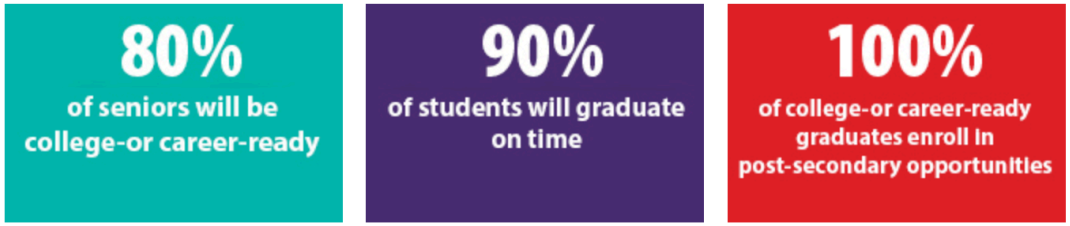
Quarter 1	Quarter 2		Quarter 3	Quarter 4	
Various Functions & Their Graphs, Polynomials & Polynomial Functions, Inverse Functions	Trigonometric Functions and Their Graphs, Unit Circle, Inverse Trigonometric Functions, Law of Sines, Law of Cosines, Trigonometric Identities		Exponential and Logarithmic Functions, Conic Sections	Systems of Equations and Matrices, Polar Coordinates and Complex Numbers, Sequences and Series, Limits and Introduction to Integrals	
August 6 2018 – October 5, 2018	October 15, 2018 – December 19, 2018		January 7, 2019 – March 8, 2019	March 18, 2019 – May 23, 2019	
P.F.IF.A.1	P. G.AT.A.1	P.F.GT.A.8	P.A.PE.A.1	P. A. REI.A.1	P.A.S.A.1
P.F.IF.A.2	P.G.AT.A.3	P.G.TI.A.2	P.A.PE.A.2	P. A. REI.A.2	P.A.S.A.2
P.F.IF.A.4	P.G.AT.A.5		P. A.C.A.2	P. N. VM.A.1	P.A.S.A.3
P.F.IF.A.5	P.G.AT.A.6		P. A.C.A.3	P. N. VM.A.2	P.A.S.A.4
P.F.IF.A.6	P.F.TF.A.1		P.F.IF.A.2	P. N. VM.A.3	P.A.S.A.5
P.F.IF.A.7	P.F.TF.A.2		P.F.IF.A.3	P. N. VM.B.4	P. N. VM.C.13
P.F.BF.A.1	P.F.GT.A.3		P.F.IF.A.5	P. N. VM.B.5	Calculus C.F.LF.A.2
P.F.BF.A.3	P.F.GT.A.4		P.S.MD.A.1	P. N. VM.B.6	Calculus C.F.LF.A.3
P.F.BF.A.5	P.F.GT.A.5		P.S.MD.A.2	P.G.PC.A.1	
P.F.BF.A.6	P.F.GT.A.6		P.S.MD.A.3	P.G.PC.A.2	
P.N.CN.B.7	P.F.GT.A.7		P.N.NE.A.1	P.G.PC.A.3	
			P.N.NE.A.2		

Tennessee Academic Standards for Mathematics

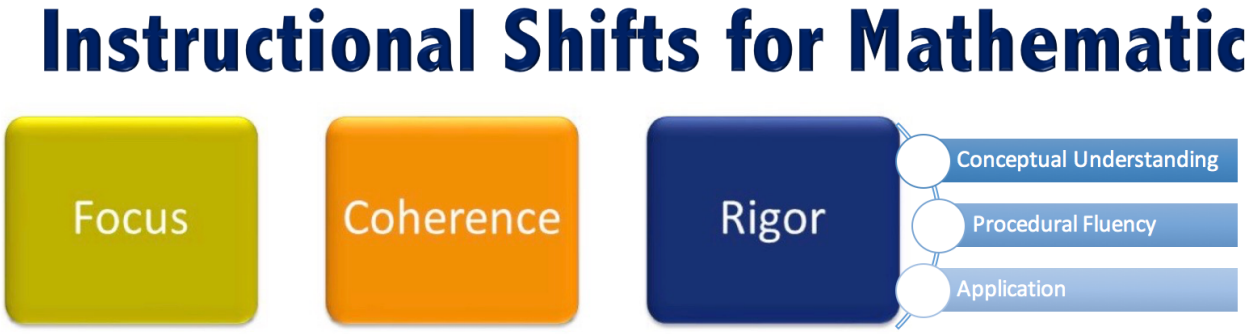
Introduction

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

Tennessee Academic Standards for Mathematics

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.

