Quarter 1		Quarter 2		Quarter 3		Quarter 4
Preparation for Calculus, Limits and Their Properties, Differentiation		Differentiation (continued from Quarter 1), Logarithmic, Exponential, and Other Transcendental Functions		Applications of Differentiation, Integration		Logarithmic, Exponential, and Other Transcendental Functions, Differential Equations, Applications of Integration
August 6 2018 – October 5, 2018		October 15, 2018 – December 19, 2018		January 7, 2019 – March 8, 2019		March 18, 2019 – May 23, 2019
C.F.LF.A.1	C.D.CD.B.6	C.D.AD.A.2	C.D.CD.B.6	C.D.AD.B.7	C.I.UI.B.7	C.I.UI.A.1
C.F.LF.A.2	C.D.CD.B.7	C.D.AD.A.4	C.D.CD.B.8	C.D.AD.B.8	C.I.AI.A.1	C.I.UI.A.2
C.F.LF.A.3	C.D.AD. A.1	C.D.AD.A.5		C.D.AD.B.9	C.I.AI.A.2	C.I.UI.A.3
C.F.BF.A.1	C.D.AD. A.2	C.D.AD.A.6		C.D.AD.B.10	C.I.AI.A.3	C.I.UI.B.5
C.F.BF.A.2	C.D.AD. A.3	C.D.AD.B.7		C.D.AD.B.11		C.I.UI.B.6
C.F.C.A.1		C.D.AD.B.8		C.D.AD.B.12		C.I.UI.B.7
C.F.C.A.2		C.D.AD.B.9		C.D.AD.C.16		C.I.AI.A.1
C.F.C.A.3		C.D.AD.B.10		C.D.AD.C.18		C.I.AI.A.2
C.F.C.A.4		C.D.AD.B.11		C.I.UI.A.1		C.I.AI.A.3
C.D.CD.A.1		C.D.AD.B.12		C.I.UI.A.2		C.I.AI.B.4
C.D.CD.A.2		C.D.AD.B.13		C.I.UI.A.3		C.I.AI.B.5
C.D.CD.A.3		C.D.AD.C.15		C.I.UI.B.4		C.I.AI.B.6
C.D.CD.A.4		C.D.AD.C.17		C.I.UI.B.5		
C.D.CD.B.5		C.D.CD.B.5		C.I.UI.B.6		

Introduction

Destination 2025, Shelby County Schools' 10-year strategic plan, is designed not only to improve the quality of public education, but also to create a more knowledgeable, productive workforce and ultimately benefit our entire community.

What will success look like?

In order to achieve these ambitious goals, we must collectively work to provide our students with high quality, college and career ready aligned instruction. The Tennessee State Standards provide a common set of expectations for what students will know and be able to do at the end of a grade. The State of Tennessee provides two sets of standards, which include the Standards for Mathematical Content and The Standards for Mathematical Practice. The Content Standards set high expectations for all students to ensure that Tennessee graduates are prepared to meet the rigorous demands of mathematical understanding for college and career. The eight Standards for Mathematical Practice describe the varieties of expertise, habits of mind, and productive dispositions that educators seek to develop in all students. The Tennessee State Standards also represent three fundamental shifts in mathematics instruction: **focus, coherence and rigor**.

Tennessee Academic Standards for Mathematics

The **Standards for Mathematical Practice** describe varieties of expertise, habits of minds and productive dispositions that mathematics educators at all levels should seek to develop in their students. These practices rest on important National Council of Teachers of Mathematics (NCTM) "processes and proficiencies" with longstanding importance in mathematics education. Throughout the year, students should continue to develop proficiency with the eight Standards for Mathematical Practice. The following are the eight Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of them.
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.

This curriculum map is designed to help teachers make effective decisions about what mathematical content to teach so that ultimately our students can reach Destination 2025. Throughout this curriculum map, you will see resources as well as links to tasks that will support you in ensuring that students are able to reach the demands of the standards in your classroom. In addition to the resources embedded in the map, there are some high-leverage resources around the content standards and mathematical practice standards that teachers should consistently access. For a full description of each, click on the links below.

