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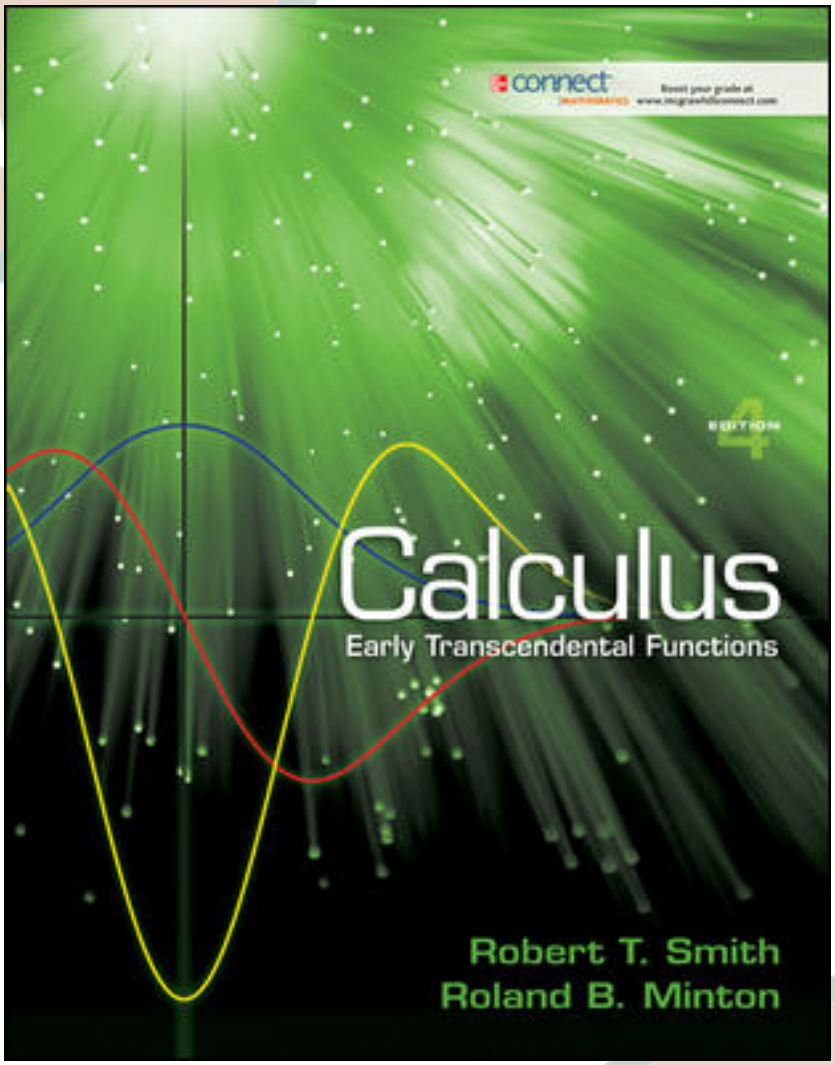
Advanced Placement*