Tennessee Academic Standards for Mathematics

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.

Tennessee Academic Standards for Mathematics

Topics Addressed in Quarter

- **Systems of Equations and Matrices**
- **Polar Coordinates and Complex Numbers**
- **Sequences and Series**
- **Limits and Introduction to Integrals**

Overview

In this quarter students see that complex numbers can be represented in the Cartesian plane and that operations with complex numbers have a geometric interpretation. They connect their understanding of trigonometry and geometry of the plane to express complex numbers in polar form. Students also work with vectors, representing them geometrically and performing operations with them. They connect the notion of vectors to the complex numbers. Students also work with matrices and their operations and they see the connection between matrices and transformations of the plane. They also find inverse matrices and use matrices to represent and solve linear systems.

Students investigate vectors as geometric objects in the plane that can be represented by ordered pairs, and matrices as objects that act on vectors. Through working with vectors and matrices both geometrically and quantitatively, students discover that vector addition and operations observe their own set of rules. Students find inverse matrices by hand in 2x2 cases and use technology in other cases. Students solve of real-world problems that can be modeled by writing equations and solved with matrices.

In earlier grades students learned about arithmetic and geometric sequences and their relationships to linear and exponential functions, respectively. Students build upon their understandings of those sequences and extend their knowledge to include arithmetic and geometric series, both finite and infinite. Summation notation and properties of sums are also introduced. Lastly, students are introduced to some calculus topics, namely limits and area under a curve/integration.

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
Glencoe: Chapter 6: *Systems of Equations and Matrices*; Chapter 8: *Vectors*; Chapter 9: *Polar Coordinates and Complex Numbers*; Chapter 10: *Sequences and Series* **Sullivan:** Chapter 9: *Polar Coordinates; Vectors*: Chapter 11: *Systems of Equations and Equalities*; Chapter 12 **(Allow approximately 4 weeks for instruction, review, and assessments)**			
Domain: Reasoning with Equations and Inequalities **Cluster:** Solve systems of equations and nonlinear inequalities. **P. A. REI.A.1** Represent a system of linear equations as a single matrix equation in a	**Essential Question(s):** • How can we represent data in matrix form? • How do we add and subtract matrices and when are these operations defined? • How do we multiply matrices and when is	**Glencoe** 6-1: *Multivariable Linear Systems and Row Operations* 6-2: *Matrix Multiplication, Inverses, and Determinants* 6-2 Extend: *Determinants and Areas of*	**Vocabulary:** augmented matrix, coefficient matrix, elementary row operations, multivariable linear system, reduced row-echelon form, Gaussian elimination, Gauss-Jordan elimination, identity matrix, inverse matrix, inverse, invertible, singular matrix, determinant