Tennessee Mathematics Content Standards

Standards for Mathematical Practice

Literacy Skills for Mathematical Proficency

Structure of the Standards

Structure of the TN State Standards include:

- **Content Standards** - Statements of what a student should know, understand, and be able to do.
- **Clusters** - Groups of related standards. Cluster headings may be considered as the big idea(s) that the group of standards they represent are addressing. They are therefore useful as a quick summary of the progression of ideas that the standards in a domain are covering and can help teachers to determine the focus of the standards they are teaching.
- **Domains** - A large category of mathematics that the clusters and their respective content standards delineate and address. For example, Number and Operations – Fractions is a domain under which there are a number of clusters (the big ideas that will be addressed) along with their respective content standards, which give the specifics of what the student should know, understand, and be able to do when working with fractions.
- **Conceptual Categories** – The content standards, clusters, and domains in the 9th-12th grades are further organized under conceptual categories. These are very broad categories of mathematical thought and lend themselves to the organization of high school course work. For example, Algebra is a conceptual category in the high school standards under which are domains such as Seeing Structure in Expressions, Creating Equations, Arithmetic with Polynomials and Rational Expressions, etc.

How to Use the Maps

Overview
An overview is provided for each quarter and includes the topics, focus standards, intended rigor of the standards and foundational skills needed for success of those standards.

Your curriculum map contains four columns that each highlight specific instructional components. Use the details below as a guide for information included in each column.

Tennessee State Standards
TN State Standards are located in the left column. Each content standard is identified as Major Content or Supporting Content (for Algebra I, Algebra II & Geometry only). A key can be found at the bottom of the map.

Content
This section contains learning objectives based upon the TN State Standards. Best practices tell us that clearly communicating measurable objectives lead to greater student understanding. Additionally, essential questions are provided to guide student exploration and inquiry.

Instructional Support & Resources
District and web-based resources have been provided in the Instructional Support & Resources columns. You will find a variety of instructional resources that align with the content standards. The additional resources provided should be used as needed for content support and scaffolding. The inclusion of vocabulary serves as a resource for teacher planning and for building a common language across K-12 mathematics. One of the goals for Tennessee State Standards is to create a common language, and the expectation is that teachers will embed this language throughout their daily lessons.

Topics Addressed in Quarter 1

- **Preparation for Calculus**
- **Limits and Their Properties**
- **Differentiation**

Overview

During the **Preparation for Calculus** chapter, students will review several concepts that will help prepare them for their study of calculus. These concepts include sketching the graphs of equations and functions and fitting mathematical models to data. It is important to review these concepts prior to moving forward with calculus. In **Chapter 1: Limits and Their Properties**, students will become acquainted with the relationship between algebra/geometry and the development of Calculus. Evaluating limits both analytically and graphically is a major area of the unit and will be emphasized. Students should use the graphing calculator to help develop the intuitive feel of limits and graph behavior. This chapter will allow students to have a complete understanding of limits and how they are used. The main topics addressed will be rational exponents, simplifying expressions, writing linear equations, and average rate of change. **Chapter 2: Differentiation** prepares the students for applications in differential calculus by giving them a firm grasp of methods of differentiation. Emphasis is placed on what a derivative represents (slope of a tangent line to a point on a curve) and the graphical differences between f(x) and f'(x). The relationship between differentiability and continuity is also a major point of interest in this chapter.

