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| **Date** | **Autumn 2016-2017** | Credits | **3** |
| **Course Title** | **Basic Mathematics** | Course Number | **MATH 115** |
| **Pre-requisite (s)** | **None** | Co-requisite (s) | **None** |
| **Hours** | **60** | Out of Class Work Hours | **120** |

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| Place and Time of Class Meeting |

D301, Tuesdays 13:00-17:00

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| Name and Contact Information of Instructor |

Dr Neil Course

office: D333

email: neil.course@okan.edu.tr

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| Book suggested |

*(The School recognizes the use of the textbook in the classroom as part of the educational methodology and strategy applied in diverse materials. The textbook is part of the curriculum and is used to reach the student in an effective manner in the classroom. It is recommended that every student acquires and uses the textbook.)*

George B. Thomas Jr., Maurice D. Weir and Joel Hass, Thomas' Calculus, Pearson. (11th, 12th or 13th edition)

**Classroom expectations for students**

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| Attendance Policy |

Students are liable to attend every course, practical and laboratory work of the program they are enrolled and to take the exams and participate in academic work required for achieving the course. Student attendance to all courses is compulsory. Students who do not attend a minimum 70% of the theoretical courses and 80% of the practical courses will be considered as absent for the related courses. Students who do not meet the mandatory minimum requirement of attendance will fail the course. Students who fail a course for not fulfilling minimum attendance requirement are obliged to meet the attendance requirement when they re-take the course.

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| Student Tardiness Policy |

Students are permitted to arrive to the class in the first 5 minutes after the scheduled start of the course; extension of tardiness time is in instructor’s discretion.

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| Course Description (must correspond exactly to Catalog description) |

This course will investigate limits, rules of limits, continuity, derivatives, differentiation rules, chain rule, implicit differentiation, maximum-minimum problems, curve sketching, applied optimization problems, integration, Riemann sums, definite integrals, area between curves, volumes of revolution, transcendental functions.

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| Learning Objectives |

**At the end of this course the student will be able to:**

* Calculate limits by substitution and by eliminating zero denominators.
* Calculate limits of rational functions at infinity.
* Determine continuity behavior of a function at a certain point.
* Obtain limits involving infinity and find asymptotes of a function.
* Apply the basic rules of differentiation and use them to find derivatives of products and quotients.
* Define derivatives of polynomials, trigonometric, exponential, hyperbolic, logarithmic and inverse trigonometric functions.
* Apply the chain rule to find derivatives of composite functions.
* Sketch graphs of rational functions including finding asymptotes, tangents and normals to graphs of functions given in explicit, implicit and parametric forms
* Define standard indefinite integrals and basic rules of indefinite integration.
* Evaluate integrals by substitution with and without suitable hints.
* Evaluate integrals of rational functions by partial fractions and repeated use of integration by parts.
* Formulate the concept of definite integral and its basic properties.
* Write the expression of the fundamental theorem of calculus and apply it for evaluating definite integrals and derivatives of integrals with variable limits of integration
* Find area between curves, volumes and surface areas of solids of revolution, and arc length.

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| Topical Outline and Schedule |

