A Correlation of

Calculus:
Graphical, Numerical, Algebraic
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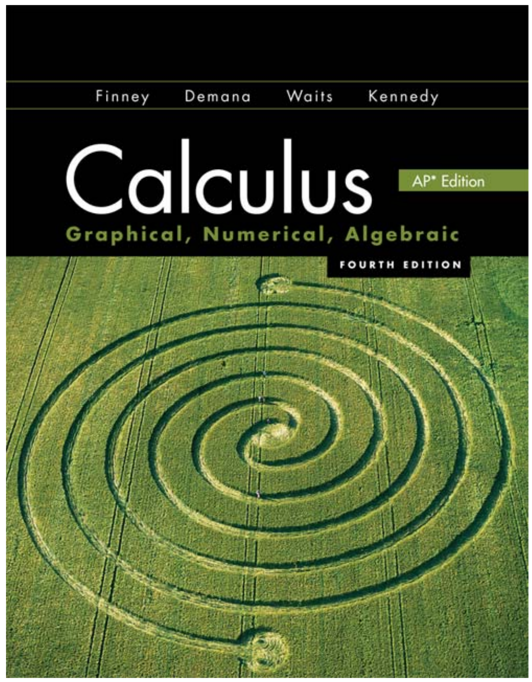

To the

Advanced Placement (AP) Calculus AB / BC Standards

Grades 9–12

Calculus: Graphical, Numerical, Algebraic © 2012
to the Advanced Placement (AP) Calculus AB/BC Standards
Grades 9–12

Introduction

The following correlation demonstrates the alignment of content between ***Calculus: Graphical, Numerical, Algebraic*** and the *Advanced Placement Calculus AB/BC Standards.* This document contains references to the page numbers from the Student and Teacher's Editions.

Organization

Intended for students taking an Advanced Placement Calculus course, the text is divided into 10 chapters with 50 subtopics designed for a full-year course of study. ***Calculus: Graphical, Numerical, Algebraic*** encompasses problems and exercises of real life situations modeled after problems that have appeared on the AP exam.

To ensure the text covers every AP topic, the preface carefully correlates the material between the AP curriculum and the text for both the AB and the BC exams. For a more comprehensive course of study of Calculus, this edition is accompanied by *Calculus, A Complete Course,* which can be used for the Calculus BC course. It contains five supplemental chapters and cumulative review for chapters 1-10. Both texts adhere to the new guidelines for AP Calculus and include preparation on the current AP Calculus AB and BC Exams.

Assessment

Cumulative Quick Quizzes are provided two or three times in each chapter so students and instructors can continuously monitor how well material is grasped and where to focus support for improvement.
Furthermore, to help students prepare for the AP Exam, the AP Calculus Test Prep provides an introduction to the AP* AB and BC Calculus Exams. There is also a precalculus review of Calculus prerequisites; a review of AP* Calculus AB and Calculus BC Topics; practice exams; and answers and solutions.

New to this Edition

- Updated exercises and examples to reflect the most current data
- Added guidance on the appropriate use of graphing calculators to ensure students make connections among graphical, numerical, and algebraic representations, rather than always relying on technology.
- Enhanced teacher support through lesson plans, pacing guides, and point-of-need answers for Explorations
- Split the chapter on Techniques of Differentiation into two chapters
- Expanded practice on slope fields
- Additional AP *Test exam preparation, including a Quick Quiz at the end of each chapter

Additional Resources

As an alternative to in-person classroom lectures, students also have the option of using Video Lectures on CD-ROM. This CD features an engaging team of mathematics instructors who present comprehensive coverage of each section of the text. The lecturers' presentations include and revisit some of the examples and exercises from the text and support an approach that emphasizes visualization and problem-solving. With the CD-ROM, students have the support of instructors outside of the classroom. These video lectures provide a 24/7 access to the content for the demanding schedules of today's student, and they provide a unique support tool for teachers or substitute teachers.