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
Chapter P: Preparation for Calculus **(Allow approximately 3 weeks for instruction, review, and assessment)**			
Preparation: **Algebra I & Algebra II** **A2.A.APR.A.2** **A1. A. CED.A.2** **A2. A. REI.A.1** **A2. A. REI.B.3** **A2. A. REI.C.4** **A1. A. REI.D.5** **A1. A. REI.D.6** **A2. F.IF.A.1** **A2. F.IF.C.B.3a/3b/3c** **A2. F.BF.A.1**	**Essential Questions:** • How can you identify the characteristics of equations and sketch their graphs? • How do you find and graph equations of lines, including parallel and perpendicular lines, using the concept of slope? • How can you evaluate and graph functions and their transformations? **Objectives:** Students will: • Sketch the graph of an equation. • Find the intercepts of a graph. • Test a graph for symmetry with respect to an axis and the origin. • Find the points of intersection of two graphs. • Interpret mathematical models for real-life data.	P.1: Graphs and Models **Additional Resource(s)** Larson Calculus Videos – Section P.1 Visual Calculus Tutorials Introducing Families of Functions Algebra and Geometry Review Videos Algebra II Activities Using the TI84	Graphic Organizers (9-12)
Preparation: **Algebra I, Algebra II & Geometry** **A1. A. CED.A.2** **A1. A. REI.B.2** **F.IF.A.A.2** **A1. A.F. LE.A.2** **G. GPE.B.3**	**Essential Questions:** • What is a linear function? • What are the different ways that linear functions may be represented? • What is the significance of a linear function's slope and *y*-intercept? • How may linear functions model real world situations? • How may linear functions help us analyze real world situations and solve practical problems? **Objectives:** Students will:	P.2: Linear Models and Rates of Change **Additional Resource(s)** Larson Calculus Videos – Section P.2 Khan Academy Videos: Linear Models Khan Academy Videos: Slope & rate of Change Visual Calculus Tutorials Functions and Graphs Review Videos Algebra II Activities Using the TI84	

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
	• Find the slope of a line passing through two points. • Write the equation of a line with a given point and slope. • Interpret slope as a ratio or as a rate in a real-life application. • Sketch the graph of a linear equation in slope-intercept form. • Write equations of lines that are parallel or perpendicular to a given line.		
A1. F. IF.A.1 **A1. F. IF.B.4** **A1. F. IF.C.6b** **A2. F.BF.A.1b** **A2. F.BF.B.3**	**Essential Questions:** • How do functions model real world situations? • How do functions help us analyze real world situations and solve practical problems? **Objectives:** Students will: • Use function notation to represent and evaluate a function. • Find the domain and range of a function. • Sketch the graph of a function. • Identify different types of transformations of functions. • Classify functions and recognize combinations of functions.	P.3: Functions and Their Graphs **Additional Resource(s)** Larson Calculus Videos – Section P.3 Visual Calculus Tutorials Functions and Graphs Review Videos Algebra II Activities Using the TI84	Graphic Organizers (9-12)
A1. F. IF.B.4 **A2. F.BF.B..4**	**Essential Questions:** • When and how is mathematical modeling used to solve real world problems? • When is it advantageous to represent relationships between quantities symbolically? Numerically? Graphically?	P.4: Fitting Models to Data **Additional Resource(s)** Larson Calculus Videos – Section P.4 Visual Calculus Tutorials Functions and Graphs Review Videos Algebra II Activities Using the TI84	

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
	Objectives: Students will • Fit a linear model to a real-life data set. • Fit a quadratic model to a real-life data set. • Fit a trigonometric model to a real-life data set.	Algebra Cheat Sheet	
Chapter 1: Limits and Their Properties **(Allow approximately 4 weeks for instruction, review, and assessment)**			
Domain: Limits of Functions **Cluster:** Understand the concept of the limit of a function. **C.F.LF.A.2** Estimate limits of functions (including one-sided limits) from graphs or tables of data. Apply the definition of limit to a variety of functions, including piece-wise functions. **C.F.LF.A.3** Draw a sketch that illustrates the definition of the limit; develop multiple real-world scenarios that illustrate the definition of the limit. **Domain:** Understand the Concept of the Derivative **Cluster**: Understand the derivative at a point. **C.D.CD.B.5** Interpret the derivative as the slope of a curve (which could be a line) at a point, including points at which there are vertical tangents and points at which	**Essential Questions:** • How does the derivative represent an instantaneous rate of change? • How does the integral represent the summation of an infinite set? • How do you determine that a function is continuous and/or differentiable? • Is there a way to visualize what a derivative is? **Objectives:** Students will • Understand what calculus is and how it compares with precalculus. • Understand that the tangent line problem is basic to calculus. • Understand that the area problem is also basic to calculus. • Estimate a limit using a numerical or graphical approach. • Learn different ways that a limit can fail to exist. • Study and use a formal definition of a limit.	1.1: A Preview of Calculus 1.2: Finding Limits Graphically and Numerically **Additional Resource(s)** Larson Calculus Videos –Section 1.1 Calculus Tutorial Videos Brightstorm: Finding Limits Graphically Calculus Activities Using the TI-84 Visual Calculus Tutorials	**Chapter 1 Vocabulary:** Domain, range, independent, dependent variable, graph, function, absolute value, increasing, decreasing, linear , quadratic, polynomial, coefficients, degree, cubic , power, root,, reciprocal , rational, algebraic, trigonometric, exponential, logarithmic , translations, composite , limit, right-hand limit, left-hand limit, vertical asymptote, continuous at a point, discontinuity, removable discontinuity, jump discontinuity, horizontal asymptote, infinite limits, limits at infinity, intermediate value theorem. **Writing in Math** • What is the definition of a limit? • What does it mean for a function to be continuous? • How do you find the slope of a line tangent to a curve?

