King Saud University
Faculty of Sciences
Department of Mathematics

First Midterm Exam
Academic Year 2025-2026 - First Semester

Exam Information	
Course name	Introduction to Differential Equations
Course Code	Math 280
Date Exam	20-11-2025
Exam Time	01: 00 PM
Duration Exam	1H30mns
Classroom No.	71
Instructor Name	Mongi Blel

Student Information	
Student's Name	
ID Number	
Section Number	321
Serial Number	
General Instructions	• Your Exam consists of 4 pages (including this page) • Keep your mobile and smart watch out of the classroom.

This section is only for instructor

#	Course Learning Outcomes (CLOs)	Related Question(s)	Points	Final Score
1	(20 points)	Q(1,2,3,4)		

Question 1 : [2,2]
Evaluate the following limits:

1. $\lim_{x\to 0^+} (\cos x)^{\frac{1}{\tan(x^2)}}$

2. $\lim_{x\to\infty} (1+4x^2)^{\frac{1}{x^2}}$.

Question 2 : [2,3]

1. Compute the differential of the following function $f(x) = \tan^{-1}(\sec x)$.

2. Let $f\colon [0,1] \longrightarrow [0,1]$ be a continuous function. Prove that there exist $c, d \in [0,1]$ such that $f(c) = 0$ and $f(d) = d^4$.

Question 3 : [3]
Prove that for $x > 0$, $1 - \frac{x}{2} \leq \frac{1}{\sqrt{x+1}} \leq 1 - \frac{x}{2} + \frac{3}{8}x^2$.

Question 4 : [3]
Let I be an interval and $f : I \to \mathbb{R}$ be a continuous function such that $f^2 = 1$.
Prove that f is constant ($f = 1$ or $f = -1$).

Question 5 : [1+1+3]
Consider the function f defined on $\mathbb{R}$ by; $f(x) = x^2 \sin(\frac{1}{x})$, for $x \neq 0$ and $f(0)$.

1. Prove that f is continuous at 0.
2. Prove that f is differentiable at 0.
3. Compute $f'(x)$ for $x \neq 0$ and deduce that f' is not continuous at 0.