

SYLLABUS AND CONTENTS OF MATH 101 (1445 H)

Course Name: Differential Calculus

Credit Hours: 3 hours

Course Number: Math 101

Actual Hours: 5 hours

Prerequisite: ---

Semester:

First Semester

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Textbook:

Differential Calculus, Fourth Edition, 2019

Authors:

Ibraheem Aloyan, Nasser Bin Turki, Tahsin Ghazal, Obaid Al-Gahtani and Khaled Khashan

References:

- Swokowski, E, W; Olinick, M; Penece, D. Calculus, Sixth Edition, PWS Publishing Company, 1994.
- Larson, R & Edwards, R. **Calculus**, Tenth Edition, Cengage Learning, 2014.
- Anton, H; Bivens, I & Davis, S. **Calculus Early Transcendentals**, Ninth Edition, Wily & Sons, 2009.

CONTENTS:

Functions: set of Numbers and Inequalities, Functions: Basic Definitions and Examples, Properties of functions, and their combination, Inverse functions, Trigonometric functions, Inverse Trigonometric functions.

Limits and Continuity: Definition of Limit, Limits Laws, Limits Involving Infinity, Continuity of Functions.

Differentiation: The Derivative and the Tangent Line Problem, Differentiation Rules, Derivatives of Trigonometric Functions, The Chain Rule, Implicit Differentiation, Higher Order Derivatives, The Derivative of Inverse Functions.

Applications of Differentiation: Extrema of Functions, The Mean Value Theorem, Increasing and Decreasing Functions, Concavity, Curve Sketching, Optimization Problems, Related Rates.

Logarithmic and Exponential Functions: Integration, The Natural Logarithmic Function, The Natural Exponential Function, General Exponential and Logarithmic Functions.

GOALS

In this course the student will:

- Define functions and their types.
- Define and apply the properties of limits of functions.
- State the definition of continuity and determine where a function is continuous or discontinuous.
- Find the derivative of an algebraic function by using the definition of a derivative.

- Apply differentiation rules to find the derivative of algebraic, trigonometric, exponential, and logarithmic functions and their inverses.
- Apply differentiation rules to find the derivative of the sum, product, quotient, inverse, and composite (chain rule) of elementary functions.
- Find the derivative of an implicitly defined function.
- Find the higher order derivatives of algebraic, trigonometric, exponential, and logarithmic functions.
- Use logarithmic differentiation as a technique to differentiate non-logarithmic functions.
- State and prove the Mean Value Theorem for derivatives and apply it algebraically and graphically.
- Use the derivative to find critical numbers, increasing intervals, decreasing intervals, local extrema, absolute extrema, concavity intervals and inflection points.
- Apply the derivative to solve problems, including tangent and normal lines to a curve, curve sketching, velocity, acceleration, related rates of change, and optimization problems.
- Define natural logarithmic function, natural exponential function, general logarithmic and exponential functions, also find its derivative and use the logarithms to find the derivative of complicated functions.

Evaluation:

The evaluation of the students will be continuous during the course and depends on the following:

Mid Term Exam	25
Activities	5
Two Home works(Paper) 5+5	
Online Home works	10
Final Exam	50

تعليمات مهمة:

١. الخطة التي بين أيديكم أنبأنا الطلاب هي خطة مختصرة تتضمن الأشياء المهمة في المقرر. الخطة التفصيلية وكل ما يتعلق بالمقرر موجود على موقع السنة الأولى المشتركة على الرابط:

<https://cfy.ksu.edu.sa/ar/node/1196>

٢. يحتسب الغياب منذ اليوم الأول من الفصل الدراسي إلى آخر يوم قبل الاختبارات النهائية.
٣. في حال تأخر الطالب عن المحاضرة عشر دقائق يعتبر غائبا، وفي حالة حضوره خلال العشر دقائق الأولى يسجل متأخرا.
٤. يحرم الطالب من المقرر إذا تجاوزت غياباته ٢٥% من ساعات الحضور.

Course Schedule and Contents:

