

# What Standards Based Specifications Grading Looks Like in the Classroom:

## CALCULUS II STANDARDS

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MATHEMATICAL MATURITY	KEY CONCEPTS AND THEORY	YOUR MATHEMATICAL TOOLBOX	EVALUATING INTEGRALS	APPLICATIONS OF CALCULUS
<p><b>Standard M1. Definitions. (core)</b> Do you understand what a definition is? Are you able to write an explicit definition statement? Are you able to explain what the definition means in your own words? Are you able to give examples and non-examples of the definition? This standard only involves the definitions for antiderivative and differential equation.</p>	<p><b>Standard C1. The Concept of an Integral. (core)</b> Do you understand what an antiderivative is? A definite integral? Do you understand when it exists? Do you understand what it means for a function to be integrable? Do you understand the difference between definite and indefinite integrals?</p>	<p><b>Standard T1. Differentiation Skills.</b> Are you able to apply your differentiation skills from Calculus I? Are you able to evaluate standard derivatives involving polynomials? Involving trigonometric functions? Involving exponential and logarithmic functions? Can you apply the product rule? The quotient rule? The chain rule?</p>	<p><b>Standard I1. Basic Integrals. (core)</b> (updated; split with I5) Can you evaluate standard antiderivatives, definite integrals, and indefinite integrals involving polynomials? Involving trigonometric functions?</p>	<p><b>Standard A1. Particle Motion. (updated)</b> Do you understand how position, velocity, and acceleration functions are related? Do you understand the difference between displacement and total distance traveled? Can you calculate displacement and distance traveled from a given velocity or acceleration? Do you understand how the relationship between position and velocity can be understood as the area under a curve?</p>
<p><b>Standard M2. Theorems.</b> Do you understand what a theorem is? Do you understand what a hypothesis is? Do you understand what a conclusion is? Are you able to determine the hypotheses and conclusions of a given theorem? Are you able to write an explicit theorem statement? Are you able to explain what a theorem means in your own words? Are you able to understand the consequences and non-consequences of a theorem?</p>	<p><b>Standard C2. Riemann Sums.</b> Can you use rectangles to approximate area under a curve? Can you set up a Riemann sum, both theoretically and for a given function? What is the midpoint rule?</p>	<p><b>Standard T2. Sigma Notation.</b> Can you convert from sums to sigma notation? Can you convert from sigma notation to a sum? Can you evaluate sums involving <math>\Sigma i</math>, <math>\Sigma i^2</math>, <math>\Sigma i^3</math>?</p>	<p><b>Standard I2. Substitution Rule. (core)</b> Can you correctly apply the substitution rule for integrals involving polynomials and trigonometric functions?</p>	<p><b>Standard A2. Area calculations with respect to x vs. with respect to y.</b> In order to calculate the area between curves, can you set up and evaluate an integral with respect to x? Can you set up and evaluate an integral with respect to y? Can you convert between the two?</p>
<p><b>Standard M3. Calculator Skills.</b> (Updated and split from M6) Can you use your calculator to take definite integrals? Can you use your calculator to calculate Riemann sums?</p>	<p><b>Standard C3. Key Theorems.</b> (updated) Can you state and apply the Fundamental Theorem of Calculus, parts I and II? Can you state and apply the Mean Value Theorem? What is the average value of a function?</p>	<p><b>Standard T3. Properties of Integrals.</b> Do you know and can you apply the algebraic properties that definite and indefinite integrals obey? Given a definite integral, can you determine simple upper and lower bounds for it?</p>	<p><b>Standard I3. FTC Integrals.</b> (updated) Can you evaluate expressions involving both derivatives and integrals? Can you apply FTC I when there are derivatives of integrals? And use the chain rule when necessary? Can you use FTC II when there are integrals of derivatives? Do you understand how to apply FTC II to calculate net change of a quantity?</p>	<p><b>Standard A3. Integrals as Slicing Mechanism, Application.</b> Can you set up integrals to calculate Area/Volume/Arc length by slicing? Can you identify the slices involved in <math>A = \int dA</math>? (Area) <math>V = \int dV</math>? (Volume) <math>L = \int dL</math>? (Arc length) Can you calculate volume of solids of revolution using cylindrical shells?</p>
