GULF UNIVERSITY FOR SCIENCE AND TECHNOLOGY

COLLEGE OF ARTS AND SCIENCES

Final Examination – Spring 2018

Course Code: MATH 131 **Section:** 1

Instructor: Dr. Mohamed Ben Romdhane **Date:** May 6, 2018

Student Name: ..... **Student Number:** .....

Important notes:

- Calculators are allowed but cannot be shared.
- The quality of your writing, the clarity, and the precision of your reasoning, all together will be taken into account in the correction process.
- Please, **switch off your cell phones**.
- This examination has **8** pages including this cover page. Before you start the examination please **verify the number of pages**.
- **No Questions are allowed during the examination.**
- In order to get full credit on any question, **show all your work**.

Student signature: .....

Grading scheme:

Objective	**1**		**2**	**3**			**4**		**5**	**Total**
Question	1	2	3	4	5	6	7	8	**9**	
Points	16	8	18	7	10	10	18	5	8	**100**
Score										

1. [**16**] **Find the following limits if they exist, or show that they do not exist** (Hint: *You may use L'Hopital's rule whenever needed*)

a. $\lim_{x\to+\infty} \dfrac{1+2x^3-3x}{x+4-5x^2}$ ____/3pts

b. $\lim_{x\to 3^+} \dfrac{2x-6}{\ln(x^2-8)}$ ____/4pts

c. $\lim_{x\to(-2)} \dfrac{x-2}{x^2+2x}$ ____/4pts

d. $\lim_{x\to 0^+} \left(5x+\cos x\right)^{\frac{3}{x}}$ ____/5pts

2. [**8**] Given $f(x)=\begin{cases} \dfrac{x-2}{\sqrt{x+7}-3} & , \ if \quad x>2 \\ 5x+b & , \ if \quad x=2 \\ 3+a\,x & , \ if \quad 0<x<2 \\ 3+e^{2x} & , \ if \quad x\le 0 \end{cases}$

a. Is $f(x)$ continuous at $x=0$? Justify. ____/3pts

b. Find the values of *a* and *b* to make $f(x)$ continuous at $x=2$. ____/5pts

3. [**18**] Find the derivatives of the following functions. YOU DON'T HAVE TO SIMPLIFY.

a. $f(x) = (x^2 + \sqrt{x} + 4e^2)\ \tan(3x)$ ____/*4pts*

b. $f(x) = \dfrac{x + e^{2x}}{4x^3 - \ln x}$ ____/*4pts*

c. $f(x) = \dfrac{\sqrt[3]{3}}{x} + 3^{x^2} + \sec(x^3)$ ____/*5pts*

d. $f(x) = \left(2\sin x + 7\right)^{x - x^2}$ ____/*5pts*

4. [**7**] Given $f(x) = 1 + \sqrt[3]{6x^2 - 2x^3}$, find all the critical points then find the absolute maximum and absolute minimum on the interval [0,3]

5. [**10**] Find the derivative y' (*i.e.* $\frac{dy}{dx}$) in the following cases

a. $y = \sqrt{5 + \cos(1 + 4x^3)}$ ____/4pts

b. $e^{x^2} + y \sin y = 2x y^3$ ____/6pts

6. [**10**] Given the function $f(x) = (x^2 - 4x + 2)\, e^{2x}$

a. Find the critical points of $f(x)$ ____/*4pts*

b. Find all the local maximum and minimum values of $f(x)$ ____/*3pts*

c. Write the linear approximation of $f(x)$ at $x = 1$ ____/*3pts*

7. [**18**] Evaluate the following integrals

a. $\int_1^2 2x^3 + \frac{1}{x^2}\, dx$ ____/4pts

b. $\int \frac{\sin(\ln x)}{2x}\, dx$ ____/4pts

c. $\int \frac{x + e^{-2x}}{x^2 - e^{-2x}}\, dx$ ____/5pts

d. $\int_0^2 5x^2\, e^{8-x^3}\, dx$ ____/5pts

8. [**5**] Find $f(x)$, given that $f'(x) = 4x - \frac{5}{x} + \frac{1}{\sqrt{x}}$, and $f(1) = 7$

9. [**8**] Find the area between the curves $f(x) = x^2 + 5x + 2$ and $g(x) = 3x^2 - x + 2$.