Chapter	Weeks	Section	Lecture	For Students	
Chapter One	1-4	<ul style="list-style-type: none"> - Solve Linear Equations. - Solve Quadratic Equations (Factoring, Quadratic Formula). - Adding and Subtracting of Algebraic Fractions. - Expansion of Square and Cubic Brackets. - Difference between Two Squares. - Difference and Sum of Two Cubes. - Simplify by Common Factor. 			
		1.1 Sets of Numbers and Inequalities	Example: 1.1.2 Related Problem: (1,2,3(a,b,d,e)) Exercise: (13,17,19)	Exercise: 1,4,5,7,8,10,11,12 ,21,23	
		1.2 Functions	Related Problem: (2,4,5,6,7) Exercise: (20,44,46,60,69)	Exercise: 4,8,9,10,11,12,13,14,15,17,18 ,23,24,30, 31,32,57,58,59,61,62,64,66,68	
		1.3 Inverse Functions	Remark page 31 Example: 1.3.1 Related Problem: (2,3,4,5) Exercise: (1,2,3,4,5)	Exercise: 8,9,11,12,13,15,16,17,32,33,34 35 ,37,38,39,41,42	
		1.4 Trigonometric Functions and Their Inverses	Example: (1.4.7, 1.4.10) Related Problem: (1,2,3,4,6,8,9) Exercise: (27,32,38,39,41)	1,3,5,6 ,7,9,11,12,13,14,16,17,18,19,20,21,23,25,28,29,30 ,35, 40, 42,43,44,48,49,50	
Chapter Two Limits and Continuity	4-8	2.1 Definition of Limit	Example: (2.1.1, 2.1.2 and 2.1.3) Exercise (from 12 to 26)	Exercise: 2,9,11	
		2.2 Limits Laws	Example: (2.2.5, 2.2.10) Related Problem (2,4,5,6,7) Exercise (35,38,64,66, 72, 73, 75) Remark page 90	Exercise: 1,2,7,11,13,14,16,19,21,26,27,29,30,31,34, 35,37,40,41,43,47,48,49,51,53,54,55,57,63,71.	
		2.3 Limits Involving Infinity	Example: 2.3.1 Related Problem: (1,2,3,4,5) Exercise (1-9) Exercise (57,58)	Exercise: from 10-to-18,20,21,22,24,25,26,28,32,35,36,37,38,41, 44,45,47,52,54,55,60,61	
		2.4 Continuity of Functions	Example: (2.4.1, 2.4.12) Related Problem: (1,2,3,4,5,6,7,9) Exercise (27,51, 52,53,57)	Exercise: 1,2,3,4,7,8,12,13,16,18,19,22,29,30, 32,34,40,47,55,56,60	
Chapter Three Differentiation	9-11	3.1 The Derivative and the Tangent Line Problem	Example: (3.1.7) Related Problem: (1,3,4,9) Exercise: (8,24,25,30, 31) Proof of Theorem: 3.1.1	Examples: 3.1.6 Related Problem (6) Exercise: 2,6,10,13,15,21	

		3.2 Differentiation Rules	Use the Remark page 166 (give an example) Related Problem: (1,2,3,4,5,6,7) Exercise: (31,44)	Examples: 3.2.2 (b and c) Exercise: 1,4,5,8,12,14,16,17,18,19,23,24,26,28,37,38,40
		3.3 Derivatives of Trigonometric functions	Related Problem (1,2,3,4,5) Proof of Theorem (3.3.1) (b)	Examples: 3.3.6 Exercise: 1,3,5,7,10,11,13,16,19,20,21,23,27
		3.4 The Chain rule	Related Problem (1,2,3,5,6,7,8,9)	Examples: 3.4.4 Exercise: 2,5,6,8,9,11,12,13,15,16,20,21,26,27,29,30,34,38,39,40,47
		3.5 Implicit Differentiation	Related Problem (1, 2, 3)	Examples: 3.5.4 Exercise: 1,2,3,4,5,8,12,13,14,15,17,19,20,23,26
		3.6 Higher Order Derivatives	Example: (3.6.6, 3.6.7) Related Problem (1,2,3,5,6) Exercise: 40	Examples: 3.6.4 Exercise: 1,4,6,7,10,12,13,14,16,18,19,22,23,26,27,29,32,34,35,37,38,42,44,43
		3.7 The Derivative of Inverse Functions	Related Problem (2,3) Exercise: (5,12)	4,7,8,11,13,15,17,23
Chapter Four Applications of Differentiation	11-14	4.1 Extrema of Functions	Example: 4.1.1, 4.1.3 Related Problem: (1,2(a, b, c),3(a, b, c)) Exercise: (1,2,3,4)	Examples: 4.1.4(e,f), 4.1.6 and 4.1.7 Exercise: 5,6,8,10,16,23,24
		4.2 The Mean Value Theorem	Related Problem: (1,2) Exercise: (1,2,3,4,14, 19,23)	5,6,7,11,13,15,17,21,24,26
		4.3 Increasing and Decreasing Functions	Example: 4.3.8 Related Problem (2,3(a),4(a)) Exercise: (1,2,3,4,5,6,37,38)	Examples: 4.3.5, 4.3.7 Exercise: 7,11,13,15,21,22,27
		4.4 Concavity	Example: 4.4.4 and 4.4.5 Related Problem: (1(a, b), 2(a)) Exercise: (1,2,3,4,5,6,7,8,9,10, 11,47,49)	Examples: 4.4.8 Exercise: 12,19,25,28,32,36,44
		4.5 Curve sketching	Example: (4.5.1) Related Problem: (2) Exercise: (5,22)	Exercise: from 1 to 9, from 15 to 20,23, 25