Tennessee Academic Standards for Mathematics

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
vector variable. **P. A. REI.A.2** 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 × 3 or greater). **Domain:** Vector and Matrix Quantities **Cluster:** Perform operations on matrices and use matrices in applications. **P. N. VM.C.9** Add, subtract, and multiply matrices of appropriate dimensions. **P. N. VM.C.13** Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.	this operation defined? • What is an identity matrix and how does it behave? • How do we find the determinant of a matrix and when is it nonzero? • How do we find the inverse of a matrix and when does a matrix not have an inverse defined? • How do we solve systems of equations using inverse matrices? **Objective(s):** Students will • Solve systems of linear equations using matrices. • Add, subtract, and multiply matrices of appropriate dimensions and multiply matrices by scalars. • Find determinants and inverses of matrices. • Find areas of polygons using determinants.	*Polygons* **Sullivan** 11.2: *Systems of Linear Equations: Matrices* 11.3: *Systems of Linear Equations: Determinants* 11.4: *Matrix Algebra* 4-1: *Right Angle Trigonometry* **Additional Resources:** Khan Academy: Matrices *Select appropriate lessons from the following Module:* engage^{ny} Lessons (Precalculus & Advanced Topics), Module 2: Vectors & Matrices	**Writing in Math/ Discussion** Why is it helpful to have multiple methods for solving a system of equations? Have students describe a reduced-echelon matrix to a partner and how it is used to solve a system of linear equations. Create a system of 3 variable equations that has infinitely many solutions. Explain your reasoning. Explain why a nonsquare matrix cannot have an inverse.
Domain: Vector and Matrix Quantities **Cluster:** Represent and model with vector quantities. **P. N. VM.A.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*).	**Essential Question(s):** • How are vectors and scalars similar and different? • How can I use vector operations to model, solve, and interpret real-world problems? • How can I represent addition, subtraction, and scalar multiplication of vectors	**Glencoe** 8-1: *Introduction to Vectors* 8-2: *Vectors in the Coordinate Plane* 8-3: *Dot Products and Vector Projections* **Sullivan** 9.4: *Vectors* 9.5: *The Dot Product*	**Vocabulary:** vector, initial point, terminal point, standard position, direction, magnitude, quadrant bearing, true bearing, parallel vectors, equivalent vectors, opposite vectors, resultant, triangle method, parallelogram method, zero vector, components, rectangular components, component form, unit vector, linear combination, dot product, orthogonal, vector projection, work

Tennessee Academic Standards for Mathematics

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
P. N. VM.A.2 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. **P. N. VM.A.3** Solve problems involving velocity and other quantities that can be represented by vectors. **Domain:** Vector and Matrix Quantities **Cluster:** Understand the graphic representation of vectors and vector arithmetic. **P. N. VM.B.4** Add and subtract vectors. a. 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. b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. c. Understand vector subtraction ***v*** – ***w*** as ***v*** + (–***w***), where –***w*** is the additive inverse of ***w***, with the same magnitude as ***w*** and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise. **P. N. VM.B.5** Multiply a vector by a scalar. a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as *c*(*v*x, *v*y) = (*cv*x, *cv*y).	geometrically? • What are some different ways to add two vectors, and how are these representations related? **Objective(s):** Students will • Represent and operate with vectors geometrically. • Solve vector problems, including velocity and other quantities that can be represented by vectors. • Add/Subtract vectors both algebraically and graphically. • Multiply a vector by a scalar both algebraically and graphically. • Calculate and interpret the dot product.	**Task(s):** GSE Pre-Calculus Unit 7: Vectors Walking and Flying Around Hogsmeade, p.13 A Delicate Operation, p.25 Hedwig and Errol, p.33 Putting Vectors to Use, p. 47 He Who Must Not Be Named, p. 54 **Additional Resources** Khan Academy: Vector Basics *Select appropriate lessons from the following Module:* engage^{ny} Lessons (Precalculus & Advanced Topics), Module 2: Vectors & Matrices Illuminations Lesson: Sums of Vectors and Their Properties	**Writing in Math/ Discussion** Have students explain how to add and subtract two vectors. Have them include diagrams. Ask students to write a vector and demonstrate how to calculate the magnitude of the vector using the dot product. Compare and contrast the parallelogram and triangle methods of finding the resultant of two or more vectors. Explain how to find the direction angle of a vector in the fourth quadrant. Determine whether the statement below is true or false. *If **a** and **b** are both orthogonal to **v** in the plane, then **a** and **b** are parallel.* Explain your reasoning. See engage^{ny} Lessons for Exit Tickets/Discussion Questions