This document demonstrates the high degree of success students will achieve by using ***Calculus: Graphical, Numerical, Algebraic*.**

Calculus: Graphical, Numerical, Algebraic © 2012
to the Advanced Placement (AP) Calculus AB/BC Standards
Grades 9–12

ADVANCED PLACEMENT (AP) CALCULUS BC STANDARDS	Calculus: Graphical, Numerical, Algebraic © 2012
I Functions, Graphs, and Limits	
I.AB. 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.	**SE/TE:** 12-18, 22-25, 29-33, 36-42, 45-50
I.AB. Limits of functions (including one–sided limits).	
• An intuitive understanding of the limiting process.	**SE/TE:** 59-69, 70-77
• Calculating limits using algebra.	**SE/TE:** 59-69, 70-77
• Estimating limits from graphs or tables of data.	**SE/TE:** 59-69, 70-77
I.AB. Asymptotic and unbounded behavior	
• Understanding asymptotes in terms of graphical behavior	**SE/TE:** 70-77
• Describing asymptotic behavior in terms of limits involving infinity	**SE/TE:** 70-77
• Comparing relative magnitudes of functions and their rates of change. (For example, contrasting exponential growth, polynomial growth, and logarithmic growth)	**SE/TE:** 70-77, 87-94, 457-462
I.AB. Continuity as a property of functions	
• An intuitive understanding of continuity. (The function values can be made as close as desired by taking sufficiently close values of the domain.)	**SE/TE:** 78-86
• Understanding continuity in terms of limits	**SE/TE:** 78-86
• Geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem)	**SE/TE:** 78-83, 191-197, 200-205, 209-218
I.BC. Parametric, polar, and vector functions. The analysis of planar curves includes those given in parametric form, polar form, and vector form	**SE/TE:** 537-543, 544-554, 555-566
II. Derivatives	
II.AB. Concept of the derivative	
• Derivative presented graphically, numerically, and analytically	**SE/TE:** 87-94, 99-104, 109-113, 116-123, 127-134, 141-145, 153-157, 162-167, 170-174, 177-183, 191-197, 200-205, 209-218, 223-230, 237-245
• Derivative interpreted as an instantaneous rate of change	**SE/TE:** 87-94
• Derivative defined as the limit of the different quotient	**SE/TE:** 87-94, 99-108
• Relationship between differentiability and continuity	**SE/TE:** 109-115
II.AB. Derivative at a point	
• 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.	**SE/TE:** 87-94
• Tangent line to a curve at a point and local linear approximation	**SE/TE:** 87-94, 237-249

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ADVANCED PLACEMENT (AP) CALCULUS BC STANDARDS	**Calculus: Graphical, Numerical, Algebraic © 2012**
• Instantaneous rate of change as the limit of average rate of change	**SE/TE:** 87-94, 127-140
• Approximate rate of change from graphs and tables of values	**SE/TE:** 87-94, 127-140
II.AB. Derivative as a function	
• Corresponding characteristics of graphs of *f* and *f'*	**SE/TE:** 99-108, 209-222
• Relationship between the increasing and decreasing behavior of *f* and the sign of *f'*	**SE/TE:** 191-199, 209-222
• The Mean Value Theorem and its geometric consequences	**SE/TE:** 200-208
• Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa	**SE/TE:** 127-140, 141-147, 250-258, 354-365, 366-375
II.AB. Second derivatives	
• Corresponding characteristics of the graphs of *f, f',* and *f"*	**SE/TE:** 209-222
• Relationship between the concavity of *f* and the sign of *f"*	**SE/TE:** 209-222
• Points of inflection as places where concavity changes	**SE/TE:** 209-222
II.AB. Applications of derivatives	
• Analysis of curves, including the notions of monotonicity and concavity	**SE/TE:** 191-199, 200-208, 209-222
• Analysis of planar curves given in parametric form, polar form, and vector form, including velocity and acceleration vectors. (Calculus BC)	**SE/TE:** 537-543, 544-554, 555-566
• Optimization, both absolute (global) and relative (local) extrema	**SE/TE:** 209-222, 223-236
• Modeling rates of change, including related rates problems	**SE/TE:** 250-258
• Use of implicit differentiation to find the derivative of an inverse function.	**SE/TE:** 162-169
• Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration	**SE/TE:** 127-140
• Geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations	**SE/TE:** 325-335
• Numerical solution of differential equations using Euler's method (Calculus BC)	**SE/TE:** 325-335
• L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series. (Calculus BC)	**SE/TE:** 448-456, 517-530
II.AB. Computation of derivatives	
• Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions	**SE/TE:** 116-126, 141-147, 170-176, 177-185

