Faculty of Applied Science and Engineering
University of Toronto

MAT 186 H1S - CALCULUS I
WEDNESDAY, APRIL 15, 2015

FINAL EXAMINATION

LAST NAME: _____

FIRST NAME: _____

STUDENT NUMBER: _____

SIGNATURE: _____

Time allowed: 2 hours, 30 minutes
Total marks: 75
No calculators allowed.
Examiner: S. Cohen
Use the backs of pages when necessary,
indicating clearly where solutions continue.

FOR MARKER'S USE ONLY	
QUESTION	MARK
1	/ 15
2	/ 15
3	/ 20
4	/ 8
5	/ 7
6	/ 8
7	/ 7
TOTAL	/ 80

1. Some warm-up questions. Justify your answers fully.

a) Evaluate $\lim_{x\to -1} \frac{3x^2+5x+2}{2x^2-x-3}$

[3 marks]

b) Evaluate $\frac{d}{dx}(2x^3 - 3)$ using the limit definition of the derivative.

[3 marks]

c) Find the tangent line for $f(x) = 4x^2 - \sin(\pi x)$ at $x = 1$.
[3 marks]

d) Find $\frac{dy}{dx}$ at the point $(1,0)$ for $xy^2 - 2x = 3xy + x^2 - 3$
[3 marks]

e) Evaluate $\int_0^1 e^{2t} + (2t-1)^2 dt$.
[3 marks]

2. Tougher questions. Evaluate the following:

a) $\lim_{x\to 0} x^2 \sin^3\left(\frac{1}{x}\right)$

[5 marks]

b) $\lim_{x\to\infty}\left(1+\frac{3}{x}\right)^{(x^2)}$

[5 marks]

c) $\int \frac{5x}{\cot(3+2x^2)}\,dx$

[5 marks]

3. Graph the function $f(x) = \frac{3-x^2}{x-1}$. Organize your solution well and include all of the important values. You have this page and the next for this problem. [20 marks]

[Continue Question 3 on this page.]

4. Using calculus (NOT linear algebra), find the point on the graph of $y = 3x + 1$ that is closest to $(7, 2)$.

[8]

5. Find the area between $f(x) = 2x^4 - x^2 + 3$ and $g(x) = 2x^4 - x^3 + 2x + 3$.

[7]

6. Let a solid be created by rotating the areas between $y = x^3 - x$ and the x-axis around the line $x = 1$. Find the volume of this solid.

[8]

7. Let a function be defined by: $F(x) = x \cdot \int_{x}^{x^2-2} \sqrt{t^2+5}\, dt$ Evaluate $F'(2)$.

[7]