SURNAME: (Print in ink) $\qquad$
GIVEN NAME(S): $\qquad$
STUDENT NUMBER: $\qquad$
SIGNATURE: (in ink)
(I understand that cheating is a serious offense)

## PLEASE CHECK THE APPROPRIATE BOX BELOW

| $\square$ | A01 | MWF - 10:30 \& T - 10:00 | W. Korytowski |
| :--- | :--- | :--- | :--- |
| $\square$ | A02 | MWF - 9:30 | O. Gueye |
| $\square$ | A03 | MWF - 11:30 | D. Kalajdzievska |
| $\square$ | A04 | MWF - 12:30 | D. Kalajdzievska |
| $\square$ | A05 | TR - 11:30 | B. Waters |
| $\square$ | A06 T - 7:00 | W. Korytowski |  |
| $\square$ | A07 MWF - 12:30 | M. Virgilio |  |
| $\square$ | A08 MWF - 8:30 | K. Gupta |  |

## INSTRUCTIONS TO STUDENTS:

This is a 1 hour exam. Please show your work clearly in the space provided below each question. If you need more room, you may continue your work on the reverse side of the page, but CLEARLY INDICATE that your work is continued.

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

Please check that you have all of the pages in the exam booklet. This exam has a title page, 5 pages of questions and also 1 blank page for rough work. You may remove the blank page if you want, but be careful not to loosen the staple.

| Question | Points | Score |
| :---: | :---: | :---: |
| 1 | 15 |  |
| 2 | 16 |  |
| 3 | 9 |  |
| 4 | 5 |  |
| 5 | 5 |  |
| 6 | 8 |  |
| 7 | 12 |  |
| Total: | 70 |  |

The value of each question is indicated in the lefthand margin beside the statement of the question. The total value of all questions is 70 points.

## UNIVERSITY OF MANITOBA

DATE: October 23, 2013
MIDTERM
PAGE: 1 of 6
TIME: 1 hour
DEPARTMENT \& COURSE NO: MATH 1500
EXAMINATION: Introduction to Calculus

1. Evaluate the following limits. If the limit does not exist, explain why, or state whether it tends to $\infty$ or $-\infty$.
[5] (a) $\lim _{x \rightarrow 3} \frac{2 \sqrt{x+6}-6}{x-3}$
[5] (b) $\lim _{x \rightarrow-\infty} \frac{\sqrt{x^{2}-3}}{2 x-1}$
[5] (c) $\lim _{x \rightarrow 4} \frac{x-4}{|x-4|}$
2. Find $f^{\prime}(x)$. DO NOT SIMPLIFY YOUR ANSWERS
[4] (a) $f(x)=(\cos x) \cos (\sin x)$
[6] (b) $f(x)=\left(3 x^{3}-\frac{3}{x}+\sqrt{3 x-2}\right)^{5}$
[6]
(c) $f(x)=\frac{x^{2} e^{x}-3 x}{2 x+2}$

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DATE: $\underline{\text { October 23, } 2013}$| MIDTERM |  |
| ---: | ---: |
| DEPARTMENT \& COURSE NO: MATH 1500 | PAGE: 3 of 6 |
| EXAMINATION: Introduction to Calculus | TIME: 1 hour |$\quad$ EXAMINER: Various

[9] 3. Find the equation of the tangent line to the curve $4 x y=\left(x^{2}+y^{2}\right)^{2}$ at the point $(1,1)$.
[5] 4. Use the definition of the derivative to determine $f^{\prime}(x)$ if $f(x)=x^{2}+x$.

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DATE: October 23, 2013
[5] 5. Prove the following theorem: if $a(x)$ and $b(x)$ are differentiable, then

$$
\frac{\mathrm{d}}{\mathrm{~d} x}[a(x)+b(x)]=\frac{\mathrm{d}}{\mathrm{~d} x} a(x)+\frac{\mathrm{d}}{\mathrm{~d} x} b(x) .
$$

6. If

$$
f(x)=\left\{\begin{array}{ccc}
\frac{x^{2}+x-2}{x-1} & \text { if } & x<1 \\
b & \text { if } & x=1 \\
a x^{2}-6 a & \text { if } & x>1
\end{array}\right.
$$

[5] (a) Find the value(s) of $a$ that will cause $\lim _{x \rightarrow 1} f(x)$ to exist. Justify your answer.
[3] (b) Find the value(s) of $b$ that will cause $f(x)$ to be continuous at $x=1$. Justify your answer.

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DATE: October 23, 2013<br>MIDTERM<br>PAGE: 5 of 6<br>DEPARTMENT \& COURSE NO: MATH 1500<br>TIME: 1 hour<br>EXAMINATION: Introduction to Calculus<br>EXAMINER: Various

[12] 7. A 10 m ladder is sliding down a vertical wall forming a right triangle with the ground and wall as its sides. At the moment the top of the ladder is 6 m up the wall it is sliding down at $2 \mathrm{~m} / \mathrm{s}$. What is the rate of change of the area of the triangle formed by the ladder, wall, and ground, at this moment?

