MA1113 - SINGLE VARIABLE CALCULUS I (4-0)

Prerequisite: Algebra

Text: Calculus (Early Transcendentals), Eighth Edition, by James Stewart, Cengage, ISBN 978-1-285-74155-0.

HOURS	TOPICS	SECTION	**HOMEWORK**
2-2	Real Numbers, Sets, Inequalities, Absolute Value	Appendix A	1-29*, 47-55*
1-3	Coordinate Geometry and Lines	Appendix B	1-9*, 21-27*, 43-51*
1-4	Trigonometry	Appendix D	1-15*
1-5	Four Ways to Represent a Function	1.1	3-9*, 27-35*
1-6	Essential Elementary Functions	1.2	1,2
	New Functions from Old	1.3	1-5*, 9-21, 33-41*
1-7	Exponentials	1.4	1,2,17-21
1-8	Inverse Functions and Logarithms	1.5	21-26,39-46,61-62
1-9	Limit Concept; Limit Calculation Laws	2.1-2.3	2.3: 1-31*
1-10	Continuity	2.5	None
1-11	Limits at Infinity; Horizontal Asymptotes	2.6	15-29*
1-12	Derivatives and Rates of Change	2.7	None
1-13	Derivatives as Functions	2.8	21-29*
1-14	Derivatives of Polynomials and Exponential Functions	3.1	3-41*
1-15	Product and Quotient Rules	3.2	3-35*
1-16	Derivatives of Trigonometric Functions	3.3	1-21*,27,29
2-18	The Chain Rule	3.4	7-45*
1-19	Implicit Differentiation	3.5	5-15*,25,27
1-20	Logarithmic Differentiation	3.6	3-25*,45-49*
2-22	Related Rates	3.9	1-19*
2-24	Linear Approximations; Differentials; Error Estimation	3.10	1-4,15-18,23-26*
0-24	Derivatives of Hyperbolic Functions	3.11	None
1-25	Maximum and Minimum Values	4.1	29-43*,51-59*
1-26	Optimization Problems	4.7	1,3,9,11,12,15,21,23
1-27	Mean Value Theorem	4.2	5-13
1-28	Indeterminate Forms and L'Hospital's Rule	4.4	9-27*
1-29	Anti-derivatives	4.9	1-17*,27-33*
1-30	Areas and Distances	5.1	None
1-31	The Definite Integral	5.2	None
1-32	The Fundamental Theorem of Calculus	5.3	9-35*
1-33	Indefinite Integrals and Net Change Theorem	5.4	5-15*,27-35*
2-35	The Substitution Rule (Change of Variable)	5.5	7-33*,59-65*
2-37	Integration by Parts	7.1	1-17*
1-38	How Derivatives Affect Graph Shapes	4.3	9-21*
1-39	Newton's Method	4.8	None
6-45	Reviews, Exams, Holidays		

* Do odd numbered problems in this range.

Course Objectives

Upon completion of this course, the student should have the following skills.

Functions and limits

- Use real numbers, inequalities involving real numbers and their absolute values, the trigonometric functions, and the radian measure of angles.
- Be able to move back and forth between the descriptions of a function by an equation, a table, a graph, and by words.
- Be able to use exponential functions, sketch their graphs, and define the number e.
- Define what it means for a function to be one-to-one and determine whether a function has an inverse or not and sketch its inverse if it does.
- Be able to use logarithmic functions, sketch their graphs, and define the relationship between the natural exponential and natural logarithmic functions.
- State in words what it means for a function to have a limit, be able to calculate limits, and be able to find the vertical and horizontal asymptotes of a function.
- State in words what it means for a function to be continuous and be able to find limits for continuous functions.

Derivatives

- Relate the notions of tangent to a curve, velocity, and rate of change, and illustrate them in a sketch.
- State the definition of derivative as the limit of a difference quotient and explain how the derivative itself can be regarded as a function.
- Be able to find derivatives of polynomials and exponential functions.
- State the product and quotient rules for differentiation and be able to use them to differentiate functions.
- Know the derivatives of sine and cosine and be able to use the quotient rule to determine the derivatives of the remaining four trigonometric functions.
- State the chain rule and use it to differentiate functions obtained by composition.
- Use the differentiation rules to differentiate implicitly, and to find higher order derivatives.
- Be able to differentiate logarithmic functions, and functions involving them.
- Define the hyperbolic functions and be able to differentiate them.

Applications of Differentiation

- Be able to solve related rates problems. Understand them as an application of the chain rule.
- Understand the connection between the derivative, the tangent line to the graph of a function, the linearization of a function, and the differential of a function.
- Use the differential (or linearization) to solve “small change” and applied approximation problems.
- Be able to state the Mean Value Theorem and give some of its consequences.
- Describe how the signs of the first and second derivatives of a function affect the shape of its graph.
- Define and recognize the various forms of indeterminate forms, and use L’Hospital’s Rule to determine their limits.
- Be able to set up and solve optimization problems using calculus methods.
- Be able to describe Newton’s method geometrically, and to use it to iteratively approximate the zeros of functions.
- Define what the antiderivative of a function is and be able to find it for reasonable functions.

Integral Calculus

- Describe the connection between the problems of finding areas and distances travelled, and how both problems lead to the same limit.
- Know and be able to work with the properties of definite integrals.
- State the Fundamental Theorem of Calculus in words, describe how it connects integral and differential calculus, and how it helps in finding antiderivatives and in evaluating definite integrals.
- Define the indefinite integral of a function and state its relation to the antiderivative.
- Be able to use the Substitution Rule to evaluate definite and indefinite integrals.
- Be able to use integration by parts to evaluate appropriate integrals.