Monroe Township Schools



Curriculum Management System

MTHS Summer Study Program Introduction to AP Calculus AB

Grade 12

July 2006

* For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy # 201. Board Approved: June 28, 2006

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Monroe Township Schools

Mission and Goals

Mission

The mission of the Monroe Township School District, a unique multi-generational community, is to collaboratively develop and facilitate programs that pursue educational excellence and foster character, responsibility, and life-long learning in a safe, stimulating, and challenging environment to empower all individuals to become productive citizens of a dynamic, global society.

<u>Goals</u>

To have an environment that is conducive to learning for all individuals.

To have learning opportunities that are challenging and comprehensive in order to stimulate the intellectual, physical, social and emotional development of the learner.

To procure and manage a variety of resources to meet the needs of all learners.

To have inviting up-to-date, multifunctional facilities that both accommodate the community and are utilized to maximum potential.

To have a system of communication that will effectively connect all facets of the community with the Monroe Township School District.

To have a staff that is highly qualified, motivated, and stable and that is held accountable to deliver a safe, outstanding, and superior education to all individuals.

INTRODUCTION, PHILOSOPHY OF EDUCATION, AND EDUCATIONAL GOALS

Philosophy

Monroe Township Schools are committed to providing all students with a quality education resulting in life-long learners who can succeed in a global society. The mathematics program, grades K - 12, is predicated on that belief and is guided by the following six principles as stated by the National Council of Teachers of Mathematics (NCTM) in the *Principles and Standards for School Mathematics, 2000.* First, a mathematics education requires equity. All students will be given worthwhile opportunities and strong support to meet high mathematical expectations. Second, a coherent mathematics curriculum will effectively organize, integrate, and articulate important mathematics, students as learners, and pedagogical strategies b) having a challenging and supportive classroom environment and c) continually reflecting on and refining instructional practice. Fourth, students must learn mathematics with understanding. A student's prior experiences and knowledge will actively build new knowledge. Fifth, assessment should support the learning of important mathematics and provide useful information to both teachers and students. Lastly, technology enhances mathematics learning, supports effective mathematics teaching, and influences what mathematics is taught.

As students begin their mathematics education in Monroe Township, classroom instruction will reflect the best thinking of the day. Children will engage in a wide variety of learning activities designed to develop their ability to reason and solve complex problems. Calculators, computers, manipulatives, technology, and the Internet will be used as tools to enhance learning and assist in problem solving. Group work, projects, literature, and interdisciplinary activities will make mathematics more meaningful and aid understanding. Classroom instruction will be designed to meet the learning needs of all children and will reflect a variety of learning styles.

In this changing world those who have a good understanding of mathematics will have many opportunities and doors open to them throughout their lives. Mathematics is not for the select few but rather is for everyone. Monroe Township Schools are committed to providing all students with the opportunity and the support necessary to learn significant mathematics with depth and understanding. This curriculum guide is designed to be a resource for staff members and to provide guidance in the planning, delivery, and assessment of mathematics instruction.

Educational Goals

Introduction to AP Calculus AB is an MTHS Summer Study option to will help students obtain a head-start on required coursework in the fall by gaining experience in skills and concepts necessary for success in AP Calculus AB. This summer study class will focus on topics generally covered in the first quarter of the school year. Student growth will be charted through a pre-test in the beginning of the course and a post-test at the end. Credit is not awarded for this course, however, students will receive a Certificate of Participation. More importantly, students will receive exposure to skills needed to be successful during the school year. Topics included are: linear, quadratic, piece-wise, exponential, logarithmic, and trigonometric functions, applications, limits, continuity, and slope of a curve.

A note about Mathematics Standards And Cumulative Progress Indicators.

* The Cumulative Progress Indicators (CPI's) referenced in this curriculum guide refer to the <u>new</u> standards revised in 2002. A complete copy of the new approved New Jersey Core Curriculum Content Standards for Mathematics may be found in the Curr2002 folder and at: <u>http://www.nj.gov/njded/cccs/02/s4_math.htm</u>.

