

KING SAUD UNIVERSITY
DEANSHIP OF COMMON FIRST YEAR
BASIC SCIENCES DEPARTMENT

SYLLABUS AND CONTENTS OF MATH 101 (1447 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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| Course Coordinator: | Dr. Diaa Eldin Elgzoley | Phone: | ----- |
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| Office hours: | (8:00AM-4:00PM)- (from Sunday to Thursday) | | |
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Textbook:

Differential Calculus, Fourth Edition, 2019

Authors:

Ibraheem Alolyan, 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:

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|---|-----------|
| Mid Term Exam | 25 |
| Activities + Tutorial (Class work) | (2+13=15) |
| Two Home works(Paper) | 10 |
| Final Exam | 50 |

تعليمات مهمة:

1. الخطة التي بين أيديكم أبنائنا 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>
2. يحتسب الغياب منذ اليوم الأول من الفصل الدراسي إلى آخر يوم قبل الاختبارات النهائية.
3. في حال تأخر الطالب عن المحاضرة عشر دقائق يعتبر غائباً، وفي حالة حضوره خلال العشر دقائق الأولى يسجل متأخراً.
4. يحرم الطالب من المقرر إذا تجاوزت غيابه 25% من ساعات الحضور.

Course Schedule and Contents:

| Chapter | Weeks | Section | Lecture "Teacher" | Exercises |
|-------------|-------|--------------------------------------|---|----------------------------------|
| | 1 | أسبوع تعريفى | | |
| Chapter One | 2-5 | 1.1 Sets of Numbers and Inequalities | Example: (1.1.1), (1.1.2), Exercise: (7) Example: (1.1.4) (except c, d), | 1,3,5,6,16,19,23 |
| | | 1.2 Functions | Example: (1.2.3), (1.2.4), (1.2.5), (1.2.10), Exercise: (20,59) | 14,17,19,23,26,48,54,57,58,63,67 |
| | | 1.3 Inverse Functions | Related Problem:(2) Example: (1.3.4), (1.3.5) Exercise: ((1,2,3),38) Remark page 31 ($a \neq 0$) | 9,13,15,16,33,41,42 |

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|--|-------|--|---|--|
| | | 1.4 Trigonometric Functions and Their Inverses | Example: (1.4.1), (1.4.2), (1.4.3), (1.4.4), (1.4.5), (1.4.6), (1.4.7), (1.4.8), (1.4.9), and (1.4.10) | 2,4,5,8,9,12,14,16,17,18,21,27,29,37,44,52 |
| Chapter Two Limits and Continuity | 6-9 | 2.1 Definition of Limit | Example: (2.1.1), (2.1.2) Exercise (from 12 to 17) | 2,3,8,10 |
| | | 2.2 Limits Laws | Example: (2.2.3), (2.2.5), (2.2.6(except {d})), (2.2.7 {a}), (2.2.8), (2.2.9), (2.2.11) (except f), Related Problem: (6 {d, f}) Exercise (73) Example: (2.2.12) Remark page 90 | 7,11,13,26,29,30,41,49,54,55,63,66,75 |
| | | 2.3 Limits Involving Infinity | Example: (2.3.1), (2.3.5), Example: (2.3.8), (2.3.9) Exercise (8, 9), 24,53) | 19,20,25,45,48 |
| | | 2.4 Continuity of Functions | Example: (2.4.1), (2.4.2), (2.4.4), Remark page 131 Example: (2.4.6), (2.4.8), (2.4.11) Exercise (28) | 1,5,7,12,18,29,30,32,34,40,58 |
| | | | | |
| Chapter Three Differentiation | 10-13 | 3.1 The Derivative and the Tangent Line Problem | Example: (3.1.4), (3.1.6), (3.1.7),3.1.8), Example: (3.1.9) (Use Remark page 153) Exercise: (30) | 2,6,8,10,13,15,21,23 |
| | | 3.2 Differentiation Rules | Example: (3.2.1 {a, b, c}), (3.2.2 {b, c}), Use Remark page 166(give an example) Example: (3.2.3 {b}), (3.2.4) (b), (3.2.5) Exercise: (44) | 1,4,5,14,16,17,23,24,29,41 |
| | | 3.3 Derivatives of Trigonometric functions | Example: (3.3.1), (3.3.2), (3.3.3), (3.3.5) | 1,5,7,10,11,13,16,19,20,21,23 |
| | | 3.4 The Chain rule | Example: (3.4.2), Exercise: (20) Example: (3.4.6) (a, c), | 2,5,6,8,11,12,15,16,19,29,34,38,47 |
| | | 3.5 Implicit Differentiation | Example: (3.5.1), (3.5.2) | 1,2,3,4,5,8,9,12,13,14,19,20,23,26 |

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|---|-------|--|--|--|
| | | 3.6 Higher Order Derivatives | Example: (3.6.1) Related Problem: (2,3) Example: (3.6.7) | 1,4,6,7,10,12,13,14,16,18,19,22,23,26,27,29,32,34,35,37,38 |
| | | 3.7 The Derivative of Inverse Functions | Example: (3.7.2) Exercise: (14) | 6,7,11,15,16,17,23 |
| Chapter Four Applications of Differentiation | 13-15 | 4.1 Extrema of Functions | Example:(4.1.1), (4.1.4 except {g}), (4.1.5) Exercise: (24) | 1-4,6,7,11,16,17 |
| | | 4.2 The Mean Value Theorem | Example: (4.2.1), (4.2.4) Exercise: (1,2) | 6,7,21,24,26 |
| | | 4.3 Increasing and Decreasing Functions | Example: (4.3.3), (4.3.4) Related Problem:(3 {a}) Example: (4.3.6) Exercise: (4,5) | 1,3,7,11,13,15,26,38 |
| | | 4.4 Concavity | Example: (4.4.1),(4.4.2), (4.4.5), (4.4.6) Related Problem: (2 {a}) Exercise: (5 to 9), (47) | 12,25,28,36,48 |
| | | 4.5 Curve sketching | Example: (4.5.1), (4.5.2) Exercise: (3) | 4,5,19 |