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
there are no tangents (i.e., where a function is not locally linear). **C.D.CD.B.7** Write the equation of the line tangent to a curve at a given point.			
Domain: Limits of Functions **Cluster:** Understand the concept of the limit of a function. **C.F.LF.A.1** Calculate limits (including limits at infinity) using algebra.	**Objectives:** Students will • Evaluate a limit using properties of limits. • Develop and use a strategy for finding limits. • Evaluate a limit using dividing out and rationalizing techniques. • Evaluate a limit using the squeeze theorem.	1.3: Evaluate Limits Analytically **Additional Resource(s)** Larson Calculus Videos –Chapter 1.3 Calculus Tutorial Videos Brightstorm: Evaluating Limits Analytically Calculus Activities Using the TI-84 Visual Calculus Tutorials	
Domain: Continuity **Cluster:** Develop an understanding of continuity as a property of functions. **C.F.C.A.1** Define continuity at a point using limits; define a continuous function. **C.F.C.A.2** Determine whether a given function is continuous at a specific point. **C.F.C.A.3** Determine and define different types of discontinuity (point, jump, infinite) in terms of limits. **C.F.C.A.4** Apply the Intermediate Value Theorem and Extreme Value Theorem to continuous functions.	**Objectives:** Students will • Determine continuity at a point and continuity on a closed interval. • Determine one-sided limits and continuity on a closed interval. • Use properties of continuity. • Understand and use the Intermediate Value Theorem.	1.4: Continuity and One-Sided limits **Additional Resource(s)** Larson Calculus Videos – Section 1.4 Brightstorm: Continuity of a Function Calculus Tutorial Videos Calculus Activities Using the TI-84 Visual Calculus Tutorials	Graphic Organizers (9-12)

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
Domain: Limits of Functions **Cluster:** Understand the concept of the limit of a function. **C.F.LF.A.1** Calculate limits (including limits at infinity) using algebra. **Domain:** Behavior of Functions **Cluster:** Describe asymptotic and unbounded behavior of functions. **C.F.BF.A.1** Describe asymptotic behavior (analytically and graphically) in terms of infinite limits and limits at infinity. **C.F.BF.A.2** Discuss the various types of end behavior of functions; identify prototypical functions for each type of end behavior.	**Objectives:** Students will • Determine infinite limits from the left and from the right. • Find and sketch the vertical asymptotes of the graph of a function.	1.5: Infinite Limits **Additional Resource(s)** Larson Calculus Videos –Section 1.5 Calculus Tutorial Videos Calculus Activities Using the TI-84 Visual Calculus Tutorials	
C.F.LF.A.1 (See above: Lesson 1.5) **C.F.BF.A.1** (See above: Lesson 1.5)	**Objectives:** Students will • Determine (finite) limits at infinity. • Determine the horizontal asymptotes, if any, of the graph of a function.	3.5: Limits at Infinity **Additional Resource(s)** Larson Calculus Video – Section 3.5 Calculus Tutorial Videos Calculus Activities Using the TI-84 Visual Calculus Tutorials	
Chapter 2: Differentiation **(Allow approximately 2 weeks for instruction, review, and assessment)**			
Domain: Understand the Concept of the Derivative **Cluster:** Demonstrate an understanding of the derivative.	**Essential Questions:** • Why is the derivative important? • How is the average rate of change related to the instantaneous rate of change?	2.1: The Derivative and the Tangent Line Problem **Additional Resource(s)** Larson Calculus Videos – Section 2.1	**Chapter 2 Vocabulary:** Tangent line, position, velocity, acceleration, average rate of change, instantaneous rate of change, derivative, differentiable, constant rule, power rule, sum rule, constant multiple rule, logarithmic rule, exponential rule, product

