Youngstown City Schools - - PRE-CALCULUS CURRICULUM MAP 2013-2014

Unit: # 1: GRAPHING RATIONAL FUNCTIONS **Time**: **Quarter 1: 3 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
F.IF7d Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (+) graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.2** Communicate using correct mathematical terminology **L.7** Research mathematics topics or related problems **L.9** Apply [details of mathematical] readings/use information found in texts to support reasoning, and develop a "works cited document" for research done to solve a problem

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Unit: # 2 DERIVE EQUATIONS OF ELLIPSES AND HYPERBOLAS **Time**: **Quarter 1: 4.5 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
G.GPE.3 (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.1** Learn to read mathematical text (including textbooks, articles, problems, problem explanations) **L.2** Communicate using correct mathematical terminology **L.5** Justify orally and in writing mathematical reasoning

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UNIT #3: COMPOSITE FUNCTIONS AND INVERSES

Time: **Quarter 1-2: 4.5 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
F.BF.1b Write a function that describes a relationship between two quantities; Combine standard function types using arithmetic operations. *For example: build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* **F.BF.1c** Write a function that describes a relationship between two quantities; (+) 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.4b** Find inverse functions. (+) verify by composition that one function is the inverse of another **F.BF.4c** Find inverse functions. (+) read values of an inverse function from a graph or a table, given that the function has an inverse. **F.BF.4d** Find inverse functions. (+) produce an invertible function from a non-invertible function by restricting the domain. **F.BF.5** (+) understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.1** Learn to read mathematical text (including textbooks, articles, problems, problem explanations) **L.2** Communicate using correct mathematical terminology

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UNIT #4: TRIG FUNCTIONS WITH RADIANS

Time: **Quarter 2: 6 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
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 value of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosines, and tangent for *x*, π + *x*, and 2π – *x* in terms of their values for *x*, where *x* is any real number. **F.TF.4** (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. **F.TF.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. **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. **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.		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.1** Learn to read mathematical text (including textbooks, articles, problems, problem explanations) **L.2** Communicate using correct mathematical terminology **L.4** Listen to and critique peer explanations of reasoning **L.6** Represent and interpret data with an without technology **L.8** Read appropriate text, providing explanation for m0athematical concepts, reason or procedures

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UNIT #5: PROVING TRIGONOMETRIC IDENTITIES **Time**: **Quarter 3: 2 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
F.TF.8. Prove the Pythagorean identity $sin^2(\theta) + cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) 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.		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.2** Communicate using correct mathematical terminology **L.3** Read, discuss, and apply the mathematics found in literature including looking at the author's purpose **L.4** Listen to and critique peer explanations of reasoning

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UNIT #6: MATRIX OPERATIONS AND THEIR RELATIONSHIP TO VECTORS Time: Quarter 3: 3 weeks

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
NVM.6 (+) Use matrices to represent and manipulate data (e.g., to represent payoffs or incidence relationships in a network. **NVM.7** (+) Multiply matrices by scalars to produce new matrices (e.g., as when all of the payoffs in a game are doubled. **NVM.8** (+) Add, subtract, and multiply matrices of appropriate dimensions. **NVM.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. **NVM.10** (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar 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 **NVM.12** (+) Work with 2 x 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area. **A.REI.9** (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater).		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.2** Communicate using correct mathematical terminology **L.4** Listen to and critique peer explanations of reasoning **L.5** Justify orally and in writing mathematical reasoning **L.6** Represent and interpret data with an without technology **L.8** Research mathematics topics or related problems

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UNIT #7: VECTOR QUANTITIES AND REPRESENTATIONS

Time: **Quarter 3: 3 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
NVM.1 (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., ***v,*** |***v***|, ||***v***||, *v*) **NVM.2** (+) find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. **NVM.3** (+) Solve problems involving velocity and other quantities that can be represented by vectors. **NVM.4a** (+) Add and subtract vectors; Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. **NVM.4b** (+) Add and subtract vectors; given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. **NVM.5a** (+) Multiply a vector by a scalar. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise; e.g., e.g., as $c(v_x, v_y) = (cv_x, cv_y)$. **NVM.5b** (+) Multiply a vector by a scalar. Compute the magnitude of scalar multiple $c\boldsymbol{v}$ *using* $\|c\boldsymbol{v}\| = |c|v$. Compute the direction of $c\boldsymbol{v}$ knowing that when $|c|v \neq 0$, the direction of $c\boldsymbol{v}$ is either along ***v*** (for c > 0) or against ***v*** (for c <0). **NVM.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. **A.REI.8** (+) Represent a system of linear equations as a single matrix equation in a vector variable.		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.1** Learn to read mathematical text (including textbooks, articles, problems, problem explanations) **L.2** Communicate using correct mathematical terminology

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Unit: #8 COMPLEX NUMBERS AND POLAR COORDINATES **Time: Quarter 4: 3 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
N.CN.1 Know there is a complex number *I* such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real. **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. **N.CN.4**(+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. **N.CN.5** (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *(e.g., (-1 +* $\sqrt{3}i$) has modulus 2 and argument 120° **N.CN.6** Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.2** Communicate using correct mathematical terminology **L.3** Read, discuss, and apply the mathematics found in literature, including looking at the author's purpose **L.7** Research mathematics topics or related problems **L.8** Read appropriate text, providing explanations for mathematics concepts, reasoning or procedures **L.9** Apply details of mathematical reading / use information found in texts to support reasoning, and develop a "works cited document" for research done to solve a problem.

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Unit: #9 PROBABILITY, RANDOM VARIABLES AND EXPECTED VALUE **Time**: **Quarter 4: 3 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
S.MD.1 (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. **S.MD.2** (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. **S.MD.3** (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example: find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.* **S.MD.4** (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example: find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect in 100 randomly selected households?* **S.MD.5a** Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Find the expected payoff for a game of chance. *For example: find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.* **S.MD.5b** Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Evaluate and compare strategies on the basis of expected values. *For example: compare a high-deductible versus low-deductible automobile insurance policy using various,*		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**L.1** Learn to read mathematical text - - problems and explanations **L.2** Communicate using correct mathematical terminology **L.3** Read, discuss, and apply the mathematics found in literature, including looking at the author's purpose **L.4** Listen to and critique peer explanations of reasoning **L.6** Represent and interpret data with and without technology **L.7** Research mathematics topics or related problems **L.8** Read appropriate text, providing explanations for mathematics concepts, reasoning or procedures **L.9** Apply details of mathematical reading / use information found in texts to support reasoning, and develop a "works cited document" for research done to solve a problem.

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
but reasonable, chances of having a minor or major accident.			

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Unit: #10: SOLVING A SYSTEM OF EQUATIONS USING MATRICES **Time**: **Quarter 4: 3 weeks**

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
A.REI.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable. **A.REI.9** (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater). **G.MD.2** (+) Give an informal argument using Cavalieri's principle for the formulas for volume of a sphere and other solid figures		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision.	**L.2** Communicate using correct mathematical terminology **L.6** Represent and interpret data with and without technology

MATH STANDARDS	NOTES	MATH PRACTICES	LITERACY
		7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	