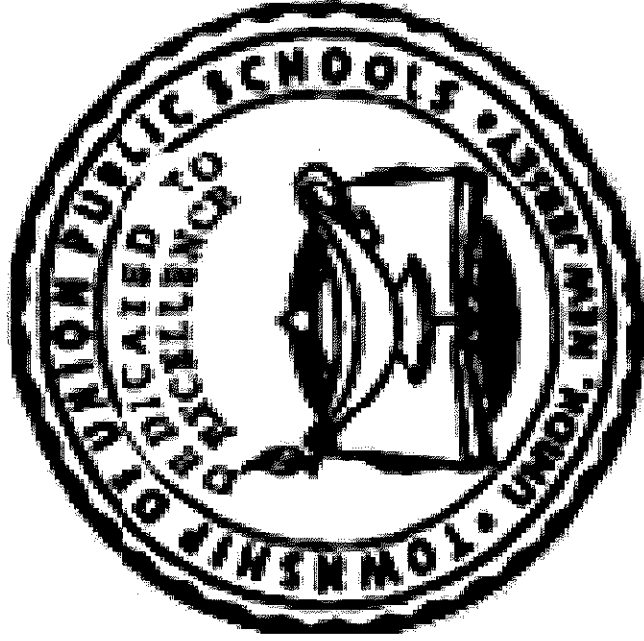
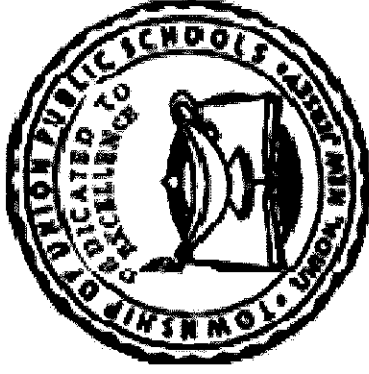


TOWNSHIP OF UNION PUBLIC SCHOOLS



MA 380 Advanced Math
Curriculum Guide 2015

Curriculum Guide Approved June 2015



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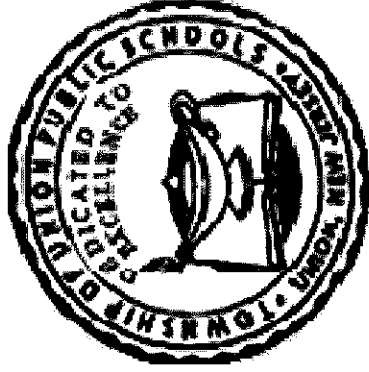
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TOWNSHIP OF UNION PUBLIC SCHOOLS
Administration

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Joseph A. Kohan

Sherri Horn

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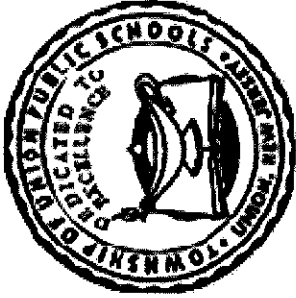
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District Mission Statement

The Township of Union Board of Education believes that every child is entitled to an education, designed to meet his or her individual needs, in an environment that is conducive to learning. State standards, federal and state mandates, and local goals and objectives, along with community input, must be reviewed and evaluated on a regular basis to ensure that an atmosphere of learning is both encouraged and implemented. Furthermore, any disruption to or interference with a healthy and safe educational environment must be addressed, corrected, or, when necessary, removed, in order for the district to maintain the appropriate educational setting.

District Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is the formulation of a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.



Statement of District Goals

- ❖ Develop reading, writing, speaking, listening, and mathematical skills.
- ❖ Develop a pride in work and a feeling of self-worth, self-reliance, and self discipline.
- ❖ Acquire and use the skills and habits involved in critical and constructive thinking.
- ❖ Develop a code of behavior based on moral and ethical principals.
- ❖ To be able to work with others cooperatively.
- ❖ Acquire a knowledge and appreciation of the historical record of human achievement and failures and current societal issues.
- ❖ Acquire a knowledge and understanding of the physical and biological sciences.
- ❖ Efficient and effective participation in economic life and the development of skills to enter a specific field of work.
- ❖ Appreciate and understand literature, art, music, and other cultural activities.
- ❖ Develop an understanding of the historical and cultural heritage.
- ❖ Develop a concern for the proper use and/or preservation of natural resources.
- ❖ Develop basic skills in sports and other forms of recreation.

