# Prince Sultan University
Deanship of Educational Services
Department of Mathematics
and General Sciences

## COURSE DETAILS:

| Calculus I | MATH 111 | MAJOR EXAM II |
|---|---|---|
| Semester: | Fall Semester --Term 181 | |
| Date: | Wednesday November 28, 2018 | |
| Time Allowed: | 90 minutes | |

## STUDENT DETAILS:

| Student Name: | |
|---|---|
| Student ID Number: | |
| Section #: | Attendance Serial #: |
| Instructor's Name: | |

## 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 | Total | Total |
|---|---|---|---|---|---|---|
| Questions | | | | | | |
| Marks | 14 | 16 | 15 | 15 | 60 | 20 |

Q1 (9 point) Find $\dfrac{dy}{dx}$

a. $y = \sqrt{\ln x + \sec(e^{7x})}$

b. $y = (\cosh x)^{x^7}$

c. $y = 8^x \tan^{-1}(7x)$

Q2. [5 pts] Find the equation of the tangent line to the curve: $y = 2^x - 3\tanh x - x\ln 2$, at $x = 0$.

Q3 [5 pts] if $x^2 + xy + y^3 = 1$, find the value of $y''$ at the point where $x = 1$.

Q4 [3 pts] Evaluate: $\lim\limits_{x\to\infty} \dfrac{2\cosh x}{3e^x}$

Q5 [4 pts] Let $g(x) = f(x)\cos x$, $f(\dfrac{\pi}{3}) = 5$ and $f'(\dfrac{\pi}{3}) = 7$. Find $g'(\dfrac{\pi}{3})$.

Q6 [4 pts] Suppose that $F(x) = f(xg(x))$ and $g(3) = 2$, $g'(3) = 5$, $f'(3) = 7$ and $f'(6) = 2$.
Find $F'(3)$.

Q7. [5 pts] Let $y = \dfrac{\sin^4(x) \cdot \sqrt[5]{7x+1}}{\sqrt{2x-1} \cdot (3x^2+8)^4}$. Use logarithmic differentiation to find $\dfrac{dy}{dx}$.

Q8. [6 pts] Find the critical numbers of each of the following functions: (Show your work in details)

a. $f(x) = 5x + 3x^{\frac{2}{3}}$

b. $f(x) = \ln(x^2 + x + 1)$

Q9. [4 pts] Verify that the function $f(x) = x + \dfrac{1}{x}$ satisfies the hypotheses of the **Rolle's Theorem** on the interval $\left[\dfrac{1}{2}, 2\right]$. Then find all numbers $\underline{c}$ that satisfy the conclusion of the Rolle's Theorem.

Q10. [6 pts] At noon, ship A is 50 km north of ship B. Ship A is sailing east at 24 km/h and ship B is sailing south at 20 km/h. how fast is the distance between the ships changing at 2:00 pm?

Q11. [4 pts] A particle is moving along a hyperbola $xy = 10$. As it reaches the point $(2,5)$, the $y-$coordinate s decreasing at a rate of 7cm/s, how fast is the $x-$coordinate of the point changing at that instant?

Q12. [5 pts] Find the Absolute minimum value of the function $f(x) = e^{x^3 - 3x}$ on the interval $[0,2]$.