

**MATHEMATICS 100 (Sections A01-A03),
Midterm # 2, October 19, 2017.**

Last name: _____

StudentID: V00_____

First name: _____

Tutorial section number: *T*_____

Problem #	1 – 5	6 – 10	11	12	13	14	TOTAL
Points (max)	5	5	2	3	5	5	25
Score							

- The only calculators allowed on any examination are Sharp EL-510R, Sharp EL-510 RN and Sharp EL-510RNB.
- This test consists of 14 questions and has 10 pages (including this cover and the **Blank page** on the last page).
 - Questions 1 through 10 are "all-or-nothing". Write your full answer in this booklet in the provided space. **Clearly write your answer. Do not simplify.**
 - Questions 11 through 14 are long-answer. Write your detailed solutions in space provided in this booklet. You need to show your supporting work for all answers, as we may disallow any answer which is not properly justified.
- Before starting your test enter your Name (Last, First), student ID, and tutorial section number (T01 - T22) on this page.
- If you have finished working on your paper with less than 10 minutes before the end of the examination, please close your paper and **remain seated** until the test time is completed. It is important to minimize the disruptions in the room.
- At the end of 120-minute test, turn-in this booklet.
- This is version A of the Midterm #1.

For the questions #1 – #10, calculate derivative $\frac{dy}{dx}$ of the following function $y = y(x)$.
Do not simplify your answer.

1. (1 point) $y = 4x^3 + x - 7$

2. (1 point) $y = \frac{3}{x^2}$

3. (1 point) $y = \sqrt[3]{x}$

4. (1 point) $y = 5^{x+2}$

5. (1 point) $y = e^{1-2x}$

6. (1 point) $y = \csc(x)$

7. (1 point) $y = \sin(x^2 + 3)$

8. (1 point) $y = x^3 \ln(x)$

9. (1 point) $y = \frac{x^2 + 3\pi}{x + 1}$

10. (1 point) $y = \ln(\ln(2x^3))$

11. (2 points) Suppose that functions f and g and their derivatives with respect to x have the following values at $x = 2$ and $x = 3$.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	3	2	4	6
2	8	3	1	-3
3	3	-1	4	5

Find derivative, $\frac{dy}{dx}$, of the function $y = f(g(x))$ at $x = 2$.

12. (3 points) Find the two points where the curves $x^2 + xy + y^2 = 3$ and $y = x$ intersect. Show that the tangents to the curve $x^2 + xy + y^2 = 3$ at these points are parallel. What is the common slope of these tangents?

13. (5 points) Consider functions $y = \cot x$ and $y = \cot^{-1} x$.

(a) Graph function $y = \cot x$, specify graph's domain and range.

(b) Graph function $y = \cot^{-1} x$, specify graph's domain and range.

(question 13 continues on the next page)

Question 13 (continues):

(c) If the following expression is defined, $\cot^{-1} \sqrt{3}$, calculate it (in radians, exact answer multiple of π) without using the identity $\cot^{-1} x = \frac{\pi}{2} - \tan^{-1} x$. Give reasons for your answers.

(d) **Derive** the formula for calculating derivative of $y = \cot^{-1} x$ without using the identity $\cot^{-1} x = \frac{\pi}{2} - \tan^{-1} x$.

14. (5 points) A rock thrown vertically upward from the surface of the moon at a velocity of 24 *meters/sec* (about 86 *km/h*) reaches a height of $s = 24t - 0.8t^2$ *meters* in t seconds.

(a) Find the rock's velocity and acceleration at time t . (The acceleration in this case is the acceleration of gravity on the moon.)

(b) How long does it take the rock to reach its highest point?

(c) How high does the rock go?

(question 14 continues on the next page)

Question 14 (continues):

(d) How long does it take the rock to reach half its maximum height on the way down?

(e) How long does the rock stay in the air until it hits the ground?

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