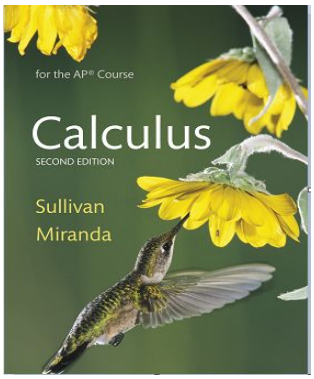
bedford, freeman & worth
high school publishers

2019 AP® Calculus AB & BC Course Framework Alignment to
Sullivan & Miranda, *Calculus for the AP® Course*, 2nd edition



CF Unit	2019 Course Framework Unit Title	Second Edition Chapter/Section	Recommendations and Observations
1	Limits and Continuity	***Limits and Continuity*** • 1.1 Limits of Functions Using Numerical and Graphical Techniques • 1.2 Limits of Functions Using Properties of Limits • 1.3 Continuity • 1.4 Limits and Continuity of Trigonometric, Exponential, and Logarithmic Functions • 1.5 Infinite Limits; Limits at Infinity; Asymptotes • 1.6 The ε - δ Definition of a Limit	Change is minimal. --Begin the course with the 2 pages entitled, *What Is Calculus?,* found at the front of the book. --After teaching sections 1.1 -1.5, you can use **Personal Progress Check 1** because section 1.6 is not assessed.
2	Differentiation: Definition and Basic Derivative Rules	***The Derivative*** • 2.1 Rates of Change and the Derivative • 2.2 The Derivative as a Function • 2.3 The Derivative of a Polynomial Function; The Derivative of $y = e^x$ • 2.4 Differentiating the Product and the Quotient of Two Functions; Higher-Order Derivatives • 2.5 The Derivative of the Trigonometric Functions	Change is minimal. --You can use **Personal Progress Check 2** after teaching section 2.5. --***Note:*** Since the mathematics does not support teaching the power rule $d/dx\ x^r$ for r a rational or a real number, and d/dx ln x, until Unit 3, at this point, have students trust that the rules work.
3	Differentiation: Composite, Implicit, and Inverse Functions	***More About Derivatives*** • 3.1 The Chain Rule • 3.2 Implicit Differentiation	The first four (of six) sections in 2e Chapter 3 remain in the new unit 3. --You can use **Personal Progress Check 3** after teaching section 3.4.

2019 AP® Calculus AB & BC Course Framework Alignment to
Sullivan & Miranda, *Calculus for the AP® Course*, 2nd edition

		• 3.3 Derivatives of the Inverse Trigonometric Functions • 3.4 Derivatives of Logarithmic Functions	
4	Contextual Applications of Differentiation	• 3.5 Differentials; Linear Approximations; Newton's Method • 4.1 Related Rates • 4.5 Indeterminate Forms and L'Hôpital's Rule	This new unit is assembled from sections taken from different parts of chapters 3 and 4 of 2e. --***Teaching tip***: Begin by stressing interpretations, which now loom larger in the curriculum. In particular, interpret the derivative as the slope of the tangent line to the graph of a function, as an instantaneous rate of change at a number, and as a velocity or acceleration. --After completing these three sections, you can use the **Personal Progress Check 4**.
5	Analytical Applications of Differentiation	***Applications of the Derivative*** • 4.2 Maximum and Minimum Values; Critical Numbers • 4.3 The Mean Value Theorem • 4.4 Local Extrema and Concavity • 4.6 Using Calculus to Graph Functions • 4.7 Optimization • 4.8 Antiderivatives; Differential Equations	This new unit largely conforms to 2e chapter 4. Note which sections "jumped forward" into unit 4. --After teaching these six sections, you can use **Personal Progress Check 5**.
6	Integration and Accumulation of Change	***The Integral*** • 5.1 Area • 5.2 The Definite Integral • 5.3 The Fundamental Theorem of Calculus • 5.4 Properties of the Definite Integral • 5.5 The Indefinite Integral; Method of Substitution ***Techniques of Integration*** • 7.1 Integration by Parts (BC topic) • 7.2 Integrals Containing Trigonometric Functions	The new unit includes a considerable portion of two chapters of the 2e. Begin with a review of antiderivatives (Section 4.8). --Note the categorization (AB or BC) of topics in the second half of the unit. This will guide the pace and choice of topic. --The logistic model is now part of the chapter on differential equations (see Unit 7). --***Note:*** For Calculus AB, Section 7.5, Objective 1 covers integration using long division. --After teaching these sections, you can use the **Personal Progress Check 6**.