<p><b>Standard M4. Mathematical Experience. (core)</b> Can you approach problems in multiple ways? Are you willing to make mistakes? Can you learn from your mistakes? Are you able to discuss mathematical concepts with your classmates? (Includes both talking and actively listening!) Can you contribute to a class discussion constructively and supportively?</p>	<p><b>Standard C4. Logarithmic and Exponential Functions. (core)</b> (updated 10/26) Do you understand what a logarithmic function is? An exponential function? <math>e^x</math>, <math>\ln x</math>, <math>a^x</math>, <math>\log_a x</math>? Can you convert between expressions involving exponentials and logarithms of different bases? Do you understand the inverse relationship between exponential and logarithmic functions? Do you know the shapes of the curves, the domains and ranges of these functions?</p>	<p><b>Standard T4. Inverse Functions.</b> Do you understand what the inverse of a function is? Do you understand inverse trigonometric functions? Can you determine the domains and ranges of the inverse of a function? Can you draw the graph of the inverse of a function? Do you understand what the properties of the inverse of a function are?</p>	<p><b>Standard I4. Inverse Function Calculus.</b> Do you know the general form of a derivative of an inverse function? Can you take the derivative of an inverse trigonometric function? Can you recognize when an inverse trigonometric function is the antiderivative?</p>	<p><b>Standard A4. Solving Differential Equations.</b> Can you set up a differential equation for a given situation? Can you solve a differential equation using separable equations? Can you visualize solutions to differential equations using vector fields?</p>
<p><b>Standard M5. Project Management.</b> Can you work together on your project as a group? Can you follow project instructions? Can you work toward a common goal with others? Can you work within a given timeframe and meet deadlines? Can you produce a well-written project summary?</p>	<p><b>Standard C5. Integrals as Slicing Mechanism, Theory. (core)</b> Do you understand the concepts of <math>A = \int dA</math>? (Area) <math>V = \int dV</math>? (Volume) <math>L = \int dL</math>? (Arc length)</p>	<p><b>Standard T5. Logarithmic Differentiation.</b> (new as of 10/26.) Can you apply the technique of logarithmic differentiation? Can you apply properties of logarithms in these calculations?</p>	<p><b>Standard I5. Exponential and Logarithm Calculus. (core)</b> (updated 10/26) Can you differentiate and integrate expressions involving exponential functions and logarithms including <math>e^x</math>, <math>\ln x</math>, <math>a^x</math>, <math>\log_a x</math>? Can you apply the substitution rule for expressions that involve exponential functions and logarithms?</p>	<p><b>Standard A5. Exponential Growth and Decay.</b> (updated, 10/26) Do you understand Exponential Growth and Decay? Can you apply Newton's Law of Cooling? Can you calculate the half-life of a decaying dample? Can you determine the value of a bank account calculated via continuously compounded interest?</p>
<p><b>Standard M6. Calculator and Computer Skills.</b> (Split from M3) Can you use Mathematica to plot functions? Can you use Mathematica's Documentation Center? Can you use Mathematica to compute the volume of the goblet in your project?</p>	<p><b>Standard C6. Differential Equations.</b> Do you understand the concept of a differential equation? Do you understand what an initial condition is?</p>	<p><b>Grades - At the end of the semester, your final grade will be based on the scores you have achieved for each of the standards, based on the following rubric:</b></p> <p><b>A - A score of 3.5 or higher on 21 of the 24 standards (90%) (including all the core standards) and no score lower than a 3 on the remaining standards.</b></p> <p><b>B - A score of 3 or higher on 19 of the 24 standards (80%) (including all the core standards) and no score lower than a 2.5 on the remaining standards.</b></p> <p><b>C - A score of 2 or higher on 19 of the 24 standards (80%) (including all the core standards) and no score lower than a 1 on the remaining standards.</b></p> <p><b>F - If you do not score 2 or higher on 19 of the 24 standards.</b></p> <p><b>Plus (+) and Minus (-) grades will be based on your homework, attendance, and in-class participation. If you answer correctly the vast majority of your homework problems, attend regularly, and actively participate in class, your grade will be raised from X to X+. On the other hand, if you do not complete your homework problems, if you have a large number of unexplained absences, or do not participate in class, your grade will be lowered from X to X-.</b></p>		