CORRELATION GUIDE

Calculus: Early Transcendental Functions



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AP Correlation

Calculus: Transcendental Functions (Smith), 4th Edition

Topics for Calculus AB

I. Functions, Graphs and Limits	Chapters 0, 1, 3, 7
Analysis of graphs. With the aid of technology, graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function.	Chapters 0, 3 19-25, 259-268
Limits of functions (including one-sided limits)	Chapter 1
• An intuitive understanding of the limiting process.	70-77
• Calculating limits using algebra.	77-86
• Estimating limits from graphs or tables of data.	70-77
Asymptotic and unbounded behavior	Chapters 0, 1
• Understanding asymptotes in terms of graphical behavior.	96-106
• Describing asymptotic behavior in terms of limits involving infinity.	96-106
• Comparing relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth and logarithmic growth).	42-53, 499-509
Continuity as a property of functions	Chapters 1, 3
• An intuitive understanding of continuity. (The function values can be made as close as desired by taking sufficiently close values of the domain.)	86-96
• Understanding continuity in terms of limits.	86-96
• Geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem).	86-96, 232-243
II. Derivatives	Chapters 2, 3, 7
Concept of the derivative	Chapter 2
• Derivative presented graphically, numerically and analytically.	125-209
• Derivative interpreted as an instantaneous rate of change.	131-136, 149-153
• Derivative defined as the limit of the difference quotient.	127-153
• Relationship between differentiability and continuity.	140-141
Derivative at a point	Chapters 2, 3
• Slope of a curve at a point. Examples are emphasized, including points at which there are vertical tangents and points at which there are no tangents.	136-145
• Tangent line to a curve at a point and local linear approximation.	125-136, 212-223
• Instantaneous rate of change as the limit of average rate of change.	130-136
• Approximate rate of change from graphs and tables of values.	142-145

Derivative as a function	Chapters 2, 3
• Corresponding characteristics of graphs of f and f'.	136-145
• Relationship between the increasing and decreasing behavior of f and the sign of f'.	136-145, 259-268
• The Mean Value Theorem and its geometric interpretation.	198-206
• Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa.	125-209 Exploratory Ex, 269-295
Second derivatives	Chapter 3
• Corresponding characteristics of the graphs of f, f' and f''.	232-269
• Relationship between the concavity of f and the sign of f''.	250-258
• Points of inflection as places where concavity changes.	250-269
Applications of derivatives	Chapters 2, 3, 7
• Analysis of curves, including the notions of monotonicity and concavity.	232-269
• Optimization, both absolute (global) and relative (local) extrema.	232-250, 269-279
• Modeling rates of change, including related rates problems.	280-295
• Use of implicit differentiation to find the derivative of an inverse function.	164-165, 183-192
• Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed and acceleration.	125-136, 150-152, 280-285
• Geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations.	518-528
Computation of derivatives	Chapter 2
• Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric and inverse trigonometric functions.	145-192
• Derivative rules for sums, products and quotients of functions.	145-192
• Chain rule and implicit differentiation.	160-166, 183-192
III. Integrals	Chapters 4, 5, 7
Interpretations and properties of definite integrals	Chapter 4
• Definite integral as a limit of Riemann sums.	316-343
• Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval: $\int_a^b f'(x)\,dx = f(b) - f(a)$	334-343
• Basic properties of definite integrals (examples include additivity and linearity).	300-306
Applications of integrals. Appropriate integrals are used in a variety of applications to model physical, biological or economic situations. Although only a sampling of applications can be included in any specific course, students should be able to adapt their knowledge and techniques to solve other similar application problems. Whatever applications are chosen, the	Chapters 4, 5 329-334, 377-445

emphasis is on using the method of setting up an approximating Riemann sum and representing its limit as a definite integral. To provide a common foundation, specific applications should include finding the area of a region, the volume of a solid with known cross sections, the average value of a function, the distance traveled by a particle along a line, and accumulated change from a rate of change.	
Fundamental Theorem of Calculus	Chapter 4
• Use of the Fundamental Theorem to evaluate definite integrals.	334-343
• Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined.	334-343
Techniques of antidifferentiation	Chapter 4
• Antiderivatives following directly from derivatives of basic functions.	300-309, 364-374
• Antiderivatives by substitution of variables (including change of limits for definite integrals).	343-352
Applications of antidifferentiation	Chapter 7
• Finding specific antiderivatives using initial conditions, including applications to motion along a line.	499-518
• Solving separable differential equations and using them in modeling (including the study of the equation $y' = ky$ and exponential growth).	499-518
Numerical approximations to definite integrals. Use of Riemann sums (using left, right and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically and by tables of values.	Chapter 4 352-364