		• 7.3 Integration by Trigonometric Substitution Integrands Containing $a_2 - x_2$, $x_2 + a_2$, or $x_2 - a_2$, $a > 0$ • 7.4 Integrands Containing $ax^2 + bx + c$ (AB topic) • 7.5 Integration of Rational Functions Using Partial Fractions; the Logistic Model (BC topic) • 7.6 Approximating Integrals: The Trapezoidal Rule; Trapezoidal Sums; The Midpoint Rule; Simpson's Rule (AB topic) • 7.7 Improper Integrals (BC topic) • 7.8 Integration Using Tables and CAS	
7	Differential Equations	• 5.7 Separable First Order Differentiable Equations • 5.6 Uninhibited and Inhibited Growth and Decay Models • 5.7 Slope Fields • 5.7 Euler's Method (BC topic) • 7.5 The Logistic Differential Equation (BC topic)	The new curriculum framework separates differential equations into a new unit. Note the 2e sections that will address this coverage. --***Teaching tip:*** Make sure to start off by classifying ordinary differential equations. Students have to be able to do so. --***Teaching tip:*** The logistic differential equation is found in 2e section 7.5, Integration of Rational Functions Using Partial Fractions; the Logistic Model. --Note differences in depth of coverage mandated for the AB course and the BC course. --After teaching these sections, you can use the **Personal Progress Check 7**.
8	Applications of Integration	***Applications of the Integral*** • 6.1 Area Between Graphs • 6.2 Volume of a Solid of Revolution: Disks and Washers • 6.3 Volume of a Solid of Revolution: Cylindrical Shells • 6.4 Volume of a Solid: Slicing • 6.5 Arc Length (BC topic); Surface Area of a Solid of Revolution	Unit 8 is basically Chapter 6 of the 2e. Some topics in the unit have been covered earlier and should be reviewed here. Specifically: Topic 8.1 Finding Average Value is covered in Section 5.3, Objective 3. Topic 8.2 Connecting Position, Velocity, and Acceleration of Functions Using Integrals is covered in Section 5.4, Objective 4. --Note that the treatment of arc length is a BC topic. --After teaching sections 6.1-6.4 and arc length from chapter 6 and the select sections from

		For enrichment: • 6.6 Work • 6.7 Hydrostatic Pressure and Force • 6.8 Center of Mass; Centroid; The Pappus Theorem	chapter 5, you can use **Personal Progress Check 8.** --Surface area, work, and Sections 6.6 – 6.8 are enrichment topics. They are not in the course curriculum, but they are important in physics, engineering, and related fields.
9	Parametric Equations, Polar Coordinates, and Vector-Valued Functions ***BC only***	***Parametric Equations; Polar Equations, Vector Functions*** • 9.1 Parametric Equations • 9.2 Tangent Lines • 9.3 Arc Length • 9.5 Polar Equations; Parametric Equations of Polar Equations; Arc Length of Polar Equations • 9.6 Area in Polar Coordinates • 11.1 Vector Functions and Their Derivatives • 11.2 Unit Tangent and Principal Unit Normal Vectors; Arc Length • 11.4 Motion along a Curve • 11.5 Integrals of Vector Functions; Projectile Motion	The new curriculum has combined sections from 2e chapters 9 and 11. --If you want to cover the basics of polar coordinates (or as a refresher), use 2e section 9.4. --If you want to cover the basics of vectors (or as a refresher), use 2e section 10.2 --After teaching these sections, you can use **Personal Progress Check 9**.
10	Infinite Sequences and Series ***BC only***	***Infinite Series*** • 8.1 Sequences • 8.2 Infinite Series • 8.3 Properties of Series; Series with Positive Terms; The Integral Test • 8.4 Comparison Tests • 8.5 Alternating Series; Absolute Convergence • 8.6 Ratio Test; Root Test • 8.7 Summary of Tests • 8.8 Power Series • 8.9 Taylor Series; Maclaurin Series • 8.10 Approximations Using Taylor/Maclaurin Expansions	Unit 10 is Chapter 8 of 2e. After teaching Chapter 8, you can use the **Personal Progress Check 10**.