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| **DATE** | **WEEK 1** |
| **SPECIFIC OBJECTIVES** | * Describe the course. * Explain the areas the calculus is needed. * Define dependent and independent variables, function, domain, and range. * Graph the easy functions * Define increasing/decreasing and even/odd functions. * Calculate the result of the operations of functions. * Explain trigonometric functions and their properties. |
| **TOPIC (S)** | * Syllabus. * 1.1 Functions and Their Graphs * 1.3 Trigonometric Functions |
| **LEARNING ACTIVITIES** | Discussion of Syllabus.  Discuss the effect of the functions’ behavior on their graphs.  Obtain the trigonometric identities step by step by discussion.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | Review the Syllabus.  **Homework**: Read Chapter 1, and sections 2.1,.2.2, 2.3 and be prepared to discuss in class.  MathXL (This course is based on Thomas' Calculus Global Edition, 12e Copyright 2015 Pearson Education)  Doing **Homework I** |
| **DATE** | **WEEK 2** |
| **SPECIFIC OBJECTIVES** | * Explain and exemplify the limit laws * Eliminate zero dominators algebraically to calculate the limit. * Explain the sandwich theorem. * Write precise definition of the limit by the aim of the students. * Find deltas algebraically for given epsilons. * Explain how to find a delta for a given function, L, x and epsilon. * Use the precise definition of the limit to prove the limit laws. |
| **TOPIC (S)** | * 2 Limits and Continuity * 2.2 Limit of a Function and Limit Laws * 2.3 The Precise Definition of a Limit |
| **LEARNING ACTIVITIES** | Illustrate the limit of a function at a certain point by using its graph and comparing values of the function at the neighborhood of the point.  Discuss how to find limit of a function if the function has zero dominator.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read Chapter 2 and be prepared to discuss in class. Solve exercise problems. |
| **DATE** | **WEEK 3** |
| **SPECIFIC OBJECTIVES** | * Illustrate continuity behavior of a function at a point. * Explain continuity test and discontinuity types by using several examples. * Illustrate the properties of the continuous functions. * Exemplify the continuous extension of a function to a point. * Explain the intermediate value theorem for continuous functions. * Explain limit of a function at infinity (+/-) and related theorems. * Define and illustrate asymptotes. * Explain precise definition of infinite limits and related examples. |
| **TOPIC (S)** | * 2.5 Continuity * 2.6 Limits Involving Infinity; Asymptotes of Graphs. |
| **LEARNING ACTIVITIES** | Discuss under which circumstance the function be discontinuous at a point.  Make the students inference to define the discontinuity types.  Graph a function to illustrate the intermediate value theorem.  Graph a function to illustrate the relationship between the function and its the asymptotes.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read Chapter 2 and section 3.1, 3.2, 3.3 and be prepared to discuss in class. Solve exercise problems. |
| **DATE** | **WEEK 4** |
| **SPECIFIC OBJECTIVES** | * Define the derivative of a function. * Calculate the derivatives of the rational functions from the definition. * Exemplify the one-sided derivative. * Prove the differentiation rules. |
| **TOPIC (S)** | * 3 Differentiation * 3.1 Tangents and the Derivative at a Point * 3.2 The Derivative as a Function * 3.3 Differentiation Rules |
| **LEARNING ACTIVITIES** | Discuss the relationship between related changes and derivative.  Write a summary on the relation between limit of the difference quotient, slope, rate of change and derivative.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read sections 3.4, 3.5, 3.6, and be prepared to discuss in class. Solve exercise problems. |
| **DATE** | **WEEK 5** |
| **SPECIFIC OBJECTIVES** | * Explain motion along a line. * Mention the applications of the derivative in economics. * Define the derivatives of the trigonometric functions and solve some examples. * Explain the chain rule and solve some examples about repeated use of it. * Explain how to calculate the derivative of an implicitly defined function. * Calculate the derivatives of higher order. |
| **TOPIC (S)** | * 3.5 Derivatives of Trigonometric Functions * 3.6 The Chain Rule * 3.7 Implicit Differentiaton |
| **LEARNING ACTIVITIES** | Discuss how to find velocity by using position function.  Discuss how to find acceleration by the aim of the velocity function.  Discuss the relationship between jerk and acceleration.  Let the students obtain the derivative of the tangent function by using the derivatives of the sine and cosine functions.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read sections 3.7, 3.8, 3.9, and be prepared to discuss in class. Solve exercise problems. |
| **DATE** | **WEEK 6** |
| **SPECIFIC OBJECTIVES** | * Define absolute maximum/minimum and local maximum/minimum. * Explain the related theorems * Define increasing and decreasing functions. * Explain the first derivative test for local extrema. |
| **TOPIC (S)** | * 4 Applications of Derivatives * 4.1 Extreme Values of Functions * 4.2 The Mean Value Theorem * 4.3 Monotonic Functions and the First Derivative Test |
| **LEARNING ACTIVITIES** | Discuss how to find the absolute extrema of a continuous function on a finite closed interval.  Discuss how to determine the monotonic behavior of the function by using derivative.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read sections 4.4, 4.5, 4.7 and be prepared to discuss in class. Solve exercise problems. |
| **DATE** | **WEEK 7** |
| **SPECIFIC OBJECTIVES** | * Define the concavity and explain second derivative test. * Define the points of inflection and solve some examples. * Explain the second derivative test for local extrema. * Explain the steps for sketching the graph of a function. * Solve applied optimization problems. * Define indefinite integral and the related terms. |
| **TOPIC (S)** | 4.4 Concavity and Curve Sketching  4.5 Applied Optimization |
| **LEARNING ACTIVITIES** | Discuss how to determine concavity of the function on an interval.  Help the students to plot the inflection points on the graph by themselves.  Construct the objective function of the problem by the aim of the students.  Discuss the relationship between antiderivative and the integral.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read Chapter 5. Solve exercise problems. |
| **DATE** | **WEEK 8** |