MTHS Summer Study Program

Introduction to AP Calculus AB

Scope and Sequence

We	ek 1
I. Introduction and Pre-test	 II. Functions a. Linear functions and their graphs b. Parallel lines, perpendicular lines, slope c. Domain & range d. Composite functions e. Piece-wise defined functions f. Exponential Functions
We	ek 2
 III. Functions continued g. Applications of exponential growth & decay h. Inverse functions i. Logarithms j. Radians & degrees k. Trigonometric functions l. Inverse Trigonometric functions 	

We	ek 3
IV. Limits & Continuity a. Average speed b. Instantaneous speed c. The Sandwich Theorem d. End behavior models e. Asymptotes f. Continuity	
We	ek 4
 V. Limits & Continuity continued g. Removable discontinuities h. Intermediate Value Theorem i. Slope of a curve j. Tangent line and normal line l. Average rate of change 	VI. Post -test

	Mandated				Curriculum Management System	Goal 1: The student will be able to solve problems involving functions.		
	Asse	essme	ent		Grade Level/Subject:			
					Grade 12/Introduction to AP Calculus			
s of					AB			
ays			A		Objectives / Cluster Concepts /	Instructional Tools / Materials /	Learning Activities / Interdisciplinary	
n d			> >		Cumulative Progress Indicators (CPI's)	Technology / Resources	Activities / Assessment Model	
ste			ž	E				
gge: truc	ΡA	AA	RA	EX	The student will be able to:			
Sug	В	HSI	Ē	AP				
10				v	1.1 write on equation and elected a	Oslaukus Orankiasi Numariasi	Teaching Suggestions	
10				^	araph of a line given specific	<u>Calculus: Graphical, Numerical,</u> <u>Algebraic</u>	 Use graphing calculator to find 	
					information.	Finney, Ross L.: Demana, Franklin	the domain of graphs. Page 19	
					(CPI 4.1.12.B.1, 4.3.12.D2,	D.; Waits, Bert K.; Kennedy, Daniel;	#67 Enter $y = \sqrt{r}$	
					4.3.12.B.2)*	Addison Wesley Longman, Inc.,	#07. Efficiency $y_1 - \sqrt{x}$,	
				Х	1.2. identify the relationships between	1999. Tao akara Dagawaga Tao akaria	$y_2 = \sqrt{1-x}$ and	
					and slope.	Teachers Resources; Teacher's Guide with Answers.	$y_3 = y_1 + y_2$ on your calculator.	
				X 1	(CPI 4.5.K12.F.3)*	<u>Calculus Second Edition</u>	Graph y_3 in [-3,3] by [-1,3].	
					function using its graph or	Smith, Robert I.; Minton, Roland B.; The McGraw Hill Companies, 2002	Compare the domain of the three	
					equation.	 Calculus Concepts and Contexts 	functions. Replace y_3 by	
					(CPI 4.5.K12.F.2)*	Stewart, James; Wadsworth Group,		
				Х	1.4. write and evaluate compositions of	2001.	$y_1 - y_2, y_2 - y_1, y_1 \cdot y_2, \frac{y_1}{2}, \frac{y_2}{2}$.	
					two functions.	 <u>Calculus For Business, Economics,</u> 	$y_2 y_1$	
				v	(CPI 4.5.K12.F.3) [*]	And The Social and Science Life.	Based on observation, what	
				Λ	piece-wise defined functions.	Laurence D · The McGraw Hill	would you conjecture about the	
					(CPI 4.5.K12.D.2)*	Companies, 2000.	products and quotients of	
				Х	1.6. determine the domain, range, and	 <u>Calculus Explorations</u>, Foerster, Paul 	functions.	
					graph exponential functions.	A., Key Curriculum Press, 1998.	Use a graphing calculator. Let	
				v	(CPI 4.1.12.B.2) [*]	 TI-83 graphing calculators 	$x = \ln(x)$ $x = \ln x$	
				^	exponential growth & decay	 <u>Journey Through Calculus</u> software, Bill Ralph: Stewart James 	$y_1 = \prod(-), y_2 = \prod x,$	
					(CPI 4.1.12.B.4, 4.3.12.C.1)*	Tools For Enriching Calculus	$y = y - y$ and $y = e^{y_3}$	
				Х	1.8. determine the algebraic	software, Keynes, Harvey B.;	$y_3 - y_2 y_1, \ unu y_4 - c$	
					representation and the graphical	Stewart, James	a) Graph y_1 and y_2 for	
					representation of a function and its		a=2,3,4,and 5. How are	
			inverse.		Inverse. (CPI $4 5 K12 F 1$)*		the graphs related?	
				Х	1.9. apply the properties of logarithms		b) Graph y_3 for a=2,3,4,5	
					(CPI 4.5.K12.D.1)		Describe the graphs. Page 40 #52	