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
C.D.CD.A.1 Represent and interpret the derivative of a function graphically, numerically, and analytically. **C.D.CD.A.2** Interpret the derivative as an instantaneous rate of change. **C.D.CD.A.3** Define the derivative as the limit of the difference quotient; illustrate with the sketch of a graph. **C.D.CD.A.4** Demonstrate the relationship between differentiability and continuity. **Domain:** Understand the Concept of the Derivative **Cluster**: Understand the derivative at a point. **C.D.CD.B.6** Approximate both the instantaneous rate of change and the average rate of change given a graph or table of values.	• How is the derivative related to the tangent line to a curve? • What is the connection between differentiability and continuity? **Objectives:** Students will • Find the slope of the tangent line to a curve at a point. • Use the limit definition to find the derivative of a function. • Understand the relationship between differentiability and continuity.	Calculus Tutorial Videos Calculus Activities Using the TI-84 Visual Calculus Tutorials	rule, quotient rule, chain rule, trigonometric rules, inverse trigonometric rule, implicit differentiation, chain rule, higher order derivatives, orthogonal, linear approximation, linearization, differentials **Writing in Math** • What is the derivative of a function? • How do you find the derivative of a function? • What does it mean for a function to be differentiable? Graphic Organizers (9-12)
Domain: Computing and Applying Derivatives **Cluster:** Apply differentiation techniques. **C.D.AD. A .1** Describe in detail how the basic derivatives rules are used to differentiate a function; discuss the difference between using the limit definition of the derivative and using the derivative rules. **C.D.AD. A .2** Calculate the derivative of basic functions	**Objectives:** Students will • Find the derivative of a function using the Constant Rule. • Find the derivative of a function using the Power Rule. • Find the derivative of a function using the Constant Multiple Rule. • Find the derivative of a function using Sum and Difference Rules.	2.2: Basic Differentiation Rules and Rates of Change **Additional Resource(s)** Larson Calculus Videos – Section 2.2 Calculus Tutorial Videos Calculus Activities Using the TI-84 Visual Calculus Tutorials	

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
(power, exponential, logarithmic, and trigonometric). **C.D.AD. A .3** Calculate the derivatives of sums, products, and quotients of basic functions.	• Find the derivative of the sine function and the cosine function. • Use derivatives to find Rates of Change.		

RESOURCE TOOLBOX		
Textbook Resources Larson/Edwards *Calculus of a Single Variable* © 2010 Larson Calculus	**Standards** Common Core Standards - Mathematics Common Core Standards - Mathematics Appendix A Edutoolbox.org (formerly TN Core) The Mathematics Common Core Toolbox Tennessee Academic Standards for Mathematics	**Videos** Larson Calculus Videos Khan Academy Hippocampus Brightstorm Pre-Calculus Review University of Houston Videos
Calculator Calculus Activities Using the TI-84 TICommonCore.com Texas Instruments Education Casio Education TI Emulator	**Interactive Manipulatives** http://www.ct4me.net/math_manipulatives_2.htm Larson Interactive Examples	
Additional Sites Visual Calculus Tutorials Lamar University Tutorial PowerPoint Lectures Algebra Cheat Sheet Trigonometry Cheat Sheet Online Algebra and Trigonometry Tutorial Study Tips for Math Courses MathBits Calculus Resources http://www.freemathhelp.com/calculus-help.html http://www.calculus.org/ http://www.calcchat.com/ http://functions.wolfram.com http://www.analyzemath.com/Graphing/piecewise_functions.html		