MATHEMATICS 100 (Sections A01-A03),
Midterm # 3, November 23, 2017.

Last name: _____ StudentID: $V00$_____

First name: _____ Tutorial section number: T_____

Problem #	$1-2$	$3-5$	6	7	8	9	10	TOTAL
Points (max)	4	6	2	3	4	2	4	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 10 questions and has 9 pages (including this cover and the **Blank page** on the last page).
  - Questions 1 through 10 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 #3.

For the questions $\#1 - \#2$, calculate antiderivative $F(x)$ of the following function $y = f(x)$:

1. (2 points) $f(x) = 8x^3 + 3x^2$, $F(2) = 0$

2. (2 points) $f(x) = \sec^2(3x)$, $F\left(\frac{\pi}{4}\right) = 2$

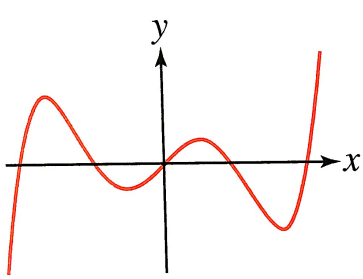
For the questions #3 − #5, calculate following limits:

3. (2 points) $\lim_{x \to 2} \dfrac{x^2 + x - 6}{x - 2}$

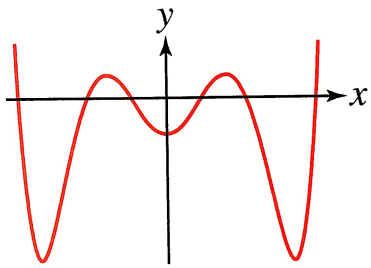
4. (2 points) $\lim_{x \to 1} \left(\dfrac{x}{x - 1} - \dfrac{1}{\ln x} \right)$

5. (2 points) $\lim_{x \to 0^+} (1 + \sin(4x))^{\cot x}$

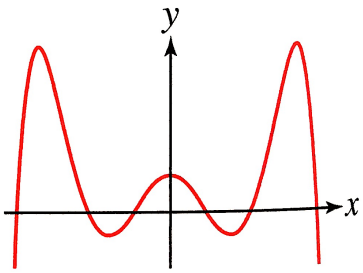
6. (2 points) Looking at the figure below, explain which of the graphs (A) or/and (B) **is not** the graph of an **antiderivative** of $y = f(x)$.



$y = f(x)$



(A)



(B)

7. (3 points) A hot air balloon rising vertically is tracked by an observer located 4 km from the lift-off point. At a certain moment, the angle between the observer's line of sight and the horizontal is $\frac{\pi}{4}$, and it is changing at a rate of 0.2 rad/min. How fast is the balloon rising at this moment?

8. (4 points) Four *feet* of wire is to be used to form **a square and a circle**. How much of the wire should be used for the square and how much should be used for the circle to enclose the maximum total area? (Notice: using a entire wire to make only square or only circle is allowed.)

9. (2 points) Find linearization at $x = \dfrac{\pi}{2}$ of the function $y = \dfrac{\sin(x)}{x}$.

10. (4 points) Sketch the graph of $f(x) = 3x + x^{-2}$ indicating all important applicable attributes (such as intervals where function is increasing / decreasing, concavity, intercepts, asymptotes, local and global extrema).

    For your information: $f'(x) = 3 - 2x^{-3}$ and $f''(x) = 6x^{-4}$

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