s of	Mandated Assessment				Curriculum Management System <u>Grade Level/Subject</u> : Grade 12/Introduction to AP Calculus AB	Goal 1: The student will be able to so	lve problems involving functions.
Suggested day nstruction	GEPA	HSPA	FERRA NOVA	AP Exam	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Instructional Tools / Materials / Technology / Resources	Learning Activities / Interdisciplinary Activities / Assessment Model
				x x x x	 1.10. convert between radians and degrees. 1.11. solve trigonometric equations. (CPI 4.5.K12.A.4)* 1.12. generate the graphs of the trigonometric functions and explore various transformations upon these graphs. (CPI 4.5.K12.A.1)* 1.13. use the inverse trigonometric functions to solve problems. (CPI 4.5.K12.A.4)* * The Cumulative Progress Indicators (CPI's) referenced in this curriculum guide refer to the <u>new</u> standards revised in 2002. A complete copy of the new approved New Jersey Core Curriculum Content Standards for Mathematics may be found in the Curr2002 folder and at: http://www.nj.gov/njded/cccs/02/s4_math.htm. 		 Use graphing calculator for trigonometric Identities. Let f(x)= sinx + cosx. A. Graph y=f(x). Describe the graph. B. Use the graph to identify the amplitude, period, horizontal shift and vertical shift. C. Use the formula sin α cos β + cos α sin β = sin(α + β) for the sine of the sum of two angles to confirm your answers. Calculus Explorations: Exploration1: page 16 Use graphing calculator to compose functions Exploration 1: page 20 Use graphing calculator to investigate exponential functions Exploration 1: page 33 Use graphing calculator to test for inverses Exploration2: page 37 Investigate family of natural log functions graphically and confirm algebraically.

of	Man Asso	dated essme	nt		Curriculum Management System <u>Grade Level/Subject</u> : Grade 12/Introduction to AP Calculus AB	Goal 1: The student will be able to se	olve problems involving functions.
Suggested days Instruction	GEPA	HSPA	TERRA NOVA	AP Exam	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Instructional Tools / Materials / Technology / Resources	Learning Activities / Interdisciplinary Activities / Assessment Model
						Alternative Assessment: • Tools for Enriching Calculus- Module 1.5. Graph exponential functions with various bases and tangent lines in order to estimate more closely the value of a for which the tangent has slope =1.	

/s of	Mano Asse	dated essme	ent		Curriculum Management System <u>Grade Level/Subject</u> : Grade 12/Introduction to AP Calculus AB	Goal 2: The student will be able to understand and apply the concepts of limits and continuity.		
Suggested day Instruction	GEPA	HSPA	TERRA NOVA	AP Exam	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Instructional Tools / Materials / Technology / Resources	Learning Activities / Interdisciplinary Activities / Assessment Model	
10				x x x x x	 2.1 calculate average and instantaneous speed. (CPI 4.3.12.B.2)* 2.2 define and calculate limits for function values and apply the properties of limits. (CPI 4.3.12.B.2)* 2.3 use the Sandwich Theorem to find certain limits indirectly. (CPI 4.3.12.B.2)* 2.4 find and verify end behavior models for various functions. (CPI 4.5.K12.F.1, 4.5.K12.F.3)* 2.5 calculate limits as x → ±∞ and to identify vertical and horizontal asymptotes. (CPI 4.3.12.B.2, 4.5.K12.F.3)* 2.6 identify the interval upon which a given function. (CPI 4.3.12.B.2)* 	 <u>Calculus: Graphical, Numerical, Algebraic</u> Finney, Ross L.; Demana. Franklin D.; Waits, Bert K.; Kennedy, Daniel; Addison Wesley Longman, Inc., 1999. Teachers Resources; Teacher's Guide with Answers. <u>Calculus Second Edition</u> Smith, Robert T.; Minton, Roland B.; The McGraw Hill Companies, 2002. <u>Calculus Concepts and Contexts</u> Stewart, James; Wadsworth Group, 2001. <u>Calculus For Business, Economics, And The Social and Science Life.</u> Bradley, Gerald L.; Hoffman, Laurence D.;The McGraw Hill Companies, 2000. <u>Calculus Explorations</u>, Foerster, Paul A., Key Curriculum Press, 1998. TI-83 graphing calculators <u>Journey Through Calculus</u> software, Bill, Ralph; Stewart, James. <u>Tools For Enriching Calculus</u> software, Keynes, Harvey B.; Stewart, James. 	 Teaching Suggestions: Use the graphing calculator to provide an introduction to limits by graphing y = sin x / x. Discussion is on p 56. A discussion of exercise 54 and the Sandwich theorem is a good way to complete the lesson. Calculus, Smith, Robert T., Minton, Roland B. page 84-87 give individual examples for limits. Calculus Concepts and Contexts. Stewart, James, chapter 2 incorporates Journey Through Calculus and Tools for enriching Calculus software into the topic of limits. Frameworks: Standard 15 #14 Develop an informal notion of limit, p. 512. Standard 15 #18 Develop an understanding of the concept of continuity of a function, p. 514. 	