Topics for Calculus BC

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Analysis of graphs. With the aid of technology, graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function.	Chapters 0,3 19-25, 259-268
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Continuity as a property of functions	Chapters 1, 3
• An intuitive understanding of continuity. (The function values can be made as close as desired by taking sufficiently close values of the	86-96

domain.)	
• Understanding continuity in terms of limits.	86-96
• Geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem).	86-96, 232-243
II. Derivatives	Chapters 2, 3, 7, 9, 11
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• Derivative presented graphically, numerically and analytically.	125-209
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Applications of derivatives	Chapters 2, 3, 7, 9, 11
• Analysis of curves, including the notions of monotonicity and concavity.	232-269
+ Analysis of planar curves given in parametric form, polar form and vector form, including velocity and acceleration.	633-676, 777-778
• Optimization, both absolute (global) and relative (local) extrema.	232-250, 269-279
• Modeling rates of change, including related rates problems.	280-295
• Use of implicit differentiation to find the derivative of an inverse function.	164-165, 183-192
• Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed and acceleration.	125-136, 150-152, 280-285
• Geometric interpretation of differential equations via slope fields and	518-528

the relationship between slope fields and solution curves for differential equations.	
+ Numerical solution of differential equations using Euler's method.	518-528
+ L'Hospital's Rule, including its use in determining limits and convergence of improper integrals and series.	223-232
Computation of derivatives	Chapter 2
• Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric and inverse trigonometric functions.	145-192
• Derivative rules for sums, products and quotients of functions.	145-192
• Chain rule and implicit differentiation.	160-166, 183-192
+ Derivatives of parametric, polar and vector functions.	633-676, 777-778
III. Integrals	Chapters 4, 5, 6, 7, 9
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Fundamental Theorem of Calculus	Chapter 4
• Use of the Fundamental Theorem to evaluate definite integrals.	334-343
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Techniques of antidifferentiation	Chapter 4
• Antiderivatives following directly from derivatives of basic functions.	300-309, 364-374
+ Antiderivatives by substitution of variables (including change of limits for definite integrals), parts, and simple partial fractions (nonrepeating linear factors only).	343-350, 452-459, 468-476
+ Improper integrals (as limits of definite integrals).	483-489

Applications of antidifferentiation	Chapter 7
• Finding specific antiderivatives using initial conditions, including applications to motion along a line.	499-518
• Solving separable differential equations and using them in modeling (including the study of the equation $y' = ky$ and exponential growth).	499-518
+ Solving logistic differential equations and using them in modeling.	513-518
Numerical approximations to definite integrals. Use of Riemann sums (using left, right and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically and by tables of values.	Chapter 4 352-364
***IV. Polynomial Approximations and Series**	Chapter 8
*** Concept of series.** A series is defined as a sequence of partial sums, and convergence is defined in terms of the limit of the sequence of partial sums. Technology can be used to explore convergence and divergence.	Chapter 8 552-554
*** Series of constants**	Chapter 8
+ Motivating examples, including decimal expansion.	552-559
+ Geometric series with applications.	555-557
+ The harmonic series.	558-559
+ Alternating series with error bound.	573-579
+ Terms of series as areas of rectangles and their relationship to improper integrals, including the integral test and its use in testing the convergence of *p*-series.	562-566
+ The ratio test for convergence and divergence.	581-584
+ Comparing series to test for convergence or divergence.	566-572
*** Taylor series**	Chapter 8
+ Taylor polynomial approximation with graphical demonstration of convergence (for example, viewing graphs of various Taylor polynomials of the sine function approximating the sine curve).	596-607
+ Maclaurin series and the general Taylor series centered at $x = a$.	595-606
+ Maclaurin series for the functions e^x, $\sin x$, $\cos x$, and $\frac{1}{1-x}$.	603
+ Formal manipulation of Taylor series and shortcuts to computing Taylor series, including substitution, differentiation, antidifferentiation and the formation of new series from known series.	590-594
+ Functions defined by power series.	595-603
+ Radius and interval of convergence of power series.	588-590
+ Lagrange error bound for Taylor polynomials.	601-604