Anthony Wayne Local Schools
Course of Study
Pre-Calculus & Pre-Calculus Honors

Anthony Wayne Local Schools Mathematics Belief Statements
All Generals will experience an innovative and engaging curriculum with instruction that is personalized, promotes creativity and application, and provides real-world experiences that facilitate deeper learning.

AWLS believes Mathematics instruction should:
- identify skill gaps for individual students and work to close them
- include engaging learning activities where all learners can grow through productive struggle.
- develop strong number sense with the ability to manipulate numbers and perform mental math with an emphasis on subitizing
- provide scenarios where real world problems help to provide a path towards being future ready students.
- develop strong mathematical modeling and reasoning skills that continually build on prior knowledge.
- encourage students to be risk takers, demonstrate resilience and grit, while solving complex mathematical problems.
- encourage flexibility, creativity, and communication while working collaboratively with peers.
- include consistent and cohesive academic vocabulary through all grade-levels that is utilized by both teachers and students

Pre-Calculus Course Description:
Students in Precalculus will start the year looking at trigonometric functions including equations and graphs, triangle trigonometry, trigonometric identities, applications of trigonometry, Law of Sines and Law of Cosines, and polar coordinates. Additional topics include 2- and 3-dimensional vectors, functions and their graphs, systems of equations, matrices, quadratic functions, complex numbers, exponential and logarithmic functions, sequences and series, and probability. The year will end with an introduction to limits and derivatives (if time). A graphing calculator is required for this course, preferably the TI 83 Plus or the TI 84.

Pre-Calculus Honors Course Description:
Students in Honors Precalculus will get an extensive look at trigonometric functions including equations and graphs, triangle trigonometry, trigonometry addition formulas and identities, in-depth applications of trigonometry, Law of Sines and Law of Cosines, and polar coordinates. Additional topics include 2- and 3-dimensional vectors, functions and their graphs, systems of equations, matrices, quadratic functions, complex numbers, exponential and logarithmic functions, sequences and series, and probability. The year will end with an introduction to calculus including limits, derivatives, and basic integrals (if time). A graphing calculator is required for this course, preferably the TI 83 Plus or the TI 84.
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Domain/ Conceptual Category	Standard	
Functions	F.TF.1	**Extend the domain of trigonometric functions using the unit circle.** **F.TF.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
Functions	F.TF.2	**Extend the domain of trigonometric functions using the unit circle.** **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.
Functions	F.TF.3	**Extend the domain of trigonometric functions using 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 $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.
Functions	F.TF.4	**Extend the domain of trigonometric functions using the unit circle.** **F.TF.4** (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
Functions	F.TF.5	**Model periodic phenomena with trigonometric functions.** **F.TF.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★
Functions	F.TF.6	**Model periodic phenomena with trigonometric functions.** **F.TF.6** (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
Geometry	G.GPE.1	**Translate between the geometric description and the equation for a conic section.** **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.

Geometry	G.SRT.1	**Understand similarity in terms of similarity transformations.** **G.SRT.1** Verify experimentally the properties of dilationsG given by a center and a scale factor: **a.** A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged. **b.** The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
Geometry	G.SRT.9	**Apply trigonometry to general triangles.** **G.SRT.9** (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
Geometry	G.SRT.10	**Apply trigonometry to general triangles.** **G.SRT.10** (+) Explain proofs of the Laws of Sines and Cosines and use the Laws to solve problems.
Geometry	G.SRT.11	**Apply trigonometry to general triangles.** **G.SRT.11** (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles, e.g., surveying problems, resultant forces.
Functions	F.TF.7	**Model periodic phenomena with trigonometric functions.** **F.T.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.★
Functions	F.TF.8	**Prove and apply trigonometric identities.** **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.
Functions	F.TF.9	**Prove and apply trigonometric identities.** **F.TF.9** (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Functions	F.IF.7	**Analyze functions using different representations.** **F.IF.7** Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ **a.** Graph linear functions and indicate intercepts. (A1, M1) **b.** Graph quadratic functions and indicate intercepts, maxima, and minima. (A1, M2) **c.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (A2, M3) **d.** Graph polynomial functions, identifying zeros, when factoring is reasonable, and indicating end behavior. (A2, M3) **e.** Graph simple exponential functions, indicating intercepts and end behavior. (A1, M1) **f.** Graph exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (A2, M3) **g.** (+) Graph rational functions, identifying zeros and asymptotes, when factoring is reasonable, and indicating end behavior. (A2, M3) **h.** (+) Graph logarithmic functions, indicating intercepts and end behavior.
Functions	F.IF.7	**Analyze functions using different representations.** **F.IF.7** Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ **a.** Graph linear functions and indicate intercepts. (A1, M1) **b.** Graph quadratic functions and indicate intercepts, maxima, and minima. (A1, M2) **c.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (A2, M3) **d.** Graph polynomial functions, identifying zeros, when factoring is reasonable, and indicating end behavior. (A2, M3) **e.** Graph simple exponential functions, indicating intercepts and end behavior. (A1, M1) **f.** Graph exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (A2, M3) **g.** (+) Graph rational functions, identifying zeros and asymptotes, when factoring is reasonable, and indicating end behavior. (A2, M3) **h.** (+) Graph logarithmic functions, indicating intercepts and end behavior.

