



Prince Sultan University

MATH 111

Major Exam II

Semester II, Term 162

Tuesday, May 02, 2017

Time Allowed: **90 minutes**

Student Name: _____

Student ID #: _____

Teacher's Name: _____ Section #: _____

Serial #: _____

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your mobile phone is seen or heard.
6. Looking around or making an attempt to cheat will result in your exam being cancelled.
7. You have to show your work in details in all problems.
8. This examination has 9 problems, some with several parts. Make sure your paper has all these problems.

Page #	Max points	Student's Points
1	20	
2,3,4	23	
5,6,7	21	
8,9	16	
Total	80	

Q1. (20 points) Compute y' .

(Note1: Show your work in details)

(Note2: Do not simplify)

1. $y = \frac{\sqrt[5]{\tan^{-1} x}}{\tan x}$

2. $y = \ln(\operatorname{sech}^3(\sqrt{5x}))$

3. $y = \cos\sqrt{\sin(\tan 5x)}$

4. $y = e^{\tan(13x^2+1)} + \tan(e^{13x^2+1})$

5. $y = (11x^{10} + 9)^8 \cdot (7x^6 + 5)^4 \cdot \sqrt[3]{x^2 + 2^x}$

Q2. (8 points) Find an equation of the **normal** line to the curve $y = \sqrt{x}$ that is parallel to the line $2x + y = 1$.
(Note: Show your work in details)

Q3. (8 points) If $x^2 + xy + y^3 = 1$, find the value of y'' at the point where $x = 1$.

Q4. (7 points) An oil spill from a tanker spreads out in a circular pattern, centered at the tanker's position. If the spill is moving outwards at 2 m/s, find the rate of increase of the contaminated area when the radius is 500 m?
(Note: Show your work in details)

Q5. (7 points) A spherical snowball is melting in such a way that its volume is decreasing at a rate of $10 \text{ cm}^3 / \text{min}$. At what rate is the radius decreasing when the radius is 5 cm?

(Note1: Volume of the sphere is: $V = \frac{4}{3}\pi r^3$)

(Note2: Show your work in details).

Q6. (8 points) Suppose $f(5) = 1$, $f'(5) = 6$, $g(5) = -3$, and $g'(5) = 2$. Find the following:

1. $\left(\frac{g}{f}\right)'(5)$.

2. Let $h(x) = \sqrt{2 + 7f(x)}$. Find $h'(5)$

Q7. (6 points) Prove the identity $\tanh(\ln x) = \frac{x^2 - 1}{x^2 + 1}$.

(Note: Show your work in details)

Q8. (6 points) Find the limit of the following:

(Note: Show your work in details)

1. $\lim_{x \rightarrow 0} 5 \csc 3x \cdot \sin(2 \sin 3x)$

2. $\lim_{x \rightarrow \pi} \sin(x - \pi) \cdot \frac{\cos x}{x^2 - \pi^2}$

Q9. (10 points) Find the derivative of the following functions:

(Note: Show your work in details)

1. $xy = \sqrt{x^4 + y^4}$

2. $y = (\tan x)^{x^2}$