Tennessee Academic Standards for Mathematics

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
b. Compute the magnitude of a scalar multiple $c\mathbf{v}$ using $\|\|c\mathbf{v}\|\| = \|c\|v$. Compute the direction of $c\mathbf{v}$ knowing that when $\|c\|v \neq 0$, the direction of $c\mathbf{v}$ is either along $\mathbf{v}$ (for $c > 0$) or against $\mathbf{v}$ (for $c < 0$). **P. N. VM.B.6** Calculate and interpret the dot product of two vectors.			
Domain: Polar Coordinates **Cluster:** Use polar coordinates. **P.G.PC.A.1** Graph functions in polar coordinates. **P.G.PC.A.2** Convert between rectangular and polar coordinates. **P.G.PC.A.3** Represent situations and solve problems involving polar coordinates	**Essential Question(s):** • Why are functions represented by polar equations? • How are complex numbers connected to polar coordinates? • How can I represent complex numbers graphically? • How does the complex plane show addition, subtraction, multiplication, and conjugation of complex numbers? • What are two ways to represent a complex number, and what are the advantages of each form? • How are operations on real numbers represented in the complex plane? **Objective(s):** • Graph points and functions with polar coordinates. • Convert from polar coordinates to rectangular coordinates and vice versa. • Perform operations with pure imaginary numbers and complex numbers and represent complex numbers on the	**Glencoe** 9-1: *Polar Coordinates* 9-2: *Graphs of Polar Equations* 9-3: *Polar and Rectangular Forms of Equations* 0-2: Operations with Complex Numbers 9-5: Complex Numbers and DeMoivre's Theorem **Sullivan** 9.1: *Polar Coordinates* 9.2: *Polar Equations and Graphs* 9.3: *The Complex Plane; DeMoivre's Theorem* **Task(s):** GSE Pre-Calculus Unit 7: Vectors It's Not That Complex, p. 62 A Plane You Can't Fly, p.66 Complex Operations, p. 76 **Additional Resources:** Khan Academy: Polar Coordinates	**Vocabulary:** Polar coordinate system, pole, polar axis, polar coordinates, polar equation, polar graph, limaçon, cardioid, rose, leminiscate, spiral of Archimedes, imaginary unit, complex number, standard form, real part, imaginary part, imaginary number, pure imaginary number, complex conjugates, complex plane, real axis, Argand plane, absolute value of a complex number, polar form, trigonometric form, modulus, augment, *p*th roots of unity **Writing in Math/ Discussion** Ask students to write a few sentences comparing and contrasting the polar coordinate system and the rectangular coordinate system. Make a conjecture as tom why having the polar coordinates for an aircraft is not enough to determine its exact location. Describe the effect of *a* in the graph of $r = a \cos \Theta$.

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
	complex plane. • Use complex conjugate to write quotients of complex numbers in standard form. • Convert complex numbers from rectangular to polar form and vice versa. • Find products, quotients, powers, and roots of complex numbers in polar form.	Wolfram: Polar Coordinates Khan Academy: Complex Numbers Wolfram: Complex Number engage^{ny} Lessons (Precalculus & Advanced Topics), Module1, Topic B: Complex Number Operations and Transformations	How are complex numbers used in real-life situations? Explain why the sum of the imaginary parts of the *p*th roots of any positive real number must be zero. See engage^{ny} Lessons for Exit Tickets/Discussion Questions.
Glencoe: Chapter 10: *Sequences and Series* **Sullivan:** Chapter 12: *Sequences; Induction; the Binomial Theorem* **(Allow approximately 3 weeks for instruction, review, and assessments)**			
Domain: Sequences and Series **Cluster:** Understand and use sequences and series. **P.A.S.A.1** Demonstrate an understanding of sequences by representing them recursively and explicitly. **P.A.S.A.2** Use sigma notation to represent a series; expand and collect expressions in both finite and infinite setting.	**Essential Question(s):** • How do you tell the difference between an arithmetic and geometric sequence? • How can different calculations with an arithmetic or geometric sequence be used in the real world? • Why do we write a recursive and explicit formulas for sequences? • Why would we need to find the sum of an infinite series? **Objective(s):** Students will • Demonstrate an understanding of sequences by representing them recursively and explicitly. • Use sigma notation to represent a notation.	**Glencoe** 10-1: *Sequences, Series, and Sigma Notation* **Sullivan** 12.1: *Sequences* **Tasks:** Accelerated Mathematics III Framework, Unit 2: Sequences and Series Fascinating Fractals Learning Task, p. 17 **Additional Resources**: Khan Academy: Sequences and Series	**Vocabulary:** Sequence, term, finite sequence, infinite sequence, recursive sequence, explicit sequence, Fibonacci sequence, converge, diverge, series, finite series, *n*th partial sum, infinite series, sigma notation **Writing in Math/ Discussion** Describe why an infinite sequence must not only converge, but converge to 0, in order for there to be a sum. Make an outline that can be used to describe the steps involved in finding the 300th partial sum of the infinite sequence $a_n = 2n - 3$. Then explain how to express the same sum using sigma notation.

