Calculus Mathematics Instructional Materials Scoring Rubric

Introduction:

The following Instructional Materials Scoring Rubric for Mathematics is designed to score materials in the following categories:

- Instructional Focus
- Math Practices
- Aspects of Rigor
- Accessibility Features

Scoring:

Each section is to be scored using a 0, 1, or 2. For all sections, except for Rigor, use the following rubric when deciding on the appropriate rating:

- 0: The metric is not present within the material.
- 1: The metric is present within the material. The intent and/or frequency component of the metric is not fully met.
- 2: A rating of 2 indicates the metric is present and all aspects of the metric are fully met.

For Rigor:

- 0: The standard is not instructionally present within the material.
- 1: The standard is instructionally present but does not have an instructional focus on the indicated type of rigor.
- 2: The standard is instructionally present and has a clear instructional focus on the indicated type of rigor.

Note: Some standards appear under multiple aspects of rigor (i.e., Conceptual Understanding, Procedural Fluency, or Application). When scoring these standards, only score the part of the standard relevant to that aspect of rigor, which is identified by a bold, italics, larger font.

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Gateway: The publisher must provide a Tennessee standards alignment guide as a part of the scope and sequence for the material. If this gateway is not met, the materials will not be scored.

Instructional Focus				
	0	**1**	**2**	**Evidence**
Connections to content from prior grades are clearly identified and explicitly related to grade-level work.				
Materials embed a minimum of 3 tasks in every unit. Each task has multiple entry-points and can be solved using a minimum of 2 solution strategies and/or representations.				
Materials give students opportunities to work problems within each lesson. Each problem set: • Covers the full breadth of the standard(s) covered in the lesson • Is aligned to on grade level expectations as identified in the standard(s)				
Teacher resources indicate common student misconceptions in every unit and provide guidance on how to instructionally address the identified misconceptions.				
Materials provide educative supports (e.g., adult level explanations of the standards and strategies) in every lesson for teachers to ensure standards are taught accurately and to the appropriate level of rigor (i.e., conceptual understanding, procedural fluency, and application) as indicated by the standards.				
Materials develop student understanding of multiple representations (i.e., concrete, representational, abstract) for relevant standards which are identified in the state's Instructional Focus Documents.				
Materials include problems and activities in every unit that connect two or more grade level standards in a domain (e.g., 4.OA.A.1 and 2.OA.A.2).				
Materials include problems and activities in every unit that connect two or more grade level domains. (e.g., 4.MD.A.2 and 4.OA.A.3)				
Materials provide opportunities for students to participate in a spiraled review in every unit.				
			Total	

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Mathematical Practices				
Math Practices/Literacy Skills for Math Proficiency	**0**	**1**	**2**	**Evidence**
Materials embed the eight math practice standards in every unit.				
Math practice standards are clearly identified in both teacher and student materials.				
Materials use appropriate math vocabulary which is aligned to the grade level standards.				
Materials support students in discussing and articulating mathematical ideas. Within each lesson students either write or verbally justify their thoughts.				
			Total	

Accessibility Features				
Digital Materials	**0**	**1**	**2**	**Evidence**
All lessons within the materials are available in digital form and include a printable option.				
In every lesson, materials include recommended supports, accommodations, and modifications for Students with Disabilities and English Language Learners that will support their regular and active participation in accessing on grade level material (e.g., modifying vocabulary words within word problems, sentence starters, etc.).				
			Total	

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Aspects of Rigor				
Conceptual Understanding: The materials support the intentional development of students' conceptual understanding of key mathematical concepts, especially where called for in specific content standards or clusters.	**0**	**1**	**2**	**Evidence**
C.F.LF.A.1 Calculate limits (including limits at infinity) using algebra.				
C.F.LF.A.2 Estimate limits of functions (including one-sided limits) from graphs or tables of data. Apply the definition of a 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.				
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.				
C.F.C.A.1 Define continuity at a point using limits; define continuous functions.				
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.				
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.				
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 there are no tangents (i.e., where a function is not locally linear).				

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.				
C.D.CD.B.7 Write the equation of the line tangent to a curve at a given point.				
C.D.CD.B.8 Apply the Mean Value Theorem.				
C.D.CD.B.9 Understand Rolle's Theorem as a special case of the Mean Value Theorem.				
C.D.AD.A.1 Describe in detail how the basic derivative 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 (power, exponential, logarithmic, and trigonometric).				
C.D.AD.A.3 Calculate the derivatives of sums, products, and quotients of basic functions.				
C.D.AD.A.4 Apply the chain rule to find the derivative of a composite function.				
C.D.AD.A.5 Implicitly differentiate an equation in two or more variables				
C.D.AD.A.6 Use implicit differentiation to find the derivative of the inverse of a function.				
C.D.AD.B.7 Relate the increasing and decreasing behavior of f to the sign of f' both analytically and graphically.				
C.D.AD.B.8 Use the first derivative to find extrema (local/relative and global/absolute).				
C.D.AD.B.9 Analytically locate the intervals on which a function is increasing, decreasing, or neither.				
C.D.AD.B.10 Relate the concavity of f to the sign of f'' both analytically and graphically.				
C.D.AD.B.11 Use the second derivative to find points of inflection as points where concavity changes.				
C.D.AD.B.12 Analytically locate intervals on which a function is concave up, concave down, or neither.				
C.D.AD.B.13 Relate corresponding characteristics of the graphs of f, f', and f''.				
C.D.AD.B.14 Translate verbal descriptions into equations involving derivatives and vice versa.				
C.D.AD.C.15 Model rates of change, including related rates problems. In each case, include a discussion of units.				