ADVANCED PLACEMENT (AP) CALCULUS BC STANDARDS	**Calculus: Graphical, Numerical, Algebraic © 2012**
• Derivative rules for sums, products, and quotients of functions.	**SE/TE:** 116-126
• Chain rule and implicit differentiation	**SE/TE:** 153-161, 162-169
• Derivatives of parametric, polar, and vector functions (Calculus BC)	**SE/TE:** 537-543, 544-554, 555-566
III. Integrals	
III.AB. Interpretations and properties of definite integrals	
• Definite integral as a limit of Riemann sums	**SE/TE:** 267-277, 278-288
• Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval: $\int_a^b f'(x)dx = f(b) - f(a)$	**SE/TE:** 267-277, 298-309
• Basic properties of definite integrals. (Examples include additivity and linearity.)	**SE/TE:** 278-288, 289-297
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 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	**SE/TE:** 298-309, 310-318, 354-365, 366-375, 383-393, 394-402, 403-415, 416-422, 423-433
III.BC 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 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 (including a region bounded by polar curves), the volume of a solid with known cross sections, the average value of a function, the distance traveled by a particle along a line, the length of a curve (including a curve given in parametric form), and accumulated change from a rate of change	**SE/TE:** 298-309, 310-318, 354-365, 366-375, 383-393, 394-402, 403-415, 416-422, 423-433, 537-543, 555-566
III.AB. Fundamental Theorem of Calculus	
• Use of the Fundamental Theorem to evaluate definite integrals	**SE/TE:** 298-309

ADVANCED PLACEMENT (AP) CALCULUS BC STANDARDS	**Calculus: Graphical, Numerical, Algebraic © 2012**
• Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined.	**SE/TE:** 298-309, 325-335
III.AB. Techniques of antidifferentiation	
• Antiderivatives following directly from derivatives of basic functions	**SE/TE:** 200-208, 325-335, 336-344
• Antiderivatives by substitution of variables (including change of limits for definite integrals)	**SE/TE:** 336-344
• Antiderivatives by substitution of variables (including change of limits for definite integrals) parts, and simple partial fractions (nonrepeating linear factors only) (Calculus BC)	**SE/TE:** 336-344, 345-353, 366-375
• Improper integrals (as limits of definite integrals) (Calculus BC)	**SE/TE:** 457-462
III.AB. Applications of antidifferentiation	
• Finding specific antiderivatives using initial conditions, including applications to motion along a line	**SE/TE:** 325-335, 383-393
• Solving separable differential equations and using them in modeling. In particular, studying the equation $y' = ky$ and exponential growth.	**SE/TE:** 354-365
• Solving logistic differential equations and using them in modeling (Calculus BC)	**SE/TE:** 366-375
Numerical approximation to definite integrals. Use of Riemann sums (using left, right and midpoint evaluation points) and trapezoid sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values.	**SE/TE:** 278-288, 310-318
IV.BC. Polynomial Approximations and Series	
IV.BC. 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 or divergence	**SE/TE:** 477-487
IV.BC. Series of constants	
• Motivating examples, including decimal expansion	**SE/TE:** 477-487
• Geometric series with applications	**SE/TE:** 477-487
• The harmonic series	**SE/TE:** 517-530
• Alternating series with error bound	**SE/TE:** 517-530
• 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.	**SE/TE:** 517-530

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• The ratio test for convergence and divergence	**SE/TE:** 507-516
• Comparing series to test for convergence or divergence	**SE/TE:** 507-516
IV.BC. Taylor series	
• Taylor polynomial approximation with graphical demonstration of convergence. (For example, viewing graphs of various Taylor polynomials of the sine function approximating the sine curve.)	**SE/TE:** 488-498
• Maclaurin series and the general Taylor series centered at x = a	**SE/TE:** 488-498
• Maclaurin series for the functions e^x, sin x, cos x, and $\frac{1}{1-x}$	**SE/TE:** 488-498
• Formal manipulation of Taylor series and shortcuts to computing Taylor series, including substitution, differentiation, antidifferentiation, and the formation of new series from known series	**SE/TE:** 477-487, 488-498
• Functions defined by power series	**SE/TE:** 477-487, 488-498
• Radius and interval of convergence of power series	**SE/TE:** 477-487, 507-516, 517-530
• Lagrange error bound for Taylor polynomials	**SE/TE:** 499-506

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