Course Description

The purpose of this course is to provide students with a working knowledge of trigonometry, a sampling of discrete mathematics topics, and an introduction to calculus topics to prepare them for future courses in mathematics.

Students will apply their reasoning abilities when recognizing patterns, making generalizations, and drawing logical conclusions. Students will use these skills in other disciplines and in real-life situations. They will use technology to evaluate and validate solutions.

Recommended Textbooks

**Precalculus Graphical, Numerical, Algebraic
Authors - Demana, Waits, Foley and Kennedy
Publisher - Addison Wesley**

Course Proficiencies

Students will be able to...

1. Sketch graphs of polynomial functions, including asymptotes, points of discontinuity, end behavior and tangent lines.
2. Calculate and graph inverses of functions.
3. Decompose a rational expression into partial fractions.
4. Utilize the fundamental theorem of algebra, the quadratic formula, remainder and factor the theorems and the rational root theorem to find roots of polynomial equations.
5. Represent angles, lengths of arcs and the coordinate plane in both degrees and radians.
6. Calculate the six trigonometric functions of an angle, its coterminal angles and those angles which have such angle as a reference.
7. Utilize formulas for lengths of an arc, area of a circle, area of a triangle and to find missing parts of a triangle.
8. Recognize and be able to translate the 6 trigonometric function graphs.
9. Use trigonometric identities to solve trigonometric equations.
10. Do vector addition and use addition to solve application problems.
11. Take the scalar product and dot product of vectors and solve application problems using these operations.
12. Plot points in polar coordinates and convert points from standard Cartesian coordinates to polar coordinates.
13. Graph equations using polar coordinates.
14. To do all operations with matrices and solve equations using matrices.
15. Decompose Fractions
16. Evaluate limits of rational expressions and derivatives of polynomials
17. Use integration to find the area under a curve.

Curriculum Units

Unit 1: Polynomial Functions

Unit 2: Angles and Trigonometric Functions

Unit 3: Applications of Trigonometric Functions

Unit 4: Matrices

Unit 5: Vectors and Polar Coordinates

Unit 6: Conic Sections

Unit 7: Differentiation and Integration

Unit 1 (ANALYZING POLYNOMIAL FUNCTIONS)

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	ANALYZE POLYNOMIAL FUNCTION TEXT SECTIONS 1.1,1.2,1.3,1.5	A-APR 1,2,3,4,5
2	FIND THE INVERSE OF POLYNOMIAL FUNCTIONS IS THE INVERSE A FUNCTION? TEXT SECTIONS 2.1,2.2,2.4,2.5,2.7	FIF 1,2,3,4,5,6,7

Selected Opportunities for Connection to Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

All of the content presented at this grade level has connections to the standards for mathematical practices.

Bold type identifies possible starting points for connections to the SLOs in this unit.

Common Core State Standards

Code #	
A-APR-1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
A-APR-2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.
A-APR-3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
A-APR-4	Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.</i>
A-APR-5	(+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n , where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.1
F-IF-1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.
F-IF-2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF-3	<p>Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. <i>For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.</i></p>
F-IF-4	<p>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★</p>
F-IF-5	<p>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★</p>
F-IF-6	<p>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★</p>
F-IF-7	<p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> Graph linear and quadratic functions and show intercepts, maxima, and minima. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

CCSS #	Assessments
A-APR 1,2,3,4,5	FIND THE INVERSE OF $Y=1/4(X-3)^2$ IS THE INVERSE A FUNCTION?
FIF 1,2,3,4,5,6,7	DETERMINE THE VERTICAL, HORIZONTAL OR SLANT ASYMPTOTES OR HOLES FOR THE FOLLOWING FUNCTION $Y= X/(X+3)(X-4)$

Unit 2 ANGLES AND TRIGONOMETRIC FUNCTIONS

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	KNOW AND USE TRIGONOMETRIC FUNCTIONS AND THEIR RELATION TO THE UNIT CIRCLE, RIGHT TRIANGLES AND ANGLES? TEXT 4.1,4.2,4.3,4.7 5.1,5.2,5.3,5.45,5.5,5.6	F-TF 1,2,3,4,5,6,7,8,9

Selected Opportunities for Connection to Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

All of the content presented at this grade level has connections to the standards for mathematical practices.

