Prince Sultan University

Deanship of Educational Services

Department of Mathematics and General Sciences

COURSE DETAILS:

Calculus I MATH 111 FINAL EXAM					
Semester:	Fall Semester --Term 191				
Date:	Saturday, December 14th, 2019				
Time Allowed:	180 minutes				
Instructor:	Dr. Nabil Mlaiki	Dr. Aiman Mukheimer		Prof. Thabet Abdeljawad	Prof. Wasfi Shatanawi
Section Number:	537 (09:00-9:50)	529 (08:00-8:50)	533 (11:00-11:50)	535 (01:00-01:50)	531 (10:00-10:50)

STUDENT DETAILS:

Student Name:	
Student ID:	

INSTRUCTIONS:

- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work and be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.

GRADING:

	Page 1	Page 2	Page 3	Page 4	Page 5	Total	Total
Marks	**20**	**16**	**14**	**14**	**16**	**80**	**40**

Q1) (20 points; 5 points each) Find the limit.

a) $\lim_{x\to 1} \frac{x^3-2x+1}{x^3-1}$

b) $\lim_{x\to \infty} \frac{(\ln x)^2}{x}$

c) $\lim_{x\to 1^+} \left(\frac{x}{x-1} - \frac{1}{\ln x}\right)$

d) $\lim_{x\to 0^+} (\tan(2x))^x$

Q2) (8 points) Verify that the function $f(x) = 2x^2 - 4x + 5$ satisfies the three hypotheses of Roller's Theorem on the interval $[-1, 3]$. Then find all numbers c that satisfies the conclusion of Roller's Theorem.

Q3) (8 points) Find the critical numbers of the function $f(x) = x^4(x-1)^3$

Q4) (6 points) Find the absolute minimum and the absolute maximum values of the function $f(x) = x - \sqrt[3]{x}$ over the interval $[-1, 4]$.

Q5) (8 points) What is the maximum vertical distance between the line $y = x + 2$ and the parabola $y = x^2$ for $-1 \leq x \leq 2$?

Q6) (8 points; 4 points each) let $f(x) = x^3 - 3x^2 - 9x + 4$

a) Find the intervals on which f is increasing or decreasing. **(Justify your answer)**

b) Find the intervals on which f is concave upward or downward. **(Justify your answer)**

Q7) (6 points) Use implicit differentiation to find the equation of the tangent line to the curve $x^2 - xy - y^2 = 1$ at the point $(2, 1)$.

Q8) (16 points) Let $f(x) = \frac{x-1}{x^2}$ **<u>Show your work in details</u>**

a) **(3 points)** Find the domain of f and the x-intercept.

b) **(2 points)** Determine the vertical and horizontal asymptotes, if any.

c) **(4 points)** Find the critical numbers **<u>and</u>** the local maximum and/or local minimum **<u>points</u>**, if any.

d) **(4 points)** Find the intervals on which f are concave up and/or concave down and the inflection **<u>point(s)</u>** if any.

e) **(3 points)** Sketch the graph of f