and faith connection activities.

While the curriculum maps clearly articulate the expected learning for all students, individual teachers have the flexibility to teach the content and skills in their own manner by:

- utilizing their own particular strengths and teaching style
- addressing the varying learning needs of their students
- determining the order in which the content and skills are presented within a marking period
- including additional content and skills once students have met the learning expectations identified in the curriculum map

Administrators at all levels will maintain the responsibility to ensure that teachers are following the curriculum maps and that appropriate teaching is being conducted. This will be done through a combination of classroom observations, faculty meetings, professional development opportunities and teacher evaluations, as well as by using various measurement tools, including but not limited to in-class and standardized testing. The Archdiocesan curriculum maps will help ensure the academic excellence that is integral to the mission of our Catholic schools and will provide educators and parents with a clear understanding of the learning expectations at each grade level.

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

First Semester

Standards	Content	Skills	Assessment	Gospel Values
This curriculum map reflects the general expectations of student learning in Pre-Calculus at the high school level. Each school will determine the course-specific expectations based on the level of the course or courses offered. Schools will also determine the sequence in which the various topics are taught within the specific course.				
A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. N.RN.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. F.IF.1 Understand that 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*). F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	*The content and skills typed in italics should be reviewed as needed based on the extent of coverage in prior courses.* **General Skills**	*The content and skills typed in italics should be reviewed as needed based on the extent of coverage in prior courses.* ***General Skills*** *Add, subtract, multiply, and divide monomials and polynomials.* *Identify rational, irrational, natural, whole numbers, and integers.* *Find and graph intersection and union of sets.* *Write sets in set-builder notation and interval notation.*	Student learning will be assessed on a continual basis using various types of formal and informal assessments. A list of possible assessment methods is provided below: Tests Quizzes Projects Homework Classwork Student presentations Observation of student work Critical thinking activities Performance Tasks Online Programs Class participation Mid-term exams Final exams	Gospel values should be evident in the classroom environment and referenced and reinforced throughout the curriculum. **Gospel Values** Community Compassion Faith in God Forgiveness Hope Justice Love Peace Respect For Life Service Simplicity Truth Teachers will also highlight elements of Catholic identity that can be related to topics in the Math curriculum.

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

First Semester

Standards	Content	Skills	Assessment	Gospel Values
F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	**Relations and Functions**	***Relations and Functions*** *Determine whether a relation is a function.* *Describe the four ways to represent a function – verbal, table of values, graphic, and algebraic.* *Identify families of functions.* *Find the domain and range of a given function, including restrictions on radical and rational functions.* *Graph piecewise defined functions.* *Add and subtract rational expressions with unlike denominators and simplify complex fractions.* *Add, subtract, multiply, divide, and evaluate functions.*		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

First Semester

Standards	Content	Skills	Assessment	Gospel Values
F.BF.1c Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* F.BF.4 Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, f(x) =2 x^3 or f(x) = (x+1)/(x-1) for $x \neq 1$.* b. Verify by composition that one function is the inverse of another.		*Compose functions and apply to real-life problems.* *Differentiate the purposes of vertical and horizontal line tests.* *Identify a function as one-to-one and its implications on inverse functions.* *Find the inverse of a function and verify two functions are inverses by using the property of inverse functions.* *Graph a function and its inverse (reflections across the identity).*		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

First Semester

Standards	Content	Skills	Assessment	Gospel Values
Standard statements F.IF.1, F.IF.2, F.IF.7a, F.IF.7c can be found in a previous section of this document. A.CED.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*. A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A.CED.3 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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*. A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.	**Constant and Linear Functions**	***Constant and Linear Functions*** *Classify a polynomial function by its degree and write its coefficients.* *Graph a linear function, analyze the graph and separate the domain into intervals that makes a function positive, negative, and zero, noticing the intercepts.* *Describe the end behavior of a graph, using function and infinity notations.* *Given two end points of a line segment, find the slope, distance, and midpoint.* *Distinguish the point-slope form, slope-intercept form, and standard form.* *Write equations of lines given different conditions, including parallel/perpendicular lines and perpendicular bisector.*		

Archdiocese of Newark Catholic Schools Curriculum Map for High School Pre-Calculus				
First Semester				
Standards	**Content**	**Skills**	**Assessment**	**Gospel Values**
A.REI.4a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.	**Quadratic Functions**	*Solve systems of linear equations by graphing, substitution, and elimination.* *Use a calculator to confirm the solution (intersecting point) of a linear system.* *Apply linear systems in solving real life problems.* ***Quadratic Functions*** *Distinguish between a quadratic function, expression, equation, and the quadratic formula.* *Identify the domain and range of a quadratic function.* *Find x- and y-intercepts, axis of symmetry, vertex, and point symmetric to y-intercept of a quadratic function, and graph the function.*		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

First Semester

Standards	Content	Skills	Assessment	Gospel Values
F.IF.4 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.* F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima. F.IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. F.IF.8a Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.		*Describe the end behavior of the function.* *Factor polynomials, including sum and difference of two cubes and factor by grouping.* *Find zeros of a quadratic function by factoring, completing the square, using the quadratic formula.* *Solve maximum/minimum problems by modeling a quadratic function.* *Utilize the maximum, minimum, and zero features of the calculator in problem solving.* *Find intersecting point(s) of a quadratic function and a linear function by solving the system.* *Find intersecting point(s) of two quadratic functions.*		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