C.D.AD.C.16 Solve optimization problems to find a desired maximum or minimum value.				
C.D.AD.C.17 Use differentiation to solve problems involving velocity, speed, and acceleration.				
C.D.AD.C.18 Use tangent lines to approximate function values and changes in function values when inputs change (linearization).				
C.I.UI.A.1 Define the definite integral as the limit of Riemann sums and as the net accumulation of change.				
C.I.UI.A.2 Write a Riemann sum that represents the definition 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.				
C.I.UI.B.4 Recognize differentiation and antidifferentiation as inverse operations.				
C.I.UI.B.5 Evaluate definite integrals using the Fundamental Theorem of Calculus.				
C.I.UI.B.6 Use the Fundamental Theorem of Calculus to represent a particular antiderivative of a function and to understand when the antiderivative so represented is continuous and differentiable.				
C.I.UI.B.7 Apply basic properties of definite integrals (e.g. additive, constant multiple, translations).				
C.I.AI.A.1 Find antiderivatives that follow directly from derivatives of basic functions (power, exponential, logarithmic, and trigonometric).				
C.I.AI.A.2 Use substitution of variables to calculate antiderivatives (including changing limits for definite integrals).				
C.I.AI.A.3 Find specific antiderivatives using initial conditions.				
C.I.AI.B.4 Use a definite integral to find the area of a region.				
C.I.AI.B.5 Use a definite integral to find the volume of a solid formed by rotating a region around a given axis.				
C.I.AI.B.6 Use integrals to solve a variety of problems (e.g., distance traveled by a particle along a line, exponential growth/decay).				
Procedural Skill and Fluency: The materials provide intentional opportunities for students to develop procedural skills and fluencies, especially where called for in specific content standards or clusters	**0**	**1**	**2**	**Evidence**
C.F.LF.A.1 Calculate limits (including limits at infinity) using algebra.				

C.F.LF.A.2 Estimate limits of functions (including one-sided limits) from graphs or tables of data. Apply the definition of a 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.				
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.				
C.F.C.A.1 Define continuity at a point using limits; define continuous functions.				
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.				
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.				
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 there are no tangents (i.e., where a function is not locally linear).				
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.				
C.D.CD.B.7 Write the equation of the line tangent to a curve at a given point.				
C.D.CD.B.8 Apply the Mean Value Theorem.				
C.D.CD.B.9 Understand Rolle's Theorem as a special case of the Mean Value Theorem.				
C.D.AD.A.1 Describe in detail how the basic derivative rules are used to differentiate a function; discuss the difference between using the limit definition of the derivative and using the derivative rules.				

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C.D.AD.A.2 Calculate the derivative of basic functions (power, exponential, logarithmic, and trigonometric).				
C.D.AD.A.3 Calculate the derivatives of sums, products, and quotients of basic functions.				
C.D.AD.A.4 Apply the chain rule to find the derivative of a composite function.				
C.D.AD.A.5 Implicitly differentiate an equation in two or more variables				
C.D.AD.A.6 Use implicit differentiation to find the derivative of the inverse of a function.				
C.D.AD.B.7 Relate the increasing and decreasing behavior of f to the sign of f' both analytically and graphically.				
C.D.AD.B.8 Use the first derivative to find extrema (local/relative and global/absolute).				
C.D.AD.B.9 Analytically locate the intervals on which a function is increasing, decreasing, or neither.				
C.D.AD.B.10 Relate the concavity of f to the sign of f'' both analytically and graphically.				
C.D.AD.B.11 Use the second derivative to find points of inflection as points where concavity changes.				
C.D.AD.B.12 Analytically locate intervals on which a function is concave up, concave down, or neither.				
C.D.AD.B.13 Relate corresponding characteristics of the graphs of f, f', and f''.				
C.D.AD.B.14 Translate verbal descriptions into equations involving derivatives and vice versa.				
C.D.AD.C.15 Model rates of change, including related rates problems. In each case, include a discussion of units.				
C.D.AD.C.16 Solve optimization problems to find a desired maximum or minimum value.				
C.D.AD.C.17 Use differentiation to solve problems involving velocity, speed, and acceleration.				
C.D.AD.C.18 Use tangent lines to approximate function values and changes in function values when inputs change (linearization).				
C.I.UI.A.1 Define the definite integral as the limit of Riemann sums and as the net accumulation of change.				
C.I.UI.A.2 Write a Riemann sum that represents the definition 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.				
C.I.UI.B.4 Recognize differentiation and antidifferentiation as inverse operations.				
C.I.UI.B.5 Evaluate definite integrals using the Fundamental Theorem of Calculus.				
C.I.UI.B.6 Use the Fundamental Theorem of Calculus to represent a particular antiderivative of a function and to understand when the antiderivative so represented is continuous and differentiable.				
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C.I.AI.A.2 Use substitution of variables to calculate antiderivatives (including changing limits for definite integrals).				
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C.I.AI.B.5 Use a definite integral to find the volume of a solid formed by rotating a region around a given axis.				
C.I.AI.B.6 Use integrals to solve a variety of problems (e.g., distance traveled by a particle along a line, exponential growth/decay).				
Applications: The materials support the intentional development of students' ability to utilize mathematical concepts and skills in engaging applications, especially where called for in specific content standards or clusters.	**0**	**1**	**2**	**Evidence**
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C.D.AD.B.10 Relate the concavity of *f* to the sign of *f″* both analytically and graphically.				
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			Total	