Bold type identifies possible starting points for connections to the SLOs in this unit.

Code #	Common Core State Standards
F-TF-1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
F-TF-2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

F-TF-3	(+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x , where x is any real number.
F-TF-4	(+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
F-TF-5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★
F-TF-6	(+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
F-TF-7	(+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. ★
F-TF-8	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.
F-TF-9	(+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

CCSS #	Assessments
F-TF	FIND THE SIX TRIGONOMETRIC VALUES OF AN ANGLE MEASURING 135°
F-TF	FIND THE AREA OF A TRIANGLE WITH TWO SIDES MEASURING 7.5 CM AND 9 CM. AND AN INCLUDED ANGLE OF 100°

Unit 3 (APPLICATIONS OF TRIGONOMETRIC FUNCTIONS)

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	STUDENT WILL USE KNOWLEDGE OF TRIANGLE TRIGONOMETRY TO SOLVE PROBLEMS DONE BY PILOTS, SURVEYORS AND NAVIGATORS. TEXT 4-8	A-APR-1,2,3,4,5

Selected Opportunities for Connection to Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

All of the content presented at this grade level has connections to the standards for mathematical practices.

Bold type identifies possible starting points for connections to the SLOs in this unit.

Code #	Common Core State Standards
A-APR-1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
A-APR-2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and

	only if $(x - a)$ is a factor of $p(x)$.
A-APR-3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
A-APR-4	Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.</i>
A-APR-5	(+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n , where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.1

Assessments	
CCSS #	A SHORELINE RUNS NORTH-SOUTH, AND A BOAT IS DUE EAST OF THE SHORELINE. THE BEARINGS OF THE BOAT FROM TWO POINTS ON THE SHORE ARE 110° AND 100° . ASSUME THE TWO POINTS ARE 550 FT APART. HOW FAR IS THE BOAT FROM THE SHORE
	A POINT ON THE TIP OF A TUNING FORK VIBRATES IN HARMONIC MOTION DESCRIBED BY THE EQUATION $d=14 \sin(\omega t)$. FIND ω FOR A TUNING FORK THAT HAS A FREQUENCY OF 528 VIBRATION PER SEC.

Unit 4 (VECTORS)

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	To use vectors to solve force problems TEXT 6.1,6.2, 6.3	N-VM 1,2,3,4abc,5ab
2	USE POLAR COORDINATES TO SOLVE PROBLEMS IN 3 DIMENSIONAL SPACE. TEXT 6.4	

Selected Opportunities for Connection to Mathematical Practices

1. Make sense of problems and persevere in solving them.
 2. Reason abstractly and quantitatively.
 3. Construct viable arguments and critique the reasoning of others.
 4. Model with mathematics.
 5. Use appropriate tools strategically.
 6. Attend to precision.
 7. Look for and make use of structure.
 8. Look for and express regularity in repeated reasoning.
- All of the content presented at this grade level has connections to the standards for mathematical practices.*
- Bold type identifies possible starting points for connections to the SLOs in this unit.***

Code #	Common Core State Standards
N-VM-1	(+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., \mathbf{v} , $ \mathbf{v} $).

	$\ v\ , v$.
N-VM-2	(+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
N-VM-3	(+) Solve problems involving velocity and other quantities that can be represented by vectors.
	(+) Add and subtract vectors.
N-VM-4	<p>a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.</p> <p>b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.</p> <p>c. Understand vector subtraction $v - w$ as $v + (-w)$, where $-w$ is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.</p>
N-VM-5	<p>(+) Multiply a vector by a scalar.</p> <p>a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.</p> <p>b. Compute the magnitude of a scalar multiple cv using $\ cv\ = c v$. Compute the direction of cv knowing that when $c v \neq 0$, the direction of cv is either along v (for $c > 0$) or against v (for $c < 0$).</p>

CCSS #	Assessments
	FIND THE COMPONENT FORM AND MAGNITUDE OF THE VECTOR PQ IF P= (-2,2) AND Q=(3,4)

FIND THE DOT PRODUCT OF U AND V IF $U = \langle 5, 3 \rangle$ AND $V = \langle 12, 4 \rangle$

FIND $|U|$ IF $U = \langle 2, -3 \rangle$

THE LOCATIONS OF TWO SHIPS FROM MAYS LANDING LIGHTHOUSE, GIVEN IN POLAR COORDINATES, ARE (3 MI, 170°) AND (5 MI, 150°). FIND THE DISTANCE BETWEEN THE SHIPS.