Tennessee Academic Standards for Mathematics

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
Domain: Sequences and Series **Cluster:** Understand and use sequences and series. **P.A.S.A.3** Derive and use the formulas for the general term and summation of finite or infinite arithmetic and geometric series, if they exist. a. Determine whether a given arithmetic or geometric series converges or diverges. b. Find the sum of a given geometric series (both infinite and finite). **c.** Find the sum of a finite arithmetic series.	**Essential Question(s):** • How can different calculations with an arithmetic sequence be used in the real world? • Why would we need to find the sum of an infinite series? **Objective(s):** Students will • Determine whether a given arithmetic series converges or diverges. • Find the sum of a finite arithmetic series.	**Glencoe** 10-2: *Arithmetic Sequences and Series* **Sullivan** 12.2: *Arithmetic Sequences* **Tasks:** Accelerated Mathematics III Framework, Unit 2: Sequences and Series Renaissance Festival Learning Task, p. 8 **Additional Resources**: Khan Academy: Sequences and Series Video: Arithmetic Sequences	**Vocabulary:** Arithmetic sequence, common difference, arithmetic means, first difference, second difference, arithmetic series **Writing in Math/ Discussion** You have learned that the *n*th term of an arithmetic sequence can be modeled by a linear function. Can the sequence of partial sums of an arithmetic series also be modeled by a linear function? If yes, provide an example. If no, how can the sequence be modeled?
Domain: Sequences and Series **Cluster:** Understand and use sequences and series. **P.A.S.A.3** Derive and use the formulas for the general term and summation of finite or infinite arithmetic and geometric series, if they exist. a. Determine whether a given arithmetic or geometric series converges or diverges. b. Find the sum of a given geometric series (both infinite and finite). **c.** Find the sum of a finite arithmetic series. **P.A.S.A.4** Understand that series represent the approximation of a number when truncated; estimate truncation error in specific examples.	**Essential Question(s):** • How can different calculations with a geometric sequence be used in the real world? • Why would we need to find the sum of an infinite series? **Objective(s):** Students will • Determine whether a given geometric series converges or diverges. • Find the sum of a given geometric series, both infinite and finite.	**Glencoe** 10-3: *Geometric Sequences and Series* **Sullivan** 12.3: *Geometric Sequences* **Tasks:** Mathematics Vision Project: Module 2 Arithmetic and Geometric Sequences Growing Dots Growing, Growing Dots Scott's Workout Don't Break the Chain Something to Chew On	**Vocabulary:** Geometric sequence, common ration, geometric means, geometric series **Writing in Math/ Discussion** Have students write how they know whether a sequence is a geometric sequence. Explain why an infinite geometric sequence will not have a sum if □r□> 1.

Tennessee Academic Standards for Mathematics

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
		Chew On This What Comes Next? What Comes Later? What Does It Mean? Geometric Meanies I Know…. What Do You Know? **Additional Resources**: Khan Academy: Sequences and Series	
Domain: Sequences and Series **Cluster:** Understand and use sequences and series. **P.A.S.A.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, with coefficients determined for example by Pascal's Triangle.	**Objective(s):** Students will • Know and apply the Binomial Theorem.	**Glencoe** 10-5: *The Binomial Theorem* **Sullivan** 12.5: *The Binomial Theorem* **Tasks:** Mathematics Vision Project: Module 3, Task 5 The Expansion **Additional Resources**: Khan Academy: The Binomial Theorem Khan Academy: Expand Binomials/Pascal's Triangle engage^{ny} (Precalculus & Advanced Topics), Module 3, Topic A, Lesson 4: The Binomial Theorem	**Vocabulary:** Binomial coefficients, Pascal's triangle, Binomial Theorem **Writing in Math/ Discussion** Describe how to find the numbers in each row of Pascal's triangle. Then write a few sentences to describe how the expansions of $(a + b)^{n-1}$ and $(a - b)^n$ are different. Determine whether the statement below is *sometimes, always,* or *never* true. Justify your reasoning. *If a binomial is raised to the power 5, the two middle terms of the expansion have the same coefficients.* See engage^{ny} Lessons for Exit Tickets/Discussion Questions.
Glencoe: Chapter 12: *Limits and Derivatives* **Sullivan**: Chapter 14: A Preview of Calculus: *The Limit, Derivative, and Integral of a Function* **(Allow approximately 2 weeks for instruction, review, and assessments)**			

