Unit A - *Rebuilding the Prerequisite Skills for Calculus*

Overview

This course is not meant to take the place of AB Calculus or Calculus I but meant to be an introduction to the basic conceptual foundations of differentiation and integration and the algebraic applications used in formulaic differentiation and integration. Major concepts taught are differentiation (Chain rule and implicit application, curve sketching and related rates) and integration (substitution, application, simple initial value problems).

Even though this is an introductory course, students will be required to use specific, correct notation in all written work. Limit notation, parentheses, etc, if left out, completely change the meaning of the written expression.

The initial unit serves as a summarized review of the concepts taught in PreCalculus which are a prerequisite to the study of differentiation and integration in calculus. Students may spend up to 25% of the course time in this unit. Students are encouraged to work in groups to help each other as needed to strengthen skills and understanding.

21st Century Capacities: Analyzing, Collective Intelligence

Stage 1 - Desired Results

ESTABLISHED GOALS/ STANDARDS

MP2 Reason abstractly and quantitatively
MP3 Construct viable arguments and critique the reasoning of others
MP4 Model with Mathematics
MP6 Attend to precision
MP7 Look for and make use of structure

CCSS.MATH.CONTENT.HSN.Q.A.2
Define appropriate quantities for the purpose of descriptive modeling.
CCSS.MATH.CONTENT.HSA.SSE.A.1
Interpret expressions that represent a quantity in terms of its context.*

Transfer:

Students will be able to independently use their learning in new situations to...

1. Manipulate equations/expressions or objects to create order and establish relationships. (Analyzing and Collective Intelligence)
2. Draw conclusions about graphs, shapes, equations, or objects (Analyzing and Collective Intelligence)

Meaning:

UNDERSTANDINGS: *Students will understand that:*

1. Mathematicians flexibly use different tools, strategies, and operations to build conceptual knowledge or solve problems.

ESSENTIAL QUESTIONS: *Students will explore & address these recurring questions:*

A. What does the solution tell me?
B. What math tools/models/strategies can I use to solve the problem?

CCSS.MATH.CONTENT.HSA.SSE.A.2 Use the structure of an expression to identify ways to rewrite it. CCSS.MATH.CONTENT.HSA.APR.B.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. CCSS.MATH.CONTENT.HSA.REI.D.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). CCSS.MATH.CONTENT.HSA.REI.D.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.* CCSS.MATH.CONTENT.HSF.IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. CCSS.MATH.CONTENT.HSF.IF.B.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.** CCSS.MATH.CONTENT.HSF.IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a	2. Mathematicians identify relevant tools, strategies, relationships, and/or information in order to draw conclusions. 3. Mathematicians use models to represent and make meaning of quantitative relationships	
	Acquisition:	
	Students will know… 1. The distance formula and its geometric application 2. The slope formula geometric application 3. Three forms of a linear equation 4. The relationship between roots and x intercepts of an equation 5. What constitutes a 'complete' graph sketch (relative max, min, asymptotes, intercepts) 6. The relationship between the six trigonometric functions 7. Amplitude and period 8. Pythagorean double angle identities 9. Sum and difference identities 10. Rules of exponents and logs 11. How to convert between exponential and log expressions 12. Vocabulary: parallel, perpendicular, composite functions, length of a curve, limit of a sequence	*Students will be skilled at…* 1. Solving linear, absolute value and rational equations 2. Solving linear, absolute value and rational inequalities and express their solutions both algebraically and graphically 3. Graphing a line in any form on a coordinate plane 4. Finding the equation of any line given specific information about the line 5. Finding the domain of any polynomial, rational or radical equation 6. Finding a reasonable window for and sketch any polynomial or rational function 7. Determining intercepts or local extrema of the graph 8. Solve equations on the calculator 9. Solving a polynomial equations by factoring 10. Sketching the graph of any of the six basic trig functions 11. Sketching sine and cosine graphs using transformations 12. Solving trig equations using identities 13. Simplifying exponential and logarithmic

specified interval. Estimate the rate of change from a graph.* CCSS.MATH.CONTENT.HSF.IF.C.7.C Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. CCSS.MATH.CONTENT.HSF.IF.C.7.D (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. CCSS.MATH.CONTENT.HSF.IF.C.7.E Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. CCSS.MATH.CONTENT.HSF.BF.A.1 Write a function that describes a relationship between two quantities.* CCSS.MATH.CONTENT.HSF.BF.A.1.C (+) Compose functions. CCSS.MATH.CONTENT.HSF.BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. CCSS.MATH.CONTENT.HSF.BF.B.5 (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.		expressions 14. Solving exponential and logarithmic equations 15. Determining and simplifying the composition of 2 functions and the resulting domain. 16. Applying transformations to a given parent function 17. Estimating the length of a curve using increasing numbers of line segments 18. Determining the limit of a sequence