UNIVERSITY OF MANITOBA

DATE: February 27, 2013
DEPARTMENT & COURSE NO: MATH 1500
EXAMINATION: Introduction to Calculus

TITLE PAGE
TIME: 60 Minutes
EXAMINER: Various

NAME: (Print in ink) _____

STUDENT NUMBER: _____

SIGNATURE: (in ink) _____
(I understand that cheating is a serious offense)

❑	A01	10:30-11:20 MWF & 10:00-10:50 T	P. Mendelsohn
❑	A02	9:30-10:20 MWF	X. Zhao
❑	A03	8:30-9:30 TR	J. Sichler
❑	A04	11:30-12:45 TR	N. Zorboska
❑	A05	1:00-2:15 TR	O. Klurman
❑	A06	3:30-4:20 MWF	V. Shepelska
❑		Challenge for credit	

INSTRUCTIONS TO STUDENTS:

This is a 60 Minute exam. **Please show your work clearly.**

No texts, notes, or other aids are permitted. There are no calculators, cellphones or electronic translators permitted.

This exam has a title page, 5 pages of questions and also 2 blank pages for rough work. Please check that you have all the pages. **DO NOT** remove the blank pages.

The value of each question is indicated in the lefthand margin beside the statement of the question. The total value of all questions is 60 points.

Answer all questions on the exam paper in the space provided beneath the question. If you need more room, you may continue your work on the reverse side of the page, or on a page at the back, but CLEARLY INDICATE that your work is continued and label the continuation.

Question	Points	Score
1	13	
2	14	
3	6	
4	6	
5	6	
6	7	
7	8	
Total:	60	

UNIVERSITY OF MANITOBA

DATE: February 27, 2013
PAGE: 1 of 5
DEPARTMENT & COURSE NO: MATH 1500
TIME: 60 Minutes
EXAMINATION: Introduction to Calculus
EXAMINER: Various

---

1. Evaluate the following limits. If the limit does not exist, indicate whether it tends to $\infty, -\infty$ or neither.

[4] (a) $\lim_{x\to 3} \dfrac{x^3 - 9x}{x - 3}$

[3] (b) $\lim_{x\to -\infty} \dfrac{7x + 2}{|x| + 7}$

[3] (c) $\lim_{x\to -1} \dfrac{x}{x^2 + 2x + 1}$

[3] (d) $\lim_{x\to 0} \dfrac{\tan x}{2x}$

---

2. Differentiate each of the following, but do not simplify your answers:

[4] (a) $y = \dfrac{x^2 + 2x + 1}{\cos 7x}$

[3] (b) $y = (x+1)^{2013}(\sqrt{1-2x} + \pi x)$

[3] (c) $y = \tan(\sin(e^{2x}))$

[4] (d) $y = \cos\left(\dfrac{x-1}{x+1}\right)$

[6] 3. Using only the definition of the derivative of a function, find the derivative of

$$f(x) = \sqrt{x + e}.$$

[6] 4. Prove that any function $f(x)$ that is differentiable at c must be continuous at c.

5. Consider the function

$$f(x) = \begin{cases} \dfrac{x^2-1}{x-1}, & x > 1 \\ -x, & x \leq 1 \end{cases}$$

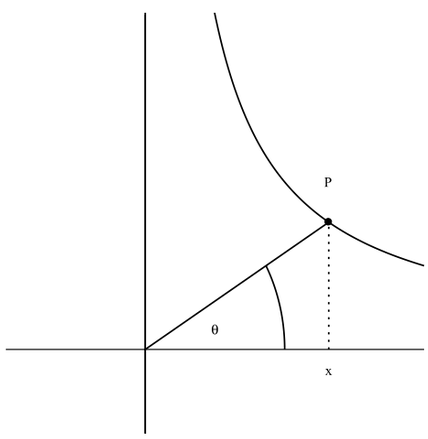
[5] (a) For what values of x is $f(x)$ **NOT** continuous? Use limits and the definition of continuity to justify your answer.

[1] (b) At each of the points where $f(x)$ is not continuous, determine the type of the discontinuity.

[7] 6. Find an equation of the line tangent to the curve $x^3 + xy + y^3 + 1 = 0$ at the point $(-1, 1)$.

7. A particle P is moving along the curve $y = \dfrac{1}{x}$, so that it's x-coordinate is increasing at the rate of 3 units per second, or $\dfrac{dx}{dt} = 3$.

   The line segment between the point $(0, 0)$ and P forms an angle θ between the line segment and the positive x-axis.



[3] (a) Write the formula that relates the quantities x and θ. (Hint: look at $\tan\theta$.)

[5] (b) Find the rate of change of the angle θ with respect to time, $\dfrac{d\theta}{dt}$ when $x = 1$.