First Semester

Standards	Content	Skills	Assessment	Gospel Values
N.CN.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. N.CN.3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. A.REI.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. G.GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	**Complex Numbers, Quadratic Inequalities, and Circles**	**Complex Numbers, Quadratic Inequalities, and Circles** Add, subtract, multiply, divide complex numbers, then simplify them - including FOIL, powers of i, and rationalizing the denominator. Determine the nature of the roots by the value of the discriminant, stating the number and type of solutions. Solve and graph quadratic inequalities in one variable. Determine the part of the domain that makes the value of the function positive, zero, or negative. Graph circles given equations in standard form.		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

First Semester

Standards	Content	Skills	Assessment	Gospel Values
G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles. G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. G.SRT.10 Prove the Laws of Sines and Cosines and use them to solve problems. F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. F.TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. F.TF.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for x, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number. F.TF.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.	**Trigonometric Functions of Angles**	Write an equation of a circle in standard form given the center and radius. Convert an equation of a circle from general form to standard form **Trigonometric Functions of Angles** Solve right triangle trigonometry and its application. Use 30-60-90 and 45-45-90 triangles properties. Recognize six trigonometric functions. Represent and convert degree measure and radian measure. Identify and plot co-terminal, reference, and quadrantal angles.		

Archdiocese of Newark Catholic Schools Curriculum Map for High School Pre-Calculus				
First Semester				
Standards	**Content**	**Skills**	**Assessment**	**Gospel Values**
		Apply "All Students Take Calculus" rule. Use the law of sines and cosines. Identify fundamental trigonometric identities.		
F.TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. F.TF.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for x, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number. F.TF.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	**Trigonometric Functions of Real Numbers**	**Trigonometric Functions of Real Numbers** Identify special angles used to graph the trigonometric functions. Use terminal point of an arc and its coordinates. Recognize graphs of the six trigonometric functions. Solve for domain, range, period, amplitude, and phase-shift.		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

Second Semester

Standards	Content	Skills	Assessment	Gospel Values
F.TF.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. F.TF.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. F.TF.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.	**Analytic Trigonometry**	**Analytic Trigonometry** Use trigonometric identities. Condense or expand using the addition and subtraction formulas. Recognize Inverse sine and cosine functions. Analyze the graphs of the inverse sine and cosine functions	Student learning will be assessed on a continual basis using various types of formal and informal assessments. A list of possible assessment methods is provided below: Tests Quizzes Projects Homework Classwork Student presentations Observation of student work Critical thinking activities Performance Tasks Online Programs Class participation Mid-term exams Final exams	Gospel values should be evident in the classroom environment and referenced and reinforced throughout the curriculum. **Gospel Values** Community Compassion Faith in God Forgiveness Hope Justice Love Peace Respect For Life Service Simplicity Truth Teachers will also highlight elements of Catholic identity that can be related to topics in the Math curriculum.
F.IF7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. F.IF.7d Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	**Polynomial Functions of Degree 3 or Higher**	**Polynomial Functions of Degree 3 or Higher** Analyze graphs of polynomial functions. Locate and describe local maxima and minima, and end behavior. Solve polynomials using synthetic division.		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

Second Semester

Standards	Content	Skills	Assessment	Gospel Values
A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. A.APR.2 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$. A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.		Understand how to factor higher degree polynomials. Use the remainder and factor theorems. Use Rational zeros theorem. Find zeros of polynomials.		
F.IF7d Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	**Exponential and Logarithmic Functions**	**Exponential and Logarithmic Functions** Recognize graphs of exponential and logarithmic functions. Identify inverse of an exponential function and logarithmic function.		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

Second Semester

Standards	Content	Skills	Assessment	Gospel Values
F.BF.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. F.LE.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. A.REI.10 Understand 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). A.REI.11 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 equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.		Evaluate logarithmic expressions. Use change of base formula. Expand and condense logarithmic expressions. Solve exponential and logarithmic equations. Solve applications of logarithms in problem solving.		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

Second Semester

Standards	Content	Skills	Assessment	Gospel Values
F.IF.1 Understand that 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*). F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1*. S.MD.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). S.MD.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	**Sequence and Series, Probability & Counting Principle**	**Sequence and Series, Probability & Counting Principle** Recognize and be able to find successive terms for both general term and recursive term sequences. Use sequence notation to write the terms of sequences. Use factorial notation. Use summation notation to write sums. Find the sums of infinite series. Use sequences and series to model and solve real-life problems. Recognize, write and find the nth terms of arithmetic and geometric sequences. Find nth partial sums of arithmetic and geometric sequences.		

Archdiocese of Newark Catholic Schools
Curriculum Map for High School Pre-Calculus

Second Semester

Standards	Content	Skills	Assessment	Gospel Values
S.CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). S.CP.2 Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. S.CP.3 Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.		Use the Fundamental Counting Principle to solve counting problems. Find the probabilities of event.		

Archdiocese of Newark Catholic Schools Curriculum Map for High School Pre-Calculus				
Second Semester				
Standards	**Content**	**Skills**	**Assessment**	**Gospel Values**
S.CP.6 Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. S.CP.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model. S.CP.8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. S.CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems.				