Functions	F.BF.4	**Build new functions from existing functions.** **F.BF.4** Find inverse functions. **a.** Informally determine the input of a function when the output is known. (A1, M1) **b.** (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. (A2, M3) **c.** (+) Verify by composition that one function is the inverse of another. (A2, M3) **d.** (+) Find the inverse of a function algebraically, given that the function has an inverse. (A2, M3) **e.** (+) Produce an invertible function from a non-invertible function by restricting the domain.
Algebra	A.REI.8	**Solve systems of equations.** **A.REI.8** (+) Represent a system of linear equations as a single matrix equation in a vector variable.
Number and Quantity	N.VM.7	**Perform operations on matrices, and use matrices in applications.** **N.VM.7** (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
Number and Quantity	N.VM.8	**Perform operations on matrices, and use matrices in applications.** **N.VM.8** (+) Add, subtract, and multiply matrices of appropriate dimensions.
Number and Quantity	N.VM.9	**Perform operations on matrices, and use matrices in applications.** **N.VM.9** (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
Number and Quantity	N.VM.10	**Perform operations on matrices, and use matrices in applications.** **N.VM.10** (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication analogous to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
Number and Quantity	N.VM.11	**Perform operations on matrices, and use matrices in applications.** **N.VM.11** (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
Number and Quantity	N.VM.12	**Perform operations on matrices, and use matrices in applications.** **N.VM.12** (+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.
Geometry	G.GPE.2	**Translate between the geometric description and the equation for a conic section.** **G.GPE.2** (+) Derive the equation of a parabola given a focus and directrix.

Functions	F.BF.5	**Build new functions from existing functions.** **F.BF.5** (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
Algebra	A.SSE.4	**Write expressions in equivalent forms to solve problems.** **A.SSE.4** (+) Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★
Algebra	A.APR.5	**Use polynomial identities to solve problems.** **A.APR.5** (+) Know and apply the Binomial Theorem for the expansion of $(x + y)n$ in powers of x and y for a positive integer n, where x and y are any numbers. *For example by using coefficients determined for by Pascal's Triangle.* The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.
Functions	F.IF.3	**Understand the concept of a function, and use function notation.** **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* $n \geq 1$.
Functions	F.BF.2	**Build a function that models a relationship between two quantities.** **F.BF.2** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★
Statistics and Probability	S.CP.2	**Understand independence and conditional probability, and use them to interpret data.** **S.CP.2** Understand that two events A and B are independent if and only 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.★
Statistics and Probability	S.CP.3	**Understand independence and conditional probability, and use them to interpret data.** **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.★
Statistics and Probability	S.CP.5	**Understand independence and conditional probability, and use them to interpret data.** **S.CP.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*★

Statistics and Probability	S.CP.6	**Use the rules of probability to compute probabilities of compound events in a uniform probability model.** **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.★
Statistics and Probability	S.CP.7	**Use the rules of probability to compute probabilities of compound events in a uniform probability 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.★
Statistics and Probability	S.CP.8	**Use the rules of probability to compute probabilities of compound events in a uniform probability model.** (+) **S.CP.8** Apply the general Multiplication Rule in a uniform probability modelG, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.★ (G, M2)
Statistics and Probability	S.CP.9	**Use the rules of probability to compute probabilities of compound events in a uniform probability model.** **S.CP.9** (+) Use permutations and combinations to compute probabilities of compound events and solve problems.★ (G, M2)