Tennessee Academic Standards for Mathematics

TN STATE STANDARDS	CONTENT	INSTRUCTIONAL SUPPORT & RESOURCES	
Calculus **Domain:** Limits of Functions **Cluster:** Understand the concept of the limit of a function. **C.F.LF.A.2** Estimate limits of functions from graphs or tables of data.	**Essential Question(s):** How does the integral represent the summation of an infinite set? **Objective(s):** Students will • Estimate limits of functions at fixed values and at infinity. • Construct the difference quotient for a given function and simplify the resulting expression.	**Glencoe** 12-1: *Estimating Limits Graphically* 12-2: *Estimating Limits Algebraically* **Sullivan** 14.1: *Finding Limits Using Tables and Graphs* 14.2: *Algebra Techniques for Finding Limits* **Additional Resources:** Khan Academy: Limits Basics Calculus Help Videos - Limits Brightstorm: Finding Limits Graphically Better Lesson: Intro to Calculus Resources	**Vocabulary:** One-sided limit, two-sided limit **Writing in Math/ Discussion** Explain what method you would use to estimate limits if a function is continuous. Explain how this differs from methods used to estimate functions that are not continuous.
Calculus **Domain:** Understanding Integrals **Cluster:** Demonstrate understanding of a Definite Integral. **C.I.UI.A.3** Use Riemann sums (left, right, and midpoint evaluation points) and trapezoid sums to approximate definite integrals of functions represented graphically, numerically, and by tables of values.	**Objective(s):** Students will • Approximate the area under a curve using rectangles.	**Glencoe** 12-5: *Area Under a Curve and Integration* **Sullivan** 14.5: *The Area Problem; The Integral* **Additional Resources:** Khan Academy: Riemann Sums Khan Academy: Trapezoidal Sums Better Lesson: Intro to Calculus Resources	**Vocabulary** Regular partition, definite integral, lower limit, upper limit, right Riemann sum, integration **Writing in Math/ Discussion** Explain the effectiveness of using triangles and circles to approximate the area between a curve and the *x*-axis. In your own words using appropriate figures, describe the methods of upper sums and lower sums in approximating the area of a region.

RESOURCE TOOLBOX

Tennessee Academic Standards for Mathematics

RESOURCE TOOLBOX		
Textbook Resources ***Glencoe Precalculus © 2011*** ***http://connected.mcgraw-hill.com/connected/login.do*** ***Sullivan Precalculus: Enhanced with Graphing Utilities, 5e © 2009.***	***Standards*** *Common Core Standards - Mathematics* *Common Core Standards - Mathematics Appendix A* *The Mathematics Common Core Toolbox* *Common Core Lessons* Tennessee Academic Standards for Mathematics	***Videos*** *Khan Academy* *Lamar University Tutorial* *UCI Precalculus Instructional Videos*
Calculator *Texas Instruments Education* *Texas Instruments - Precalculus Activities* *Casio Education* *TI Emulator* *Math Nspired*	***Interactive Manipulatives*** *http://www.ct4me.net/math_manipulatives_2.htm* *Illuminations (NCTM)* **ACT** ACT College & Career Readiness Mathematics Standards **Tasks/Lessons** UT Dana Center Inside Math Tasks Math Vision Project Tasks Better Lesson Edutoolbox.org (formerly TN Core) **SCS Math Tasks (Precalculus)**	***Additional Sites*** *http://functions.wolfram.com* *http://www.analyzemath.com/Graphing/piecewise_functions.html* *http://www.purplemath.com/* *http://www.onlinemathlearning.com/math-word-problems.html* *http://education.ti.com/calculators/downloads/US/Activities/Detail?id=9530* *Better Lesson* Algebra Cheat Sheet Trigonometry Cheat Sheet Online Algebra and Trigonometry Tutorial Study Tips for Math Courses *Graphic Organizers (9-12)*

Tennessee Academic Standards for Mathematics