East Penn School District
Secondary Curriculum

A Planned Course Statement
for
Advanced Calculus Topics (Honors)
(given AP credit towards g.p.a)

Course # **353** Grade(s) 11,12

Department: Mathematics

Length of Period (mins.) 42 Total Clock Hours: 126

Periods per Cycle: 5 Length of Course (yrs.) 1

Type of Offering: ____ required ✓ elective

Credit: 1

Adopted: 6/28/10

Developed by:
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Description of Course #353

Course Title: Advanced Calculus Topics (Honors)

Description: This course is designed to review concepts covered in AP Calculus and will include many enrichment activities involving both differential and integral Calculus. These enrichment activities will include applications such as work, hydrostatic forces, hyperbolic functions, centroids, normal curve analysis (Statistics connections)… Moreover, a significant introduction will be given to 3-dimensional graphing systems and multi-variate functions. This will include vector-analysis, cylindrical and spherical coordinate systems, partial derivatives, iterated integrals and applications thereof.

Goals: The students will better appreciate the power of the tools they've acquired in the A.P. Calculus curriculum and will be able to solve problems involving a more diverse number of applications.

Requirements: The students must have a graphing calculator
Prerequisite: BC Calculus

Text: Anton, Howard, et al. Calculus with Early Transcendentals. Full Edition
Peoples Publishing, 2002

Key to Levels of Achievement (Listed with each learning objective)

Awareness (A):	Students are introduced to concepts, forms, and patterns.
Learning (L):	Students are involved in a sequence of steps and practice activities which involved further development and allow evaluation of process.
Understanding (U):	Students demonstrate ability to apply acquired concepts and skills to individual assignments and projects on an independent level.
Reinforcement (R):	Students maintain and broaden understanding of concepts and skills to accomplish tasks at a greater level of sophistication.

Course Objectives –

Unit	Num	Objective	Level	Content	Evaluation	Standard
Review of Limits	1	Students will be able to evaluate limits rigorously	A	• Elementary delta epsilon proofs	• Graded assignments	2.4.11A
Review of Derivatives	2	Students will reinforce and expand their knowledge of differential Calculus	R,L	• Function analysis • Max/Min problems • Related Rates • Slope fields	• Assignments, • Graded assignments • Quiz	2.5.11 (A–D) 2.8.11E,Q-T 2.11.11 A-C
New applications of Differential Calculus	3	Students will be able to apply the differential Calculus techniques they've learned to new situations	L	• Newton's Method • Research topic	• Graded assignment	2.4.11E
Review of Integration	4	Students reinforce and expand their knowledge of integral Calculus	R. L	• Integration by parts • Integration by substitution • Partial Fractions • Series • Riemann Sums	• Graded assignment, • Quiz	2.5.11(A–D) 2.3.11 C 2.8.11Q-T 2.11.11D,E
New techniques of Integral Calculus	5	Students will be able to integrate functions they were not previously able to integrate	L	• Method of integrating factors	• Assignments, • Quiz	2.5.11(A–D)
New Applications of Integral Calculus	6	Students will be able to solve applications from physics	R,L,U	• Hyperbolic Functions work • Hydrostatic Force • Centroids, center of mass…	• Quizzes/ Test	2.5.11(A–D) 2.3.11 C 2.8.11H
New Applications of Integral Calculus involving Statistics	7	Students will be able to solve applications from statistics which involve techniques of integration(transition into multi-variate calculus)	R, L	• The "normal" curve and "z-scores"	• Assignments	2.6.11I
Students will review Vector-Valued functions	8	Students will be able to use vector notation to describe motion along a line, a plane, or in space	R	• Tracing a curve • Computing derivatives / integrals of a vector-valued function • Observing motion on a component by component basis	• Quiz	2.5.11(A–D) 2.8.11E,T 2.10.11A,B
New topics involving Vector-valued functions	9	Students will be able to use vector notation and vector valued functions to discuss various distances, and to discuss forces on an object	L	• Arc-length parameterization • Unit tangent, normal, and binormal • Dot products and cross-products • The equations of a plane	• Assignments • Quiz/Test	2.5.11(A–D)

Unit	Num	Objective	Level	Content	Evaluation	Standard
3-dimensional curve analysis	10	Students will be able to identify a particular surface using its equation	L	• Quadric surfaces • The "trace" of an equation	• Quiz	2.5.11(A–D) 2.8.11E,T
Polar, Spherical, and Cylindrical Coordinate Systems	11	Students will be able to describe point and curves in space using non-rectangular systems	R,L	• Review of Polar curves • Converting from one coordinate system to another	• Assignments • Quiz	2.5.11(A–D) 2.8.11E 2.10.11 A
3d Differential Calculus	12	Students will be able to extend the ideas of limits, continuity, and derivatives to 3-space	R, L, U	• Graphing Functions • Computing limits at a point and determining continuity at point • Partial derivatives • The Gradient • Contrained extrema	• Assignments • Quiz	2.5.11(A–D) 2.11.11 A,B
3d Integral Calculus	13	Students will be able to extend the ideas of integral calculus to 3-space	R, L, U	• Reconstructive a function from its gradient • Iterated Integrals • Calculation of Area and Volume using iterated integrals • Computing center of mass (revisited)	• Assignments • Quiz	2.5.11(A–D)
(Optional)	14	Students will apply 3d Calculus to physics applications	A	• Vector Fields, Line Integrals, Flux…	• Assignments	2.5.11(A–D) 2.3.11 C