

**UNIVERSITY OF MANITOBA**

DATE: February 25, 2010

MIDTERM EXAM

TITLE PAGE

COURSE: MATH 1500

TIME: 1 hour

EXAMINATION: Calculus I

EXAMINER: Various

NAME: (Print in ink) \_\_\_\_\_

STUDENT NUMBER: \_\_\_\_\_

SEAT NUMBER: \_\_\_\_\_

SIGNATURE: (in ink) \_\_\_\_\_

(I understand that cheating is a serious offense)

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|--|--|---|--|
| <input type="checkbox"/> A01<br>G.I. Moghaddam | <input type="checkbox"/> A02<br>T. Malik | <input type="checkbox"/> A03<br>P.N. Shivakumar | <input type="checkbox"/> A04<br>T. Mohammed          |
| <input type="checkbox"/> A05<br>A. Mahmoodi    | <input type="checkbox"/> A06<br>M. Imran | <input type="checkbox"/> A07<br>C. Podder       | <input type="checkbox"/> A92<br>Challenge for Credit |

**INSTRUCTIONS TO STUDENTS:**

This is a 1 hour exam. Please show your work clearly.

Texts, notes, or other aids are not permitted. Calculators, cellphones or electronic translators are not permitted.

This exam has a title page, 6 pages of questions and also one blank page for rough work. Please check that you have all the pages. You may remove the blank page if you want, but be careful not to loosen the staple.

In **Part A**, there are 7 multiple choice questions each of which has at most 5 possible answers lettered A to E. **Print clearly the letter corresponding to your choice of answer in the box on page 1.** You will receive 0 marks for each incorrectly answered question. Any other work that you do to derive your choice will NOT be marked.

In **Part B** answer all questions in the space provided beneath the 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.

Question	Points	Score
1-7	14	
8	11	
9	4	
10	5	
11	15	
12	5	
13	6	
<b>Total</b>	<b>60</b>	

## PART A: Multiple Choice Questions

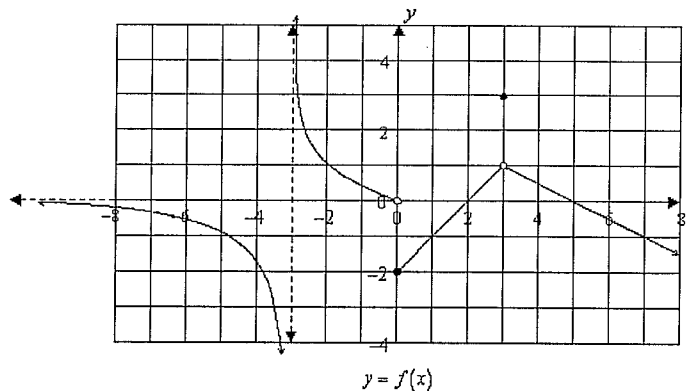
Answer each question by putting one of the letters A, B, C, D, E in the appropriate answer box below.

Question	1	2	3	4	5	6	7
Answer							

[2] 1. Let  $f(x) = \frac{1}{x^2}$  and  $g(x) = \sqrt{x}$ . What is the domain of  $f \circ g$ ?

- A.  $[0, \infty)$ ;
- B.  $(-\infty, 0) \cup (0, \infty)$ ;
- C.  $(0, \infty)$ ;
- D.  $(-\infty, 0]$ ;
- E. None of the above.

Use this picture to answer questions (2) and (3) below.



[2] 2. Let  $f(x)$  be the function whose graph is given above. Which one of the following is **not correct**.

- A.  $f(3) = 3$  and  $\lim_{x \rightarrow 3} f(x) = 1$ ;
- B.  $f(x)$  is discontinuous at  $x = 0$ ,  $x = -3$  and  $x = 3$ ;
- C.  $f'(0) = 0$ ;
- D.  $f(x)$  is *right continuous* at  $x = 0$ .

[2] 3. Let  $f(x)$  be the function whose graph is given above. Which one of the following is **not correct**.