Unit 5 (MATRICES)

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	TO USE MATRICES TO ORGANIZE, MANIPULATE AND DISPLAY INFORMATION TEXT 7.2	N-VM 6,7,8,9,10,11,12

Selected Opportunities for Connection to Mathematical Practices

1. Make sense of problems and persevere in solving them.
 2. Reason abstractly and quantitatively.
 3. Construct viable arguments and critique the reasoning of others.
 4. Model with mathematics.
 5. Use appropriate tools strategically.
 6. Attend to precision.
 7. Look for and make use of structure.
 8. Look for and express regularity in repeated reasoning.
- All of the content presented at this grade level has connections to the standards for mathematical practices.*

Bold type identifies possible starting points for connections to the SLOs in this unit.

Code #	Common Core State Standards
N-VM-6	(+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
N-VM-7	(+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
N-VM-8	(+) Add, subtract, and multiply matrices of appropriate dimensions.

N-VM-9	(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
N-VM-10	(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
N-VM-11	(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
N-VM-12	(+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

CCSS #	Assessments
	<p>SOLVE FOR X IF $3X + A = B$, WHERE</p> <p>$A = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$ AND $B = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$</p>

Unit 6 (CONIC SECTIONS)

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	The student will be able to solve problems using the geometry and reflective properties of conic sections.	
2	The student will be able to write polar equations of conics.	
3	Text sections 8.1,2,3,5	

Selected Opportunities for Connection to Mathematical Practices

8. Make sense of problems and persevere in solving them.
 9. Reason abstractly and quantitatively.
 10. Construct viable arguments and critique the reasoning of others.
 11. Model with mathematics.
 12. Use appropriate tools strategically.
 13. Attend to precision.
 14. Look for and make use of structure.
 8. Look for and express regularity in repeated reasoning.
- All of the content presented at this grade level has connections to the standards for mathematical practices.*

Bold type identifies possible starting points for connections to the SLOs in this unit.

CCSS #	Assessments
	Quizzes on geometry of conics
	Quiz on Polar Equations of conics
	Test on Conics

Unit 7 (DIFFERENTIATION AND INTEGRATION)

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	HOW DIFFERENTIAL AND INTEGRAL CALCULUS HELP US MAKE DECISIONS? TEXT 10.1,10.2,10.3,10.4	

Selected Opportunities for Connection to Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
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All of the content presented at this grade level has connections to the standards for mathematical practices.

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CCSS #	Assessments
	FIND THE DERIVATIVE OF THE FUNCTION $F(X)=3X^2 + 2X - 1$
	FIND THE SLOPE OF THE GRAPH AT THE INDICATED POINT $F(X) = 2X^2$ AT $X = -1$
	FIND THE DEFINITE INTEGRAL BY COMPUTING AN AREA OF 5 dx FROM 3 TO 7

Pacing Guide – Course

<u>Content</u>	<u>Number of Days</u>
<u>Unit 1: POLYNOMIAL FUNCTIONS</u>	<u>45</u>
<u>Unit 2: ANGLES AND TRIGONOMETRIC FUNCTIONS</u>	<u>45</u>
<u>Unit 3: APPLICATIONS OF TRIGONOMETRIC FUNCTIONS</u>	<u>15</u>
<u>Unit 4: MATRIX ALGEBRA</u>	<u>15</u>
<u>Unit 5: VECTORS AND POLAR COORDINATES</u>	<u>15</u>
<u>Unit 6: CONIC SECTIONS</u>	<u>15</u>
<u>Unit 7: DIFFERENTIATION AND INTEGRATION</u>	<u>10</u>