| **SPECIFIC OBJECTIVES** | * Estimate the area of a region by using lower sums, midpoint rule and upper sums. * Explain the finite sums, and denote its notation. * Explain some properties of the finite sums. * Calculate the limits of the finite sums as n goes to infinity. * Define definite integral of a function over a closed interval and explain related theorems. * Mention the properties of the definite integrals. * Calculate the area under the graph of a nonnegative function. * Calculate the average value of a continuous function. |
| **TOPIC (S)** | 5 Integration  5.1 Area and Estimating with Finite Sums  5.2 Sigma Notation and Limits of Finite Sums  5.3 The Definite Integral |
| **LEARNING ACTIVITIES** | Discuss how to compute the sum.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read section 5.4, 5.5, 5.6 and be prepared to discuss in the class. Solve exercise problems. |
| **DATE** | **WEEK 9** |
| **SPECIFIC OBJECTIVES** | * Midterm |
| **DATE** | **WEEK 10** |
| **SPECIFIC OBJECTIVES** | * Explain the mean value theorem for definite integrals, fundamental theorem of calculus, and net change theorem. * Explain the relationship between integration and differentiation. * Calculate the total area of a region. * Explain how to calculate the definite integrals by using substitution method. * Explain the substitution method in definite integrals. * Explain the definite integral of the even and od functions on the symmetric interval. * Explain calculating the areas between curves. |
| **TOPIC (S)** | 5.4 The Fundamental Theorem of Calculus  5.5 Indefinite Integrals and the Substitution Method  5.6 Substitution and Area Between Curves |
| **LEARNING ACTIVITIES** | Discuss how to calculate the area of a region bounded by a negative function.  Discuss how to use substitution method in definite integrals.  Discuss the simplicity of the calculating integral of an even/odd function.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read Chapter 6. Solve exercise problems. |
| **DATE** | **WEEK 11** |
| **SPECIFIC OBJECTIVES** | * Calculate the volume by using cross-sections. * Calculate the volume of a solid of revolution by using disc method. * Calculate the volume of a solid of revolution by using washer method. * Calculate the volume of a solid of revolution by using the shell method. * Explain the formula of the arc length of a curve and solve some examples. |
| **TOPIC (S)** | Applications of Definite Integrals  6.1 Volumes Using Cross-Sections  6.2 Volumes Using Cylindrical Shells  6.3 Arc Length |
| **LEARNING ACTIVITIES** | Obtain the formula of the volume by discussion.  Find the formula of the volume by using disc method step by step.  Write the formula of the volume by using washer method with perceptions of the students.  Write the formula of the volume by using shell method with perceptions of the students.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read Chapter 7. Solve exercise problems. |
| **DATE** | **WEEK 12** |
| **SPECIFIC OBJECTIVES** | * Explain the 3D coordinate system. * Define the vectors and related terms. * Explain the vector algebra operations of the vectors and the properties of them. * Calculate the angle between two vectors. * Define dot product and orthogonallity. * Explain the properties of the dot product. |
| **TOPIC (S)** | Vectors and Geometry of Space  12.1 Three Dimensional Coordinate Systems  12.2 Vectors  12.3 The Dot Product |
| **LEARNING ACTIVITIES** | Illustrate the parallelogram law.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read Chapter 12. Solve exercise problems. |
| **DATE** | **WEEK 13** |
| **SPECIFIC OBJECTIVES** | * Define the cross product and the related terms. * Calculate the cross product of the vectors. * Explain the equations for a line. * Explain the equations for a plane. * Calculate the distance from a point to a plane. |
| **TOPIC (S)** | 12.4 The Cross Product  12.5 Lines and Planes in Space  12.6 Cylinders and Quadratic Surfaces |
| **LEARNING ACTIVITIES** | Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | **Homework**: Read Chapter 12. Solve exercise problems. |
| **DATE** | **WEEK 14** |
| **SPECIFIC OBJECTIVES** | * Write an example about linear equations. * Identify the relationship between a linear equation and its solution. * Show some examples about the systems which have same solution set. * Define row echelon, reduced row echelon and leading term. * Compare row echelon and reduced row echelon form. * Reduce some systems into row echelon form/ reduced row echelon form. * Define the general solution of a linear system. * Explain the differences between consistent and inconsistent system * Explain the trivial solution. * Define the matrix, entries in a matrix, main diagonal, dimension of a matrix, square matrix, equality of matrices. * Show how to name a matrix and its entries. * Determine the dimension of a matrix. * Compare two matrices to decide equality. * Define matrix operations: addition, subtraction, multiplication by a scalar, and multiplication. * Calculate the sum and difference of two matrices. * Find a scalar multiple of a matrix * Determining whether a product is defined * Define linear combination of r matrices. * Writing a system of m equations with n unknowns as a single matrix equation. * Define transpose and trace of a matrix. * Explain the properties of matrix arithmetic by giving an example. * Define zero matrix. * Define inverse matrix. * Explain properties of the inverse matrices. * Define elementary matrices. * Solve a system by matrix inversion |
| **TOPIC (S)** | Matrices  Definition and Properties of the Matrices  Solving Systems of Equations |
| **LEARNING ACTIVITIES** | Discuss solution types of the linear equations.  Solve two systems which have same solution set.  Discussion of the solution types of a system of the linear equations.  Evaluate the relation between unknown number and the free variables by discussing.  Finding unknown terms by comparing two equal matrices.  Discussion of the existence of the product of the two matrices.  Finding a suitable way to denote the systems of the linear equations.  Group discussion: how to illustrate a system of equations by using matrices.  Support the students to make inferences about existence of the properties of the matrix arithmetic and prove them step by step.  Encourage the students to show a new way to finding the solution sets of the systems.  Discuss the conditions to solve a system with matrix inversion.  Completion of exercises and problems. |
| **OUT OF CLASS WORK ASSIGNMENT** | Read related sections and be prepared to discuss in class. Solve exercise problems. |