ys of	Mano Asse	dated essme	ent		Curriculum Management System Grade Level/Subject: Grade 12/Introduction to AP Calculus AB	Goal 2: The student will be able to understand and apply the concepts of limits and continuity.		
Suggested da Instruction	GEPA	HSPA	TERRA NOVA	AP Exam	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Instructional Tools / Materials / Technology / Resources	Learning Activities / Interdisciplinary Activities / Assessment Model	
	x x x x x		x x x x	 2.7 remove removable discontinuities by extending or modifying a function. (CPI 4.3.12.B.2)* 2.8 apply the Intermediate Value Theorem and the properties of algebraic combinations and composites of continuous functions. (CPI 4.3.12.B.2)* 2.9 apply directly the definition of the slope of a curve in order to calculate slope. (CPI 4.3.12.B.2)* 2.10 find the equations of the tangent line and normal line to a curve at a given point. (CPI 4.3.12.B.2)* 2.11 find the average rate of change of a function. (CPI 4.3.12.B.2)* 	Internet • www.calc101.com • www.sosmath.com • www.math.temple.edu • www.netsrq.com • www.mat.up.edu • www.mat.up.edu • www.mat.iup.edu • www.mat.iup.edu	 Exploration Extensions: <u>Calculus: Graphical, Numerical,</u> <u>Algebraic</u> Exploration 1, page 68, investigate rule 5, Quotient rule, by examining two functions to find out if the limits exist as <i>x</i> goes to infinity, and to find out if the quotient rule can be applied. Exploration 1, page 77, explores how to remove a discontinuity from a function by factoring the denominator and finding the domain of the function. Investigate the graph around the discontinuity, continuous extension). <u>Calculus Explorations.</u> Exploration 1: Instantaneous Rate of Change of a Function. Exploration 5: Introduction to Limits Exploration 6: The Definition of Limit. Exploration 9: Limits Involving Infinity. 		

Mandated Assessment ້ວ			Curriculum Management System <u>Grade Level/Subject</u> : Grade 12/Introduction to AP Calculus AB	Goal 2: The student will be able to understand and apply the concepts of limits and continuity.			
gested day uction	A	A	RA NOVA	Exam	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's)	Instructional Tools / Materials / Technology / Resources	Learning Activities / Interdisciplinary Activities / Assessment Model
Sugg	GEPA	HSPA	TERR	AP Ex	* The Cumulative Progress Indicators (CPI's) referenced in this curriculum guide refer to the <u>new</u> standards revised in 2002. A complete copy of the new approved New Jersey Core Curriculum Content Standards for Mathematics may be found in the Curr2002 folder and at: http://www.nj.gov/njded/cccs/02/s4_math. htm.		Alternative Assessment: • Journey Through Calculus module 2/continuity/Problems and tests. • <u>Calculus: Graphical, Numerical,</u> <u>Algebraic, page 64</u> Prove that $\lim_{\theta \to \infty} \frac{\sin \theta}{\theta} = 1$ when θ is measured in radians.

MTHS Summer Study Program

Introduction to AP Calculus AB

COURSE BENCHMARKS

- 1. The student will be able to solve problems involving functions.
- 2. The student will be able to understand and apply the concepts of limits and continuity.