- A.  $\lim_{x \rightarrow -\infty} f(x) = 0$ ;
- B.  $\lim_{x \rightarrow -3} f(x) = +\infty$ ;
- C.  $y = 0$  is a horizontal asymptote and  $x = -3$  is a vertical asymptote;
- D.  $f'(2) = 1$ .

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[2] 4. The function  $f(x) = x^3 + x - 4$  has a real root in the interval:

- A.  $[-2, -1]$ ;
- B.  $[-1, 1]$ ;
- C.  $[1, 2]$ ;
- D.  $[0, 1]$ ;
- E. None of the above.

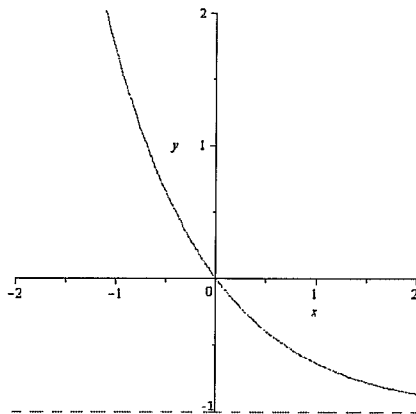
[2] 5. Using squeeze theorem the value of  $\lim_{x \rightarrow 0^+} \sqrt{x} \sin\left(\frac{\pi}{x}\right)$  is:

- A. 0;
- B.  $\pi$ ;
- C. 1;
- D. limit does not exist;
- E. None of the above.

[2] 6. Which one of the following is **not** correct?

- A.  $(f(x) + g(x))' = f'(x) + g'(x)$ ;
- B.  $(f(x)g(x))' = f'(x)g(x) + f(x)g'(x)$ ;
- C.  $(cf(x))' = cf'(x)$ ;
- D.  $(\sin x)' = \cos x$
- E. If  $f(x)$  is continuous at  $x = a$ , then  $f(x)$  is differentiable at  $x = a$ .

[2] 7. What is the function whose graph is given below?



- A.  $f(x) = e^{-x} - 1$ ;
- B.  $f(x) = e^{-x} + 1$ ;
- C.  $f(x) = e^{-x+1} - 1$ ;
- D.  $f(x) = e^x - 1$ ;
- E. None of the above.

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**Part B : Long Answer Questions**

- [11] 8. Evaluate each of the following limits or explain why it does not exist.

(a)  $\lim_{x \rightarrow -1} \frac{x^5 + 5x^4 + 4x^3}{x^2 + x}$

(b)  $\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{x^2 + x} \right)$

(c)  $\lim_{x \rightarrow -\infty} \frac{\sqrt{9x^6 - 4}}{x^3 + 1}$

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- [4] 9. Find value(s) of  $c$  for which the function  $f(x) = \begin{cases} cx^2 + 2c & \text{if } x < 2 \\ x^3 - cx & \text{if } x \geq 2 \end{cases}$  is continuous everywhere. Justify your answer.

- [5] 10. Let  $y$  be a function of  $x$  which satisfies the equation  $y^3 + \cos(xy) = x^2 + 6x + 2$ . Find  $y'$  at the point  $(0, 1)$ .
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[15] 11. Differentiate each of the following functions with respect to  $x$ . (Do not simplify)

(a)  $y = x^2 - \sec \pi + e^5 x + \frac{1}{x}$

(b)  $y = e^{-2x} + (x+1)\sqrt{x+2}$

(c)  $y = \frac{5 \cos x + 1}{2\sqrt{x}}$

(d)  $y = [\sqrt{x} x^\pi + \cos(2 \sin x)]^{\frac{1}{3}}$ 

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[5] 12. Use only the definition of derivative to find  $f'(x)$  if  $f(x) = \frac{3}{2+x}$ .

[6] 13. A man, standing at the front of the window of the second floor of his house, is looking at his dog in the yard who is running straight toward the building at the rate of  $2\text{ m/s}$ . If the height of the second floor is  $4\text{ m}$ , how fast is the distance between the man and his dog changing when the dog is  $5\text{ m}$  away from the house?

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