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| Instructional Methods |

In developing methodological strategies, it is best to discuss them between teachers and students in an environment of freedom and mutual agreement in order to ensure that the students make them their own and take responsibility for their execution and for attaining the goals of this course.

The following strategies may be used in this class:

1. A review of the literature.
2. Analysis of assigned readings.
3. Individual and group discussions.
4. Preparation of a didactic plan.
5. Preparation of lecture notes.

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| Instructional Materials and References |

George B. Thomas Jr., Maurice D. Weir and Joel Hass, Thomas' Calculus, Pearson. (11th, 12th or 13th edition)

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| Assessment Criteria and Methods of Evaluating Students |

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| **Grade** | **Coefficient** |
| AA | 4.00 |
| BA | 3.50 |
| BB | 3.00 |
| CB | 2.50 |
| CC | 2.00 |
| DC | 1.50 |
| DD | 1.00 |
| FF | 0.00 |
| VF | 0.00 |

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| Distribution of Grade Elements | | | | |
|  | **In-Term Studies** | **Quantity** | **Percentage** | |
|  | Midterm I | 1 | 25 | |
|  | Homework | 8 | 25 | |
|  | **Total** | 9 | 50 | |
|  | **End-Term Studies** | **Quantity** | **Percentage** | |
|  | Final | 1 | 50 | |
|  | **Total** | 1 | 50 | |
|  | **Contribution Of In-Term Studies To Overall Grade** | | | 50 |
|  | **End-Term Studies** | | | 50 |
|  | **Total** | | | 100 |

Date Syllabus Was Last Reviewed: September 20, 2016